A STUDY TO DETERMINE THE NATURE OF SCIENCE TEACHERS' FUNCTIONAL PARADIGMS USING QUALITATIVE RESEARCH METHODS

by

STEVEN MCDONALD CARDWELL

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Steven McDonald Cardwell

Department of Science and Math Education

The University of British Columbia
1956 Main Mall
Vancouver, Canada
V6T 1Y3

Date October 12th, 1988
ABSTRACT

It is believed that one of the overriding factors that has contributed to the resistance to curriculum change on the part of teachers is that some of the new curricula seem to require a major change in teaching methodology and style. This change amounts to a conflict between paradigms. If this belief is correct, then one can argue that there will have to be a shift in teachers' functional paradigms in order for these curriculum innovations to be implemented.

The study focusses on the goals, problems, exemplars, and routines, which constitute the "functional paradigms" of teachers. The term "functional paradigm" is meant to convey the idea that the characteristics which unite a community of practitioners are likely to be centered on practical matters: Why do teachers function in particular ways? Do teachers attach "common meanings" to particular situations or entities?

The following specific research questions were examined:

1. What are some of the factors which influence the formulation of teachers' functional paradigms?

2. What is the nature of teachers' functional paradigms?
3. a) What are the perceptions of teachers with regard to curriculum change?

b) What is the relationship between teachers' functional paradigms and their perceptions of curriculum change?

c) To what extent do teachers' functional paradigms become idiosyncratic when they are faced with a curriculum change?

The methodology involved interviews with teachers. A pilot study was conducted prior to the main study. The interviews in the main study were analyzed in terms of six main categories.

The results seem to indicate:

1. There are common categories and sub-categories that contribute to the formation, development, and maintenance of teachers' functional paradigms. They include:

   - past educational experiences.
   - background in general.
   - practicum experiences.
   - past and present teaching experiences.
   - curriculum materials.
   - constraints on teaching.
   - school, students, and other workers in the school.

2. There seems to be a "core" of common categories among teachers. The intersection of elements within these categories composes the functional paradigms of teachers in general. Although the paradigms are functional in an active sense, they are relatively stable within the "culture", and over the long term. This stability must be considered if innovators in education ever contemplate a change which
would require a shift in teachers' functional paradigms. This commonality of beliefs, routines, problems, and exemplars is probably greater among teachers within the same small segment of the organization than within the entire profession.

3. Evidently, teachers select, interpret, and utilize learning materials in different ways dependent on the nature of their personal functional paradigms. A number of differing elements in teachers' functional paradigms have been identified. These elements determine how teachers teach in terms of their use of curriculum materials. Curriculum change agents must consider the functional paradigms of individuals and determine how common these paradigms are before attempting a major pedagogical change. This study has shown that if these factors are not considered, then the curriculum change that is contemplated will be reduced to a mere change in content. The teachers will utilize the curriculum materials according to their own functional paradigms.

4. The inertia against curriculum change is most difficult to overcome with more experienced teachers, and more easily overcome with beginning teachers. This suggests that the focus of curriculum implementation needs to be aimed at certain segments of the profession. Somehow the change agents must assist educators to change their
functional paradigms to meet the desired ends of the new curriculum prior to implementation. The alternative is the disparity that seems to exist between the curriculum that is intended by the policy makers, the curriculum that is implemented by the teachers, and the curriculum that is ultimately attained by the students.
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Finally, the author would like to thank his family, Maryann and Stephanie, for their patience and understanding when he couldn’t be with them.
CHAPTER 1

INTRODUCTION

1.1 Background to the Study

It is becoming increasingly evident that the large scale curriculum projects, such as those undertaken by the National Science Foundation in North America and the Nuffield Foundation in the UK, have not had the impact at the classroom level that was intended. Massive amounts of time, energy and money was spent putting together extensive curriculum packages, providing preservice, inservice and resource materials...and yet, implementation of these projects has largely been a failure (Ellis, 1984; Crocker, 1984a; Plimmer, 1981; Welch, 1979). These projects contemplated major changes in both content and methodology. Textbooks became much more generalized in their approach to science. The "everyday" practicality of science gave way to a much broader concept. However, the idea of "discovery learning" as a form of pedagogy was not accepted as had been intended. Chakagondua (1981) claims that the gap that exists between intended curricula and what is actually going on in science classrooms is due to the inappropriateness of the scientific methods of research in science education on a theoretical level, and on a
practical level, due to the top-down approach implicit in large scale curriculum developments.

Common (1981) suggests that teachers have been able to resist the changes that administrators, researchers, curriculum developers and other change agents have been trying to implement. According to Common, classrooms look more or less the same as they did twenty years ago because:

...teachers had the power to shut the classroom doors and their minds to any cold winds blowing centrally advocated change (p.80).

Olson (1980) argues that all is not lost. Even though the classroom teacher has been bombarded with curriculum innovations, we are still left with the "status quo". The very stability of the system provides an avenue for research into why there is such a strong teacher-inertia against curriculum innovation, especially as it applies to intended changes in teaching methodology. Olson believes that these attempts at curriculum change challenge established practices and even if the status quo does remain, we should have a better understanding of what these practices are and how they are formulated.

Science education in Canada is not excluded from this discussion. Criticisms and concerns about the state of science education in schools led to a major study of science education in Canadian schools between 1980 and 1983 (Orpwood and Souque,1984). Recently, a second parallel
study of science education in Canada stated as one of its primary assumptions that teachers "markedly influence the translation of curriculum policy intentions". The authors felt that this was partly due to teachers' perceptions of curriculum policies, processes and practices (Connelly, Crocker and Kass, 1985, p.273).

Science teachers in British Columbia have experienced a number of curriculum changes over the last few years. Although, in my mind, none of the changes are particularly "innovative", some of the changes have been more "traumatic" than others. These include a major change in the Junior Science Curriculum (see for example Table I), changes in the Senior Biology and Chemistry courses (including a list of options for the nontraditional topics) and, due to changed graduation requirements, the imposition of a new course called Science and Technology 11. In addition, elementary teachers in B.C. anticipate a change in the Elementary Science Curriculum.

Some of the policy changes seem to have been readily accepted, whereas others have still not or have only partially reached the classroom acceptance stage. In reference to the Junior Science Curriculum, Langdale (1984) provides evidence to show that there are conflicts between the assumptions and intents of the curriculum and the belief systems of the teachers who must implement this new curriculum.
### TABLE I

**A Comparison of the previous British Columbia Junior Secondary Science Curriculum (pre 1983) to the current British Columbia Junior Secondary Science Curriculum (1983).**

<table>
<thead>
<tr>
<th><strong>B.C. JUNIOR SECONDARY SCIENCE CURRICULUM: 1968-1979</strong></th>
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<tr>
<td>o lab centered.</td>
<td></td>
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<tr>
<td>o discovery approach based on inquiry and observation.</td>
<td></td>
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<tr>
<td>o emphasis on skills, processes, and knowledge.</td>
<td></td>
</tr>
<tr>
<td>o experimental in nature.</td>
<td></td>
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<tr>
<td>o lab oriented activities.</td>
<td></td>
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<tr>
<td>o content in discrete disciplines.</td>
<td></td>
</tr>
<tr>
<td>o grades 8, 9, and 10.</td>
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</table>

<table>
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<tr>
<th><strong>CURRENT B.C. JUNIOR SECONDARY SCIENCE CURRICULUM: 1983</strong></th>
<th></th>
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<tbody>
<tr>
<td>o student centered.</td>
<td></td>
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<tr>
<td>o personal and practical approach.</td>
<td></td>
</tr>
<tr>
<td>o emphasis on skills, processes, knowledge, and thinking abilities.</td>
<td></td>
</tr>
<tr>
<td>o investigative and experiential in nature.</td>
<td></td>
</tr>
<tr>
<td>o wide variety of activities stressing application of solution and clarification of science related societal issues.</td>
<td></td>
</tr>
<tr>
<td>o integrated (thematic) content.</td>
<td></td>
</tr>
<tr>
<td>o grades 8, 9, and 10.</td>
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</table>

*Junior Secondary Science Curriculum Guide.*  
Victoria: Ministry of Education, Province of B.C.
Olson (1982a) indicates that in order to effect a curriculum change, there must be some compatibility between teachers' belief systems and the curriculum innovation. Since the choices that teachers make in the classroom are a function of their belief systems, we must focus our research on the nature of these beliefs. This concurs with the view of Crocker and Banfield (1986) who suggest that the incompatibility arises out of a lack of understanding of teachers' thoughts, judgements, and decisions relative to science curriculum.

This study focusses attention on teachers' beliefs, values and practices in the context of curriculum innovations...in this case, the recently revised B.C. Junior Science Curriculum.

1.2 Teachers' Functional Paradigms

Crocker (1983) formulated the concept that teachers belong to a community of practitioners who share common beliefs, goals, problems, exemplars and routines -- these and other characteristics constitute the practitioners' functional paradigms. Crocker argues that one can apply the concepts of a paradigm as described by Thomas Kuhn in his much quoted book, The Structure of Scientific Revolutions, to teaching. He builds on the work of Alan Imershein (1977), whose analysis in a social arena is that members of an
organization can be considered to operate under a shared paradigm in a manner analogous to that of a community of scholars. Crocker's fundamental assumption is that:

...individuals act on situations on the basis of the meanings they derive from these situations. The development of meaning is an interactive and dynamic process which evolves as individuals encounter objects, events, and symbols in the social setting. The extension of this is that meanings may stabilize on sustained encounters with a situation and that similar encounters on the part of different individuals are likely to be given common interpretations and hence yield common meanings. Such common meanings evolve into what is called a functional paradigm (1984d, p.5).

A study was recently conducted to determine the extent to which teachers' functional paradigms, as they apply to translating new curriculum materials into practice, are idiosyncratic and to what extent they are common to all teachers (Lantz and Kass, 1987). The authors generated a model of teachers' interpretations of curriculum materials based on previous work done by Roberts (1980) and Connelly, Crocker and Kass (1984). The model outlined the relationship between the teachers' functional paradigms, backgrounds and teaching situations. Among other things, the study identified aspects of the teachers' backgrounds as having a strong influence in shaping their current functional paradigms.

It is worthwhile clarifying the notion of a functional paradigm at this point. The term "functional" is used in an active rather than passive sense. That is, the
ideas, beliefs, goals, problems, exemplars and routines that describe teachers' paradigms are the solutions for every situation in which the individual faces an impasse due to competing factors. Even though paradigms can change, they become entrenched over time, and become problematic if change is contemplated (Nespor, 1987, p.326; Ball, 1982, p.25). It is perhaps for these reasons that functional paradigms are very difficult to change. It is of interest to consider how open functional paradigms are to change in the context of a curriculum innovation requiring a shift in methodology. This notion of a "functional paradigm" is considered further in section 2.3.1.2.

1.3 Identification of the Problem

1.3.1 General Statement of the Problem

It is believed that one of the overriding factors that has contributed to the resistance to curriculum change on the part of teachers is that some of the new curricula seem to require a major change in teaching methodology and style. This requirement produces a conflict between paradigms. If this belief is correct, then one can argue that there will have to be a shift in teachers' functional paradigms in order for these curriculum innovations to be implemented.
The purpose of this study is to determine the nature of teachers' functional paradigms in terms of how they interpret curriculum change. The term "curriculum change" is used generally here to mean any change in curriculum policy. A change in topics, sequence, timing, methodology or emphasis constitutes such a curriculum change. For the purposes of this study, the recent changes in secondary science curricula in British Columbia are considered, particularly at the junior science level.

A subsidiary purpose is to examine teachers' backgrounds and determine what aspects of their backgrounds might influence the formation of their functional paradigms. Of particular interest is the nature of teachers' past educational experiences in terms of how these might shape their functional paradigms.

1.3.2 Research Questions

The following specific research questions were examined:

1. What are some of the factors which influence the formulation of teachers' functional paradigms?
2. What is the nature of teachers' functional paradigms?
3. a) What are the perceptions of teachers with regard to curriculum change?
b) What is the relationship between teachers' functional paradigms and their perceptions of curriculum change?

c) To what extent do teachers' functional paradigms become idiosyncratic when they are faced with a curriculum change?

1.4 Rationale for the Study

Several studies have indicated a need for more research on the nature of teachers' practical knowledge -- in particular, the summary report of the study into science education in Canadian schools (Orpwood and Souque, 1984b), and such comprehensive reviews as Shavelson and Sterns' work on teachers (1981) and Fullan and Pomfret's review of curriculum and instruction implementation (1977).

This study may provide practical knowledge for those interested in some form of organizational change whose impact is at the classroom level. This research will hopefully shed some light on the gap between the mandated and translated curriculum by explicating the nature of teachers' functional paradigms. The study may also provide an insight into why teachers and classrooms function as they do. For example, is a teacher most likely to teach using an eclectic model of teaching which has its roots predominantly in the teacher's own experiences as a student?
1.5 Philosophical Context

This study was approached from a contextualist point of view. Central to this outlook is the belief that adequate knowledge of objects and events cannot reasonably be obtained without knowing the context in which they occur (Roberts, 1982b).

In this sense then, one can argue that human behaviour is significantly influenced by the natural settings in which it occurs. Although Kilbourn (1980a) contends that much of science teaching and the curriculum materials from which this is drawn are oriented towards a more mechanistic world view, he does subscribe to the notion of the "hidden curriculum" and the sort of intuitive teaching that takes place in every classroom. It is this intuitiveness or, as Schon (1984, p.11) implies, "tacit knowledge" that is of interest in this study.

1.6 Theoretical Perspective

The methodology to be outlined later has its basis in social phenomenology. It holds that an individual's beliefs, values and actions are shaped and moulded by life experiences. The personal history, background, acquaintances, and experiences influence current practice.
An attempt to change current behaviour depends largely on the individual's internal constructs.

The setting influences behaviour in terms of the physical arrangements, internalized notions about what is expected and allowed, and the traditions, roles, values and norms. A researcher may enter a setting with a preconceived understanding of the events and objects therein. However, once present, the person attempts to seek clarification and mutual understanding of the common interest (Spector, 1984a; Wilson, 1979).

Much of the understanding in this area evolves from the writings of sociologists such as Herbert Blumer who coined the term "symbolic interaction". He contends that individuals act toward events or objects on the basis of the meanings that these things have for them. Such meanings are derived, modified and interpreted through a process of social interaction (Blumer, 1969). Blumer suggests that organizations are composed of networks of people interlinked by their various actions.

The organization and interdependency is between such actions of people stationed at different points. At any one point the participants are confronted by the organized activities of other people into which they have to fit their own acts. It (symbolic interactionism) seeks explanation in the way in which the participants define, interpret, and meet the situations at their respective points (p.18).
1.7 Situational Perspective

The methodology used in this study will be outlined in a subsequent section; however, since the study is phenomenological, it is worthwhile expanding on the nature of the setting. Olson (1982b) describes "phenomenology" as a "representation and interpretation of the viewpoint of the person involved in the action being studied" (p. 72). According to Wilson (1979), this mode of inquiry reflects Habermas' historical-hermeneutic form of science — at the root is a mutual understanding of the structures, meanings and rules that are constructed in particular situations.

As discussed earlier, in order to gain an understanding of an individual's actions, the researcher has to be in the setting — ideally, the researcher should be a part of the setting. Olson and others have distinguished between an "insider" and an "outsider". The former is a person who is a part of the setting. The insider must deal with the day-to-day tasks such as those required of a classroom teacher. The latter is a person external to the setting. The outsider may have the insider's best interests in mind; however, as with curriculum developers and researchers, the outsider may not understand the meaning behind an insider's practice. It is clear that, in this case, the best approach would be for the researcher to be a part of the setting.
1.7.1 The Setting

This study took place in a small, compact district located in the Northern part of British Columbia. The town has a population of about 12000 people, and it is the site of a major industrial processing plant. There is one secondary school and a small alternate school serving the school district. The secondary school has an enrollment of approximately 1050 students and a staff complement of 66 teachers. The senior courses are semestered, whereas the junior courses are on a linear timetable. A pilot study took place in two schools in a similar sized town located approximately 65 Km away.

The science department is comprised of 7 teachers (6.7 full-time equivalents). The teachers in the department range in age from about 24 to 40. There are 2 female science teachers. There is one teacher who has just graduated from university; one teacher who has taught a variety of subjects as a substitute teacher, but has never been fully employed as a teacher before; one teacher who taught science for one year on a part-time basis a few years ago, but has now transferred into science full-time, having taught physical education for the previous 13 years; and the remaining 4 teachers who have taught for 7, 8, 10 and 16 years respectively. None of the teachers has taught
for more than one year elsewhere. The "substitute" teacher has a B.Ed. The remaining teachers have Bachelor of Science degrees plus one year of teacher training. The '10' year teacher has an M.Sc. in physics and the '8' year teacher has almost completed his M.A. in Science Education. The '8' year teacher is the Department Head (second year) and is the author of this study.

In order to protect the confidentiality of the participants as much as possible, pseudonyms have been used (see Table III in Chapter 4). Similarly, false names have been used for the schools. In addition, the location of the study, and any other clues that might indicate the location of the site have not been divulged. The school shall be referred to as Mountainview Secondary.

There are distinct advantages and disadvantages in being both a researcher and an active participant in the setting. One can see that there can be a certain ease of entry into the situation. In this case, the researcher is readily accepted, he has credibility, and he knows his co-workers as they know him. However, from an external perspective, one might interpret his position as Department Head as having a negative influence -- especially with the newer department members. Wilson (1979) feels that the possible bias that might occur when using an insider is outweighed by the level of understanding of the "ethos"
portrayed by the insider that might otherwise be missing with a researcher external to the situation. Lantz and Kass (1987) found that using an experienced insider helped establish and maintain a feeling of trust and collegiality in the interviews. In my view, this setting is a rich microcosm. The heterogeneity described provides a meaningful source of evidence in support of the research study. For a further discussion of these points, see Chapter 3.

1.8 Limitations of the Study

1.8.1 Validity

The validity of this form of inquiry may be challenged due to the unintended projection of ideas, opinions and feelings toward the teacher-respondents. Similarly, "knowing" teacher-respondents may wish to assist the researcher through tacit collusion. Reason (1981, p.244) suggests that validity is much more personal in this form of research. The validity of the study depends on the skills, sensitivities and actions of the researcher. The author states that valid research cannot be conducted in a vacuum; it can be enhanced by systematic checking; the researcher can critically examine the data as in the conventional notion of falsification; different methods can
be used; and the work can be built on other research work, or be replicated itself.

Dodge (in Spector, 1984b, p.461) indicates that the researcher must be competent, systematic, exercise care in avoiding conscious bias, reduce bias arising out of poor techniques, and report all instances of known bias.

Benson (1984) suggests that an important method of ensuring validity in qualitative studies is to confirm (or disconfirm) the researcher's descriptions and interpretations with the participants. This is, in a sense, also a test of reliability.

Woods (1979) argues that the more typical the school, the greater the chances are for the results to have external validity. The school selected is representative of large secondary schools in B.C. The teachers represent a broad range of backgrounds, age, and experience. There are both male and female teachers participating in the study.

1.8.2 Reliability

Reliability, in the qualitative sense, is how the researcher's descriptions and interpretations reflect the participants' perceptions of the real world. This can be checked by looking for inconsistencies in a participant's responses. Participants' perspectives can also be compared for similarities and differences. The taped interviews are
transcribed verbatim. In the analysis, quotes are taken directly with bridging words only added where necessary to facilitate the reader’s understanding. In the discussion, statements are either quoted directly or paraphrased using "denotative analogues". Jones (1985a) suggests that the use of open-ended questions helps eliminate interviewer bias. This study used a combination of open-ended and specific questions.

1.8.3 Generalizability

The notion of generalizability in this form of research is understood to mean that the reader can take general findings or trends from this study and apply them to particular instances. Woods (1979) finds that some researchers view this form of research as being entirely "idiographic", that is, descriptive of a specific situation. The research "descriptions are full of content, meanings, style and pattern, features which are not easily quantifiable" (p.268)...therefore they may not allow for generalization, but they might serve as a basis. Other researchers view this kind of research as generalizable through repeated studies, broader based studies, or more narrowly focused studies. Woods suggests that these two viewpoints are not necessarily exclusive of one another. He
points out several ways of improving the generalizability of studies.

In another study, Measor and Woods (1984) make three points with regard to the generalizability of such research. Firstly, others can use the material to add to their own knowledge and apply this knowledge to other situations as they see fit (the entire transcripts of 10 interviews, and the audiotapes are available, providing confidentiality of the participants is maintained). Secondly, the material adds to a collective body of knowledge from which new theory can be generated. Thirdly, one must recognize the limitations of each study as it is carried out and reported (p.158).

In the context of this study, the results can be generalized through further investigation. However, one must recognize the fact that the sample size is small, the interview questions are not all-encompassing, there are certain groups of individuals not represented in the study (see for example section 3.3), and the study was conducted over a relatively short time-frame.

Finally, one must consider that the interviewer in this case is not just an "insider" -- he is the Department Head. Although, it is believed that this did not affect the outcome, one must still take this possibility into account.
Additionally, caution must be used when considering the results in that being an "insider" may place the researcher too close to the setting. He may not be able to "see the forest for the trees"! The interviewer must be careful not to bring preconceptions to the study. Finally, one must be aware that, as such, the analysis and interpretation of the results are those of the researcher. It is possible that other researchers may find other relationships in the same situation.

In considering the validity, reliability and generalizability of this study, many of the points raised above have been addressed.
CHAPTER 2

REVIEW OF THE LITERATURE

In order to provide a framework in which to ground this study, the review of relevant research has been divided into several categories:

1. Theories of Action.
2. Paradigms according to Kuhn.
3. Teachers' Functional Paradigms.

2.1 Theories of Action

The behaviours that an individual manifests in a certain situation may not be congruent with the intrinsic behaviours to which an individual may subscribe. The former behaviours are referred to as "theories-in-use" or "level of practice". The latter behaviours correspond to an individual's "espoused theories" or "level of rhetoric". Various dilemmas may arise in a person's theories of action when the dichotomy between the two levels becomes incongruent, or the level of practice becomes incompatible with the individual's internal constructs (Argyris and Schon, 1974, p.7; Orpwood and Souque, 1984, p.27). In order to understand teachers' perspectives on curriculum change, it will be useful to explore the concept of "theories of action" a little further.
At the classroom level, theories-in-use include actual teaching practices, the use of curriculum and other learning materials, and the activities of the students. The espoused theories refer to both the intended curriculum guides and teachers' communications about their teaching. Argyris and Schon (1974) provide many examples of the incongruities that exist between espoused theories and theories-in-use. On introducing a new curriculum to teachers, the authors state that:

...most of the schemes for changing the curriculum assumed that a clear, rational picture, effectively presented to individual teachers would result in the programs' acceptance. Ignored were the feelings, attitudes, values that had developed around the old curriculum, the group norms that protected them, and the bureaucratic arrangements that had evolved over the years to protect individual feelings and values as well as the group norms (p.175).

According to Argyris and Schon, theories-in-use constitute human behaviour in everyday life. One cannot know another individual's theory-in-use without actually observing their behaviour. Furthermore, individuals may not understand their own theories-in-use. They are able to assess objects and events, or exhibit skills for which they cannot describe their criteria or procedures (Schon, 1984, p.11). Such intuition is referred to as "tacit knowledge" (Polyani in Argyris and Schon, 1974, p.11).

Teachers, as a community of professional practitioners have particular espoused theories and
theories-in-use, much of which is implicit knowledge. However, the boundaries of this body of knowledge are indistinct, in that, an individual's personal belief systems may not be congruent with those of the community. Clearly, it would be an impossible task to identify the entire range of beliefs that constitute one individual's espoused theories -- let alone the beliefs relevant to the behaviours of a whole community! One question of interest, in this case, is to what extent are an individual's set of espoused theories idiosyncratic and to what extent are they common to a community of practitioners?

In the study of *Science Education in Canadian Schools* (Orpwood and Souque, 1984), the researchers utilized the concept of "theories of action" to differentiate between the theoretical level of education and the practical level of teaching. They also found Roberts' concept of "curriculum emphases" to be useful in explaining the relationship between the intended curriculum and the variety of classroom teaching strategies that occur. A curriculum emphasis is a coherent set of messages about a subject that may be communicated implicitly and explicitly (Roberts, 1982a, p.245). Again, there is a need to analyze the nature of teachers' curriculum emphases and how they relate to teachers' functional paradigms.
2.2 Paradigms according to Kuhn

Before attempting to describe teachers' functional paradigms, it is necessary to delineate the concepts of paradigms as Kuhn defines them in his essay titled *The Structure of Scientific Revolutions*. This book has generated a substantial body of literature, some of which is more critical of Kuhn's thesis than others -- others comment on the possible misuse of Kuhn's work, especially in the social sciences (Erickson, 1987, p.13; Scharnberg, 1984; Gutting, 1980, p.14). For example, Scharnberg contends that much of the social science research, including pedagogical research, that has taken place over the last 10 to 15 years has been based on a strictly scientific paradigm. He argues that "there is a fundamental difference between the natural and the behavioural sciences. Quantitative and experimental methods as well as "hard" data are adequate within the former. But they are...wholly inappropriate within the latter. The main reason is that man has consciousness...(the behavioural sciences) require "soft" data as well as qualitative, "understanding" and empathetic methods" (p.13). This problem will be discussed again in a later section.

Gutting (p.13) indicates that the fact that there are so many attempts by social scientists to apply Kuhn's logic to their own situations is evidence that these disciplines
do not have a consensus of opinion as to what exemplary models describe their field. This particular situation similarly constitutes evidence of this point.

Kuhn responds to those critics of his sociological and philosophical stance in a postscript to the second edition of his book. In a sociological sense, he describes a paradigm as "the entire constellation of beliefs, values, techniques, and so on shared by the members of a given community" (p.175). The paradigm governs a community of practitioners. These practitioners have undergone similar academic and professional training; they have studied the same body of literature and they possess a common "disciplinary matrix". The components of the matrix include:

1. common symbols or expressions;
2. shared beliefs and values;
3. exemplars -- shared examples, models or practical solutions to common problems.

Part of the confusion evident in Kuhn's work is his use of the term "paradigm" to denote a body of knowledge characteristic of a community of scholars/practitioners and his other use of the term as being synonymous with "exemplar".

According to Kuhn (p.43), this matrix is developed through a process of observation, study, and practice of
established exemplars (via textbooks, lessons and other means of schooling). Geeraerts (1985) points out three characteristics common to paradigms. Firstly, paradigms are not solely conceptual entities; they are incorporated into a larger set of cognitive abilities through a combination of both academic and practical experience. Secondly, concrete examples provide a unifying function in the relationship between theory and practice. Thirdly, the exemplars provide a way of "seeing" reality (p.247).

One other aspect of Kuhn's thesis worth considering is his notion of "incommensurability" since this also has its application in curriculum change. "Two men who perceive the same situation differently but nevertheless employ the same vocabulary in its discussion must be using words differently...they speak from incommensurable viewpoints" (p.200). Kuhn states that since the two men have a great deal in common, perhaps their only difference is in their use of language. Each needs to be able to translate the other's language and, hence, gain an understanding of the other's point of view (p.203). Geeraerts finds that differences in value systems and world views may also contribute to incommensurability (1985, p.238). Other researchers have found that there are "barriers to dialogue" (Southgate and Randall, 1981). They propose that there are four different approaches to solving problems --
somewhat akin to Pepper's "World Hypotheses". These differing ideas, values and approaches to problems can influence constructive dialogue (p.61).

Equating these ideas to curriculum problems suggests that there is a communication barrier between the curriculum theorists and practitioners and somehow the differences between them must be articulated. Roberts (1980) proposes the concept of a "Developer-Teacher Interface" that links the theoretical world and the practical world of the teacher. At this level, the teacher has to "unpack" the curriculum in order to determine its meaning. The teacher then either rejects or "modulates" the new curriculum depending on their perceptions of the intended change.

It is becoming clear that one must come to understand teachers' perceptions of a curriculum in terms of their own "practical-language".
2.3 Teachers' Functional Paradigms

2.3.1 Conceptual Framework

2.3.1.1 A Concept of "Paradigms".

Crocker (1983) reformulates the concept of "paradigm" away from the idea of a set of exemplary procedures and practices for conducting scientific research towards what he calls the "functional paradigms of teachers". Crocker assumes that:

...teachers are, indeed, similar to other communities of scholars or practitioners in that they share common goals, problems, exemplars, routines, etc. which constitute a "functional paradigm"... (this) term is meant to convey the idea that the characteristics which unite a community of practitioners are likely to be centered on practical matters (p.354).

Essentially, Crocker is concerned with redirecting our focus on teaching from the question of how teachers and classrooms function to a question of why they function in particular ways (Crocker, 1984c, p.119). In considering the circuitous nature of Kuhn's concept of a paradigm as it might apply to teachers, one can understand that the paradigm characterizes a set of exemplars in teaching which are characteristic of teachers. Of importance to this study is the nature of some of these exemplars.
In proposing the concept of functional paradigms for teachers, Crocker relies on the work of Imershein (1977). His central thesis is that members of a social organization (health care delivery services, labour unions, teachers...) can be considered to operate under a shared paradigm similar to Kuhn's "community of scientists". This paradigm delineates the realm of thinking, the range of acceptable behaviours and determines the rules that are considered appropriate for members of that organization. Problems are resolved by referring to exemplars that are common to familiar situations and applying them to the new situations. Imershein finds that, in the health care field, little has been done to define the explanatory framework or exemplars that are used to account for problems of change or to predict the possibilities for change. Crocker (1983) believes that a similar condition exists in the field of education. Imershein contends that existing paradigms can be retained if the change to be implemented requires only minor adjustments, and any problems that occur can be resolved using prevalent exemplars. Recalcitrant problems (Kuhn refers to these as "anomalies") can be resolved by extending and modifying the existing body of knowledge. If the present repertoire of exemplars cannot be used to solve the problem, then a major shift in paradigms must occur if the innovation is to be successful (p.38). However, Candy (in Olson, 1982b, p.74) warns educators to be cautious in
that "major interventions in people's construct systems raise the real problem of how a person immersed in one set of personal constructs can construe and, ultimately, come to use another "mind set" or personal paradigm." The writer adds that there are ethical considerations to be considered when an individual is asked to reconstruct his or her own world view.

Since a functional paradigm implies a commonality, the research must focus on shared exemplars rather than the more traditional focus on differences between teachers. These exemplars are not as distinct as they might be in the natural sciences. This is in agreement with Olson (1980), who proposes that the challenges faced by teachers when experiencing a curriculum change present ambiguities. In order to "survive", teachers have to deal successfully with these ambiguities. He suggests that we should focus on these ambiguities as they will shed light on what it is teachers generally deal with successfully.

"(This)...suggests that there is more at issue than their behaviour when confronted with innovative suggestions, because it emphasizes understanding existing constructs that are likely to be well adapted to the purpose of keeping ambiguity under control" (p.10). Clearly, it is important to examine the exemplars common to teachers facing a curriculum change.
West (1986) has recently proposed a parallel paradigm for teacher education based mostly on the work of John Dewey. Others also use the concept of "paradigm" to denote a model, pattern, or scheme (Gage, 1963, p.95); or to represent a broad conceptual framework (Schubert, 1986, p.10).

2.3.1.2 A Concept of "Functional".

The notion of a "functional paradigm" must be extended beyond the relatively static model proposed by Crocker and others. The problem with a "functionalist" perspective for an organization such as teaching is that it does not take into account the myriad of identities that develop over time.

Bucher and Strauss (1976) use the term "segment" of a profession to describe groups having common identities, values, and interests. They describe a profession as a loose "amalgamation of segments pursuing different objectives in different manners and more or less delicately held together under a common name at a particular period in history" (p.24).
Coalitions develop between and among segments. They (segments) are continually undergoing change. They take form and develop, they are modified, and they disappear. Movement is forced upon them by changes in their conceptual and technical apparatus, in the institutional conditions of work, and in their relationship to other segments and occupations. Each generation engages in spelling out, again, what it is about and where it is going. In this process, boundaries become diffuse as generations overlap, and different loci of professional activity articulate somewhat different definitions of the work situation. Out of this fluidity new groupings emerge (p.24).

One can surmise from this account that science teachers constitute a particular segment of the profession. There are overlaps between segments. For instance, secondary and elementary groupings; junior and senior secondary teachers; biology, physics, and chemistry teachers. Olson (1988) makes a parallel argument. He suggests that teachers belong to a society. The way in which this society communicates and acts is its culture. He goes on to say that there are societies within the culture. "These societies have distinctly different cultures and those who join them as neophytes are encultured in quite different ways" (p.168). Olson uses the term "ritual" to describe this process. Perhaps one can equate these "subcultures" to the "segments" discussed earlier.

If these segments develop and evolve over time, then it follows that if teachers' paradigms are indeed common to the organization, then they too must evolve over time. This
is why the concept of "functional paradigms" must be thought of in an active rather than passive sense. Ball (1982) supports the notion of fluctuating paradigms. He finds that the time required for a major curriculum change to take effect does not allow normal analysis of paradigmatic changes.

Curriculum change is seen to be a long term and interpersonal process, based upon the establishment of subject paradigms via networks of communication and apprenticeship. With many of the teachers who are not exposed directly to experience of these paradigms being influenced marginally or not at all, by them (p.25).

In a later work, Ball and Goodson (1985) suggest that there are both pragmatic and paradigmatic orientations. The former allows for "partial redefinition and situational adjustment", the latter "allows for no compromise" (p.16). In referring to current analyses of teaching, Cole (1985) uses the terms "hegemony amongst teachers, emphasis on common structural parameters, ideology, conservative attitudes, determinism, structuralism and stereotypes" (p.89). He argues that teachers must be considered as active participants in the socialization process of schooling. Clearly, in light of the foregoing, one must accept the term "functional paradigm" as portrayed in the active sense.
2.3.2 Empirical Framework

Functional paradigms are probably based on individual differences, external influences, and the practical aspects of daily schooling (Connelly, Crocker and Kass, 1985, p.274). The following studies provide more insight into the nature of teachers' functional paradigms.

Based on the recognition that the reasons for the failure of many curriculum development projects in the UK were generalizable across classrooms, schools, age levels, and curricula, a teacher-centered action research project was initiated in the UK (Elliot, 1977). The study encouraged teachers to reflect on their own actions in the classroom. The research group was interested in having teachers explain the meaning of an innovation requiring an inquiry/discovery teaching approach. This fundamental change in teaching was a source of dissonance between students and teachers in that the students had an expectation of certain teacher behaviours based on the commonly held teacher paradigms prior to the innovation. Crocker (1983) suggests that a parallel can be drawn here to Kuhn's argument that paradigms become self-perpetuating as they are incorporated in textbooks, lessons and other pedagogic structures. The final part of the report provided a number of hypotheses related to teachers perceptions.
about curriculum change (p.18). Although the report suggests that a greater degree of implementation will occur through the sort of intensive dialogue that occurred in this study, the effort required on the part of the teachers involved makes the exercise almost impossible (see also Lampert, 1986, p.246; Schon, 1984, p.19; Connelly and Ben-Peretz, 1980, p.102).

In a study of teacher perspectives on curriculum change in primary science in Australia (Crocker, 1979), the researchers found that certain elements of the teachers' functional paradigm included a concern with content coverage, classroom management, time pressures, clarity of the curriculum mandate, and a concern for slow learning students. In addition, the teachers studied also held the view that students should be taught through direct instruction and that teachers have to intervene to facilitate student learning. Crocker concludes the study by stating that "rarely does the curriculum developer have to base his decisions on the realities of the teachers' world...the factors that the teacher needs to consider in order to function in the classroom are not the same as those that the curriculum developer must consider in producing a product and attempting to have the product implemented" (p.60). In a similar study (Spector, 1984a), teachers' responses to the demand for role change due to
the implementation of a new course were explored. The researcher found that the perspectives that teachers held about the change-agent, the school setting, teaching, and curriculum change, derived from their past experiences, influenced their willingness to initiate the new curriculum. Similar findings have been reported by others (Taylor and Richards, 1985, p.96; Doyle and Ponder, 1977).

In another study that investigated teacher interventions in elementary science laboratory groups, Oakley and Crocker (1980) found that teachers' espoused theories were incongruent with their theories-in-use. Teachers asked to change their teaching approach from a "whole class" to small group situations believed they were doing so based on surface changes. On analysis, in reality there was no significant role change. This again has implications for curriculum developers who desire a role change of the teachers.

In 1984, Crocker replicated the study that he had conducted in Australia in 1979. Although there appeared to be some research design problems with this more recent study, Crocker (1984a) found that the major factors influencing the implementation of an elementary school science program were the attitudes of teachers toward the curriculum, regardless of the features of the innovation itself. The researcher suggested some areas for further
research including comparative studies in contrasting contexts.

The study of Science Education in Canada (Connelly, Crocker, and Kass, 1985) also focused on science teachers' perceptions of curriculum in relation to their functional paradigms. This approach was taken because:

1. the way in which teachers approach curriculum is probably common;

2. teachers are likely to have a different perspective of curriculum than curriculum developers because the two groups have different functional paradigms;

3. the alternate viewpoint of practitioners should be examined as compared to that of the researcher.

The results provide several important insights into teachers' functional paradigms as they apply to curriculum translation:

1. there is an overriding concern with the characteristics of the students;

2. it appeared that as long as teachers are satisfied that the curriculum will meet the needs of a particular group of students, the curriculum can be constructed on the basis of a variety of scientific rationales;

3. teachers are sensitive to the impact of their actions on the school and community;

4. teachers favour curricula that emphasize "learning how to learn", the use of parallel student textbooks, and small groups as opposed to "whole classes";

5. teachers desire more responsibility for curriculum decision-making.
Other hypotheses resulting from this study include:

1. dependent on whether teachers' functional paradigms are determined by the socio-political characteristics of the educational system, or are more internally determined, one might expect teachers to want curricular autonomy that is consistent with the degree of centralization that exists in their own jurisdiction (in the first instance), or one might expect their behaviours to be common across all jurisdictions (in the latter case).

2. In line with point (2) above, teachers may translate curricula to the extent that the required teaching methods are compatible with their own teaching styles.

In a related sub-study, Crocker and Banfield (1986, p.815) suggest that the functional paradigms of science teachers are grounded in three main areas: (1) for students; (2) for strong school spirit and morale; and (3) for teaching methods.

Recently, Lantz and Kass (1987) examined the nature of teachers' functional paradigms in relation to a new chemistry curriculum at the secondary school level. The researchers have proposed a model to illustrate how teachers interpret curriculum materials (see Figure 1). Some of the parameters identified in the Lantz and Kass model will be examined further in this study.
FIGURE 1


- POLICY DOCUMENTS
- CURRICULUM MATERIALS
- TEACHERS' BACKGROUND
- TEACHERS' FUNCTIONAL PARADIGMS
- TEACHING SITUATION
- CLASSROOM PRACTICE
Lantz and Kass categorized their data according to Schwab's four curriculum commonplaces (Schwab, 1973, p.502). These include an equal consideration of perceptions about the subject matter, teaching, the students, and the school setting. Results indicated that there were some variations between teachers' personal functional paradigms; however, there were many shared elements. The study found that while teaching theoretical chemistry rated highly, teaching references to science, technology and society, and the nature of science had a low value. The specific teaching situation was an important factor. Academic history also seemed to be a major factor in shaping teachers' functional paradigms. The authors suggest that this should be examined in more detail.

The Lantz and Kass model, and many of the categories therein form a basis for the analysis of this study found in Chapters 4 and 5.

2.3.3 Teachers' Backgrounds

2.3.3.1 Past Experiences.

In the study conducted by Lantz and Kass (1987), a teacher's background was found to have a considerable influence on shaping his/her perceptions of the nature of the subject. The individual's academic history, including training and experiences, influenced his/her interpretation
of the curricular materials by shaping the functional paradigm. Merton (1957, p.101) suggests that when individuals are confronted with stimuli that would be expected to cause responses counter to their predispositions, their actual behaviour can be predicted more on the basis of their predispositions than it can on the basis of the stimuli. As part of Goodlad’s study of schooling, Klein (1980, p.5) surveyed teachers across the U.S. The researcher asked, “How much influence do each of the following (categories) have on what you teach?” Over 2/3 of all respondents felt that their own backgrounds, interests, and experiences had a “high” influence (this was the primary influence across all subject/grade levels). Student interests and abilities was rated second highest. These findings seem to be supported by others (Erickson, 1987, p.27; Spector, 1984a; Wilson, 1984, p.105; McFadden, 1980, p.50; Beecher, 1978, p.37).
The influence of past experiences either before or during an individual's career must be considered as a major determinant in shaping teachers' functional paradigms. A number of researchers have found that both early experiences as a student and later experiences as a practicing teacher have a profound effect on the development of teachers' personal knowledge (Diamond, 1988; Zeuli, 1988; Roehler et al., 1988; Clandinin and Connelly, 1987; Smith, 1985; Cole, 1985; Woods, 1984; Ball, 1982; Mardle and Walker in Ball 1982; Lortie, 1975).

Various terms have been used to refer to this personal knowledge. Clandinin and Connelly (1987) provided an extensive review of studies of teacher's personal knowledge. They used the term "the personal" to describe this inner knowledge. In their review, the researchers found a high degree of commonality between studies. They identified three components pertaining to teacher thought: "practical actions, biographical history, and thoughts in isolation from action and biographical history" (p.498). Evidently, most studies focussed on the latter case. Their study elicited a number of responses from the field, and their suggestions for further research in the three component areas seems to be of value -- and is pertinent to this study.

Lortie (1975) states that "socialization is a subjective process - it is something that happens to people
as they move through a series of structured experiences and internalize the subculture of the group" (p.61). Even as students in the classroom, our understanding of "teaching" is being shaped and developed. Students are exposed to a wide variety of teaching styles during their school life. They come to know the routines, exemplars, and methods of teaching. Students can distinguish the "good" from the "bad". By the time students complete high school, they are:

...thoroughly familiar with a variety of teaching styles and approaches to teaching,...they may already have identified with one or more of those styles and the ploys and strategies inherent within it. Thus experience as a pupil is more likely to provide the basis of a role model than experience as a probationary teacher (Mardle and Walker in Ball, 1982, p.24).

These thoughts are supported by the work of Ball (1982, p.25) involving English teachers. He found that a student's personal experiences as a pupil are equally as likely to have an influence on his or her understanding of a school subject and its pedagogy, as any teacher training. The extensive life history studies conducted by Woods (1985, p.260) and others, suggests that in addition to the influence of schooling itself in the development of a teacher's personal knowledge, home environment, age, parents, marriage, and socioeconomic and political factors may also be of influence.
2.3.3.2 Teaching Careers.

It is worthwhile at this point to consider the nature of the teacher's whole career in the context of curriculum interventions. For the purposes of this study, we shall use the definition suggested by Becker (1976). A career is a:

...patterned series of adjustments made by the individual to the "network of institutions, formal organizations, and informal relationships" in which the work of the occupation is performed (p.75).

Huberman (1988) argues that curriculum innovations "have been construed as a time-bound process, with little concern being shown for the prior and subsequent careers of the actors involved" (p.119). He suggests that curriculum implementation might be better understood through a closer scrutiny of the relationship between teachers' professional biographies and the innovations. Few attempts have been made to study the careers of teachers apart from the work of Becker (1970), Ball and Goodson (1985), Sikes, Measor and Woods (1985), and Smith and Kleine et al. (1985). Huberman summarizes the impact of curriculum innovations by stating that:

...large-scale innovations are only moments, however intense and significant, in the 40-odd years of activity; they constitute a few brief episodes in a professional and personal biography...when one overlooks people's lives to focus on events - and large-scale improvement efforts are mostly just that..., one is taking out the actors and assuming that the scenery is animate enough to carry the plot and account for the denouement (p.120).
Huberman also reports that in a 1984 study of school improvement, Huberman and Miles found that about half the teachers and administrators had career related motives for adopting the innovation (p.121).

Researchers have also identified key stages or phases that occur during an individual's career life cycle (Huberman, 1988, p.130; Diamond, 1988). In their study, Sikes, Measor, and Woods (1985) use age phases to categorize their subjects. But they admit that these categories are not rigid in that some people could have entered the profession at an early or late stage in their life. "Thus what the late entrant has to say may, in some instances and in relation to their occupational development, be representative of a person in a younger age group" (p.25). One must therefore be flexible in categorizing people. In this study, it was believed that relative experience levels would provide a more accurate indication of the individual's position along the career path.

In summary, the work of Crocker, Lantz and Kass, and others has led to a general understanding of the notion of teachers' functional paradigms. In an earlier study, Crocker (1979, p.2) decried the lack of a coherent theory of implementation. In a postscript to a summary of research on teaching in Canada, Crocker (1984c, p.119) points at the lack
of a theoretical framework specific to the study of teaching. Other researchers have also pointed this out (Winne and Marx, 1977). Perhaps by concentrating more research on the nature of teachers' functional paradigms -- by fleshing out the common goals, problems, exemplars, routines...and yet keeping in mind their individual career stages, we shall start to gain a better understanding of why teachers and classrooms function as they do.
CHAPTER 3

METHODOLOGY AND ANALYSIS

3.1 Methodology

There is a continuing debate that predominates research literature in the social sciences. This discourse revolves around the value of qualitative versus quantitative research methods (Power, 1976; Kilbourn, 1980b; Russell, 1980; Reason and Rowan, 1981; Roberts, 1982b; Elliot, 1983; Benson, 1984; Pinar, 1986). Discussion centers on the appropriateness of using the more quantitative experimental and survey research paradigms in education. Woods (1987, p.121) argues that such teacher knowledge is "produced in a scientific paradigm, whereas many would claim that teaching is also, and perhaps more essentially, an art". Lincoln and Guba (1986) approach the problem from a moral and ethical point of view. They argue for an "emergent-paradigm" or "naturalistic inquiry", stating that such an inquiry focusses

...upon realities as multiple, divergent social constructions, the search for a single "reality" is avoided...the emphasis on utilizing, rather than compensating for, the interactivity of researcher and respondent, creates the conditions for participants in research processes to retain their locus of control individually, (and) to make informed decisions regarding their participation... (p.36).
Much of the research has not been fruitful -- conflicting results, or "no significant difference" are typical. The relative merits of the experimental and survey research paradigms, and the more naturalistic research paradigms will not be discussed here; however, the notion of "complementarity" or "synergistic payoffs" in utilizing both approaches, referred to by Roberts (1982b) is a worthwhile consideration that has been successfully used by others (Orpwood and Souque, 1984; Connelly, Crocker and Kass, 1985).

In his paper, Elliot (1983) describes the strengths and weaknesses of four commonly used research paradigms: (1) The "systems analysis" paradigm views social processes as self-regulating. It provides the basis for a functionalist empirical/analytical orientation towards society that is free of value bias; (2) The phenomenological model views social processes as constructions of autonomous individuals; (3) The educational action-research model is founded on the belief that social processes rely on subjectively shared rules of interpretation for translating social traditions and values; and (4) The social-reproductionist model theorizes that subjective meanings expressed in social action are biased by their economic function.
The methodology employed in this study is somewhat sympathetic with both Adam Schutz's phenomenological approach and Habermas' action-research approach. According to Elliot, the orientation of the former "views teachers as craftspersons drawing on tacit common sense 'knowledge', acquired through experience in the context of their personal life and career histories" (p.9). It follows then that the shared understandings (exemplars...) characteristic of the community of practitioners are constructed out of the social interactions that occur throughout the "lived experience".

The latter orientation accounts for the apparent ambiguities attributable to the former case. Habermas (in Elliot, p.9) contends that in order for individuals to communicate their perspective of the real world to others, then they must already share certain concepts or rules for interpreting the world -- such rules are vested in shared values. The traditions that govern the community are embodied in social institutions and are rooted in descriptions of institutional practice.

3.2 Methods of Data Collection

In light of the previous discussion, this study involved a series of interviews with each member of the science department. Clearly, the interview method is an
appropriate means of examining the nature of teachers' functional paradigms. In this case, the espoused theories and tacit knowledge shared by a community of teachers can best be "got at" by actually being a part of the setting. This researcher shares the language, concepts and values of the community to be examined.

Woods (1987) indicates that the input of teachers who one can consider as the prime resource in the setting are largely left out of studies. He calls for:

...a new conception of knowledge, one that is not simply an extant body of facts and theories, but a living, experiential, processual, flexible, creative, compilation of insights, memories, information, associations, articulations, that go into resourcing on-the-spot teacher decision-making and action. It will include the ambiguities, inconsistencies, contradictions of life; what to some outsiders may appear as trivia, but what to teachers are of the utmost importance;...it will also include the skill of "orchestration" - a kind of practical theorizing whereby the teacher blends actions together into a harmonious whole (p.122).

Woods is suggesting something more than is practical in this study. However, his call for a "new conception of knowledge" is not taken lightly. This author certainly believes that the methods utilized in this study will add to this body of knowledge. The "life-history" method used by Woods and others was not used because in Wood's words, "teachers must want to do life histories for them to be of any value...and they are more naturally disposed to them at key career points in their lives" (p.132). Clearly, in this
study, time and willingness on the part of the participants was a factor in choosing a less ambitious form of interview.

Various authors have reviewed the interview process as a method of qualitative research. Massarik (1981) describes seven interview typologies. This study took an eclectic approach and utilized parts of, in Massarik's terms, the "Rapport Interview" and the "Depth Interview" (p.202). The characteristics of the "Rapport Interview" most closely fit my intentions. In this style of interview, there is a genuine human relationship between the interviewer and interviewee -- rapport and mutual trust are important aspects. Although the objectives can be quite focussed, small-talk and interpersonal exchanges can occur. In this case, the interviewer appears as a "human-being-in-a-role". Woods (1986) describes three positive elements of an interviewer: trust, curiosity, and naturalness. It is believed that being an "insider" will help promote such attributes.

In the "Depth Interview", the interviewer explores more deeply the perspectives and dynamics of the interviewee. Conversely, the interviewee may ask questions, seek clarification and reciprocate in the depth of his/her responses. This interview may be open-ended in terms of questions and time frame. The interviewer is regarded as a
"peer". Jones (1985a) discusses the need for trust and rapport with the subjects. She also suggests that some open-ended questions be used to help eliminate "interviewer bias".

The interview method was chosen as a research tool essentially because it allowed for a greater access and depth of understanding into the nature of the teacher's perceptions. Initial questions elicited unanticipated responses, and responses to particular questions were followed up in more detail with secondary focus questions. Some of the questions were more open-ended than others. Each interview lasted for about one hour.

An initial pilot study was conducted with six teachers in a city located approximately 65 kilometers from the primary site. The pilot study was conducted in order to test the interview questions, and to provide the interviewer with practical knowledge in terms of the process. The interviews were conducted in two schools. One of the schools is a grade 8 to 10 junior secondary school, and the other is a grade 10 to 12 senior secondary school. The schools are situated almost next to each other. Most of the students pursuing more academic programs take grade 10 in the senior high school. The individual teachers were first contacted by letter asking for their participation in the study (see Appendices D and E). The teachers who
volunteered were then contacted by phone to set up meeting times that were convenient to them. Four teachers agreed to participate at the junior secondary, and two agreed to take part at the senior school. The interviews were conducted two at a time over a period of one month.

Following the first two interviews, the interview schedule was revised to provide more focus. It was found that most questions in the schedule served as a guideline. In fact, as the interviews progressed, the interviewer did not have to refer to the schedule as much. An electrical short in the microphone lead during the second set of interviews caused the audiotape to be almost inaudible. It was decided that those two interviews would not be used since, it was believed that in comparison to the other interviews, there was insufficient detail. The session did serve a purpose, however, in that it provided the interviewer with more experience.

Following the third set of pilot interviews, the interview schedule was revised for a final time. The number of categories was reduced, and some of the more extraneous questions were eliminated. The final interview schedule can be found in Appendix A. The four audible interviews were transcribed. This provided data from two teachers at each school.
One other reason for conducting a pilot study was to provide a comparison against the six interviews that formed the data base for the primary study.

3.3 Methods of Analysis

The interviews were audiotaped -- notes were not taken in order to allow the interviewer to focus on the responses, and to be less disruptive. All the audiotapes were transcribed. The transcripts were then checked for inaccuracies against the master tapes. Samples of the transcripts for both the pilot study and the main study can be found in Appendices B and C respectively.

An added benefit in using data transcribed onto a word processing program is that the researcher was able to manipulate the data to facilitate analysis in a manner somewhat similar to the methods suggested by Jones (1985b).

One way of analyzing qualitative interview data is to classify or categorize the information. In so doing, one gradually breaks down the large amount of data into more manageable units. It is then possible to identify themes, trends or dimensions within the data (Alkenhead, 1984, p.171; Jones, 1985b; Woods, 1986, p.125). One danger is that the data may become too dilute in the process, and meaningful results may then not be as forthcoming.
The interview questions were categorized according to the following general scheme:

1. Background and experience...
2. Teacher views and opinions...
3. Curriculum perceptions, emphases, and meanings...
4. Teaching practices, methods, and style...
5. Perceptions of teaching...

The responses were then analysed according to six main categories: teachers' backgrounds, experiences, and teaching situations; teachers' current classroom practices; and teachers' perceptions of teaching, subject matter, setting, and students. In a study conducted in 1984, Crocker utilized six different descriptive categories of teachers (1984b, p.13). This interview schedule incorporates similar categories to those used by Crocker (1979), and Lantz and Kass (1987). The categories used in the analysis are discussed further in Chapter 4.

The data were also grouped according to the experience levels of the participants. As was discussed in section 2.3.3.2, the use of career-related experience levels rather than age categories was determined to be a more appropriate method of grouping the subjects.
Table II that follows shows the experience groupings that were used in this study:

**TABLE II**

**Relevant Experience Categories**

<table>
<thead>
<tr>
<th>Category</th>
<th>Experience Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Apprentice teachers:</td>
<td>0 to 3 years of teaching experience.</td>
</tr>
<tr>
<td>b) Post-apprentice teachers:</td>
<td>4 to 10 years of teaching experience</td>
</tr>
<tr>
<td>c) Experienced teachers:</td>
<td>11 years and more of teaching experience.</td>
</tr>
</tbody>
</table>

These particular groupings were used to separate the teachers simply because there are approximately ten incremental steps that are required to reach full pay in the B.C. education system. The boundaries between the groups must be flexible, especially considering the size of the population studied. These groupings more than anything, simply facilitate analysis. There are, of course, more groupings possible. Another study could investigate a pre-apprenticeship group, a pre-retirement group, and a retired group of teachers. This study did not involve teachers who were close to retirement or who had retired; nor did it involve those enrolled in teacher training institutes.
3.4 Reporting Format

The results were categorized, compiled, and reported in a descriptive "case study" style. Each section is summarized with respect to the initial questions. An overarching summary is provided at the end to relate each section to the general problem to be studied. The subgroups were compared using the "key decision rule that a common 'theme' has to include either the specific term or a denotative analogue..." (Huberman, 1988, p.122). There also had to be similar features describing the theme.

Among others, the following researchers refer to the use of case studies and other methods of ethnographic techniques in educational research (Wiersma, 1986; Olson and Russell, 1984; Kenny and Grotelueschen, 1984; Smith, 1978; Wilson, 1977).

Kenny and Grotelueschen characterize case studies by the following: "data are qualitative; data are not manipulated; studies focus on single cases; ambiguity in observation and report is tolerated; multiple perspectives are solicited; holism is advocated; humanism is encouraged; and common and/or nontechnical language is used" (p.38).

Similarly, in their work, Ball and Goodson (1985) find that such methods "serve to identify aspects of common experience and to isolate some of those factors which separate and differentiate teachers; factors like age,
subject, level of specialization...these methods tap into
the lived experiences of teachers in schools, their
successes and failures, their relationships with the
' hierarchy', their conditions of work, their responses to
change" (p.13). It is precisely these aspects and factors
of teachers' lives that this study intends to investigate.

These features serve to support the methodological
approach, followed in this study, as outlined previously.
RESULTS

4.1 Analysis of the Pilot Study

The interview questions were pilot tested with a group of six science teachers at two schools in a nearby town -- changes were made as necessary to the interview schedule (see section 3.2).

After comparing the transcripts of the pilot study and the main study, there do not seem to be any major inconsistencies between the projects. There was only one recognizable difference between the two sets of data. The interviews were, for the most part, much longer in the pilot study. This is understandable primarily because there were more questions in the pilot study. The interviewer was also relatively unknown to the respondents in the pilot study, but was well known in the primary study. It is possible that there was a greater commonality of underlying meanings and understanding between the interviewer and participants in the main study than in the pilot study, and so both the interviewer and respondents were relying on this common knowledge in their dialogue. Perhaps another point to consider is that the primary study was conducted
at the end of the school year, and so timing could have been a factor. Another consideration is that as the interviews progressed, the interviewer became more experienced and adept at posing questions.

4.2 Analysis of the Main Study

For the reasons discussed in previous chapters, the data were grouped according to the experience levels of the participants (see Table II).

As was outlined in Chapter 3, the groupings of teachers were analyzed according to the categories identified by Lantz and Kass (1987). They categorized the data on teachers' functional paradigms according to Schwab's curriculum commonplaces (Schwab, 1973, p.502). These include teachers' perceptions of teaching; subject matter; school setting; and students. One component of the "Perceptions of teaching" category as suggested by Schwab (p.504), and Lantz and Kass (p.133) is teachers' background and experience. This was identified as another category in the analysis. Current teaching situation was examined briefly in the preceding category. Current teaching practices was also considered as a separate category. It was anticipated that elements of teachers' functional paradigms would emerge from a consideration of the following categories:
1. Teachers' background and experience.
2. Perceptions of teaching.
4. Perceptions of school setting.
5. Perceptions of students.

This chapter will focus on the functional paradigms of individuals taking part in the study with respect to the foregoing categories. Each category is analyzed in the context of "why" teachers select, interpret, and utilize curriculum materials in certain ways.

4.2.1 Teachers' Backgrounds and Experiences

The following Table (Table III) outlines the teaching experience of the participants as of June 30th, 1988. The participants are grouped accordingly. It should be noted that the study included both a male and female in each group except for the "experienced teachers" group of senior teachers. This is consistent with the trends of males to females found at the high school level in the Science Council of Canada Study (Orpwood and Alam, 1984c, p.34) in that there are fewer female science teachers in the senior years of teaching. One perhaps would assume (and hope) that this trend is beginning to change, although there were no female science teachers at either of the schools in the pilot study.
### TABLE III

*Teaching Experience of Participants*  
(as of June 30th, 1988).

<table>
<thead>
<tr>
<th>Type of Teachers</th>
<th>Participant</th>
<th>Years</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Apprentice teachers:</strong></td>
<td>(1) Betty</td>
<td>1 year</td>
</tr>
<tr>
<td></td>
<td>(2) Sam</td>
<td>1 year</td>
</tr>
<tr>
<td><strong>Post-apprentice teachers:</strong></td>
<td>(3) Leona</td>
<td>8 years</td>
</tr>
<tr>
<td></td>
<td>(4) Pete</td>
<td>10 years</td>
</tr>
<tr>
<td><strong>Experienced teachers:</strong></td>
<td>(5) Ron</td>
<td>14 years</td>
</tr>
<tr>
<td></td>
<td>(6) Dave</td>
<td>16 years</td>
</tr>
</tbody>
</table>

An "early entrant" to teaching is classified in this study as one who started teaching at an age younger than 24. A "late entrant" is one who started teaching after age 28.

For the purposes of this study, "traditionalist" teachers are regarded as those who teach using a standard lecture-lab format. Their teaching is conformist, in that they do not stray from the curriculum. They are reluctant to try new methods of teaching, although they do adjust the content of their material if it becomes factually outdated or technically incorrect. These teachers value academic rigor, and they tend to adhere to a strict knowledge-based
course. Their view of science is disciplinary with firm boundaries between each science discipline.

The notion of a "progressive" teacher is used to mean those teachers who are willing to try new ways of teaching. Their teaching approach is varied, in that they use a variety of teaching strategies. These teachers tend to value the application of science to every day societal problems. They are interested in the technological aspects of science. They do not view science as a series of discrete disciplines, rather they see science as interdisciplinary in nature. These teachers are more concerned with the practicality of science, than with science as a body of facts and principles.

In the discussions that follow, "SC" is the interviewer.

Apprentice teachers:

(1) Betty:

Betty graduated from UBC in 1982 with a Bachelor of Education degree. Her concentrations were Biology and Physical Education. She is a relatively late entrant to teaching. This year is Betty's first year at teaching, although she has substitute taught for a number of years.
Betty is currently teaching Science 8 classes, two Science 10 classes, and two Modified Science 10 classes (a generalized program for students with learning difficulties).

Betty is married, in her mid-thirties, and has one small child and another on the way. Betty grew up in this town, and so she still has family members nearby. Her husband is employed by one of the larger industries in town.

When asked why she chose teaching as a career, Betty indicated three reasons: an interest in coaching, family support, and the influence of one of her early science teachers.

Betty: I think it was probably because I enjoyed working with students. I was quite active, athletically involved and I thought I would really like to pursue coaching. So that's probably a lot of why I went into teaching.

Some of Betty's uncles are teachers. She said that teaching is looked upon favourably by her family members.

Betty stated that she always wanted to be a teacher...

SC: Do you know what influenced that?

Betty: Okay, well I think once again the Phys. Ed. part and also my science teacher.

SC: That person stands out in your mind?
Betty: Yes, and I think he's the reason why I pursued the science because I enjoyed it and a lot of it was personal interest. Betty's response was immediate in recalling the science teacher as being a factor in her career choice. This point was pursued further. She was asked to describe the science teacher whom she recalled as being influential in her decision to enter teaching.

Betty: I just found him fun and interesting. I think I really enjoyed his classes.

SC: How would you describe his classes? Can you picture that?

Betty: Okay he...that was way back when. I think he was demanding, like he expected a lot of you. But the way he taught he was interesting, he was also fun. He was just a fun person.

SC: Did he teach in what you might call a traditional method, using the blackboard and lecture?

Betty: Yes. I think he was fairly sort of...structured. Lots of notes I remember. Like the lab work, I really enjoyed that.

SC: Was he more of a, would you say he was more of a theoretical kind of science teacher or more practical?

Betty: I think he was a combination.

SC: So he liked to vary.

Betty: He would just throw in interesting things too. Not just lecture and notes.

Betty was then asked to describe her favourite courses during high school. She responded:

Betty: Biology and I probably enjoyed the math and then there's Phys. Ed. I wanted construction then.

SC: Did you take construction?
Betty: Yes. Actually, that was a good course. We had a good instructor there.

SC: Why was that a good course?

Betty: Well, I enjoyed woodworking... I still do, and our instructor was really good... It was fun. It was really fun.

Betty is practical-minded. She enjoys lab work and woodwork. This is clearly evident in her descriptions of the science and construction classes -- she made a similar comment regarding lab work at the university level. Her response regarding taking the construction course indicate that this was something unusual (which it was), and her tone indicates that it was something of an achievement. Her recollections of these classes suggest that each teacher had something more to offer than a traditionalist sense of teaching.

Betty does not recall any outstanding teachers during her university years (either positive or negative). She enjoyed most of the "instructors". She said that they "weren't too bad". Her use of the term "instructor" suggests that Betty does not necessarily view university educators as being the same as school teachers. Her expectations of them were evidently confirmed during her undergrad. years -- they were not great, but they weren't too bad either. The term perhaps stems from her physical education courses, where the teachers were probably technically "instructors".
Betty was asked to comment on whether she tries to empathize with certain teachers from her past.

Betty: Well, I think you do because you're thinking about the classes that you enjoyed and so you try to follow in their footsteps and you work on it.

Summary

Betty is a beginning teacher, who got started in the profession at a later stage. She has family members who are teachers, and they seem to be supportive of her career choice. Betty always wanted to be a teacher. She claims that she entered teaching for three reasons: an interest in coaching, family support, and the influence of one of her early science teachers. Betty is practical-minded. She enjoyed lab-work during her own schooling. Her impression of her university "instructors" was non-committal. Evidently, they did not leave a lasting impression. Betty believes that there is some kind of relationship between her teaching, and that of her previous instructors. Betty is quite committed to teaching, although there also seems to be a family pressure.

Betty used the following terms to describe the teachers who she says had an impact on her...they were fun; enjoyable; interesting; good; tried different teaching methods; not just lectures and notes; the labs were enjoyable; structured; demanding; expected a lot;
traditional; used a combination of theoretical and practical approaches...

(2) Sam:

Sam graduated from UBC in 1986 following five years of study. He has a Bachelor of Science degree with a major in Biochemistry, "heavy on the organic and inorganic side as well as genetics". In 1986-87, Sam took one year of teacher training, also at UBC.

Currently, Sam is teaching the Science and Technology 11 course, two Chemistry 11 classes, three classes of Science 10, and one Modified Science 8 class. Recall that the senior courses are semestered, whereas the junior courses are on a linear timetable.

Sam is a relatively early entrant to teaching -- he is about 24. Sam is single at the moment. Sam does not have any relatives living nearby. Sam is from the central part of Southern B.C.

When Sam was asked about his reasons for choosing teaching as a career, he indicated that it was a fairly late decision (second year university). It was an unexpected but fortuitous chance at tutoring a student that seems to have convinced him of this career choice.
Sam: I tutored a...One summer, I wasn't working so much at the mill that I worked at for a summer job, so I took another job on. Just a kid came down with a case of the measles and I was asked to tutor him for two weeks before his finals, in four subject areas for grade eight. I really enjoyed that. That was back in my second year and I really enjoyed it...and the kid passed with flying colours which was kind of a positive thing to me. I ended up tutoring him again the following year in just one subject, in science, and he did the same thing again, he passed the course. He was falling before the final and passed it. So I was doing something right with him. So it gave me another branch, it wasn't...I didn't have a clear-cut teaching profession in mind but it was there. I was encouraged to take it.

In his early years, Sam wanted to be, among other things, a dentist, or an electrical engineer. These ambitions still held up in university. However, he also entertained ideas of entering medicine -- apparently, teaching was an acceptable alternative to be considered throughout. Evidently, teaching, in Sam's mind is held in relatively high esteem...along with dentistry, medicine and engineering.

Sam: (When I was) very young, I wanted to be a dentist. Then in high school, I wanted to be an electrical engineer. Then in university, I wanted to be either. When that didn't pan out I was looking...I did very well in biology and chemistry so I thought, I was looking towards medicine...but teaching was right beside it.

According to Sam, it didn't matter which career he chose, although it was always something "professional". It seems that towards the end of his undergraduate years, he was "fishing around" for a career, with no set direction in mind. Although Sam does not have family members who are
teachers, he has a number of friends who went into teaching, and he used to socialize with practicing teachers in his hometown before he himself became a teacher. Again, it is apparent that teaching was not a second choice to other career possibilities; it was one of a number of acceptable alternatives.

Sam's family were quite supportive of his career choice, although, they perhaps have a slightly different view of the hierarchy of professions than Sam. Another reason for Sam choosing the profession is for the coaching aspects. This is somewhat similar to Betty's reasoning, although Sam wants to provide a service, whereas Betty wants to enjoy her participation as a coach. Elsewhere in the interview, Sam said that "if I was in this job for the money, obviously I wouldn't be in this job. There's something else that's motivating me to do it". Sam is currently coaching a number of teams. Betty is not coaching this year -- probably due to the time constraints and family pressures that Sam does not face.

Sam: My family's quite proud of me for even, like I'm the only one in our family history to have a degree, in their history. And so they're all quite proud that I'm at least something, like a teacher, and they're all still...they know that one of my aspirations was to be a doctor and they're really still keen on me trying to do that but I need to...One of the reasons why I took it was because I was involved heavily in the volleyball program and I don't think I could put back into the system what I got out of it by being a doctor, going through med. school right now, so that's, in a sense, why I'm
doing this. While I’m younger I still have the energy to coach and that.

In reading the above a little more closely, Sam is not firmly committed to teaching...yet. In fact, Sam feels that if he was to change jobs, a career at a college or university might be acceptable. Evidently, Sam views teaching in levels, with possibly elementary teaching being the "lowest" form of teaching, and post-secondary being most acceptable. From his earlier comments, these impressions may be family oriented. Interestingly, administration in the secondary school did not come up as a form of career advancement.

SC: Do you see teaching as a lifetime career?

Sam: No, I don’t right now because I don’t think I could have this, it takes a lot of energy. I don’t think I could be as successful a teacher thirty years down the road. But possibly, this is at the high school level, if that’s what you mean maybe just at the high school level, but possibly I can envision myself being a college or university teacher or something like that.

Sam was asked about his formative school years. He has a positive image of his high school years. He commented that "we" had a good time at high school, and despite a few "quirks", he liked all his teachers. When asked about these questions, Sam’s introspection left a smile on his face, and his reference to "we" suggests that his high school years were also positive in terms of the social scene.

Sam recalled two high school teachers in particular who stood out in his mind. He described these teachers as
being very personable. They incorporated some humour into their classes, and they involved themselves in activities beyond the normal curricular school day.

Sam: ...they liked to discuss things with you. They always had a nice thing to say walking down the hall...They coached us or ran some sort of club and that's where, I think, you really get to know the teacher better, just in a smaller group setting, something different from up in a classroom setting.

Sam could not remember any particular elementary teachers because he says that he moved around a lot during those years. He just had a vague recollection that "if you showed maturity, they treated you like a small adult". Apparently, changing schools a lot prevented him from building up a strong initial image of his teachers...and perhaps the constant moving was also a negative factor.

At the university level, Sam recalled three "profs" who stuck out in his mind. The first two were Biochemistry and Chemistry teachers, and the third was from his teacher training year. In his description of these teachers, Sam was very enthusiastic!

On the science "profs."

Sam: ...they made the course much more pleasurable to be in. They used some humour in their teaching; used a number of different teaching strategies, such as not just straight overhead notes; they incorporated some demonstrations or something different out of the ordinary than other profs., instead of just getting up there and lecturing the whole way through.
On the teacher training year "prof."

Sam: Very enthusiastic. In a sense, that supports another attribute of the other two. Wandering around the classroom, like maybe put the notes on...like step back into the audience to see what they wrote and ask questions...and you weren't afraid to ask questions. In particular, in this fifth year, incredibly knowledgeable about how they teach stuff. I mean, he was the Science Education prof. and at eight o'clock in the morning, incredibly enthusiastic about the job...he would wake you up basically. Always smiling always got something positive to say, no matter, even if it's a terrible job he would find something positive to say about it. Very enthusiastic tone in his voice.

Sam's espoused theories of teaching seem to be based on the positive elements just discussed.

Sam: ...I tried to take that enthusiastic approach. I think if the kids can be entertained in some way, they don't find the class as boring or as...I think they'll also learn, maybe pick-up on something, even if you say it in a funny way or whatever, they'll hang onto it better.

Sam did however recall some negative aspects of teachers, but only at the university level. He commented on their monotone voices, inability to communicate with the undergrads, and inadequate responses to questions. He also felt that the ones he didn't like were "so high above us and they didn't come down to our level". This is in keeping with his earlier comments regarding the hierarchy of professions, and his place in the system.
Summary

Sam is a beginning teacher. He decided to opt for teaching as a career midway through his undergrad. program. His family were supportive of his career choice, although they may have hoped that he would choose one of his "higher" career ambitions. A positive experience tutoring a student finally convinced Sam to teach. Sam views teaching to a certain extent as a service. He feels that it is important to be involved in all aspects of teaching. At this stage in his career lifecycle, Sam is not firmly committed to teaching. If he does change careers, it would most likely be for a teaching position at a post-secondary institution. Sam's high school days had a positive effect on him.

Sam describes the teachers who he recalls in a positive light as being...personable; humorous; involved in school activities; very enthusiastic; discussed things with you; circulated around the class; effective communicators; good at question and answer; used different methods; not just lecture and labs; entertaining...He also described some negative factors. They include...monotone voice; poor communicators; could not answer questions clearly; were "above" the students...
Post-apprentice teachers:

(3) **Leona:**

Leona obtained a Bachelor of Science degree in Marine Biology from St. John’s Memorial University in Newfoundland. Prior to taking teacher training at Simon Fraser University, Leona worked as a substitute teacher in town, and worked part time at the local Catholic school. Following her training year, she worked for 6 months as a permanent substitute teacher in Vernon, B.C. The following September, she began a year of substitute teaching at Mountainview Secondary. Leona began full time teaching at Mountainview in September 1981. She is currently teaching Science 8, Science 10, and Biology 11.

Leona spent a lot of her formative years in this community; her parents still live here. She is about 34 years old and single. Leona would not be considered an early or late entrant to teaching.

Leona did not have any specific career goals in mind. She recollects that two teachers in town were factors in her decision to enter teaching. However, it becomes apparent that her parents, especially her mother were major influences in her career path.
Leona: My mother...likes to reminisce about me sitting on the doorstep with all the neighbourhood children, reading them a story and then having a test after. And then I started teaching swimming and was the swimming instructor and lifeguard before I went into teaching as a career. So she thinks, even though I wasn't in a school setting, that was always where I was headed.

SC: And what do you think?

Leona: Looking back, mostly I agree.

At the time, Leona doesn't recall wanting to be a teacher. She had offers of a Department of the Environment job in Ottawa, which she turned down.

Leona: ...I didn't know what I wanted to do so...I sort of wandered around. But when I was working at the swimming pool, we had a school swimming program organized, Clive Penman (a principal), Bill Irvine (a teacher), and myself. Clive Penman called me in to sub for Bill Irvine and that's how it started...he's (Clive) the one who brought up the papers to the swimming pool one day and said, here, fill this in. It was November and I said, "Well, what is this?", and he said, "I think you should be a teacher". Made me fill in the papers and I was accepted two weeks later and had to quit my job and drive down to Vancouver. That's you know, like I never did it for myself.

Apparently, teaching was an acceptable career for both Leona and her family. She enjoyed the "people" aspect of teaching, and had had some brief positive experiences as an unqualified substitute teacher.

Leona does not have a strong commitment to teaching. She does not view it as necessarily a lifelong career. Leona indicates that she would like to get into politics, business, or some form of consulting. Her frustration, the
need to change, and to change things is evident in the following comment.

Leona: I got into teaching, I guess, because I thought, you know, you're sort of in charge of your own classroom and what you want as an environment, you can have. All the outside issues are starting to really play on me and I feel almost like a puppet where I would like to be in some sort of more control of what I'm teaching and how I teach.

Leona was asked about her past educational experiences.

Leona: Well, I went to a convent for grade 11 and grade 12. They were very curriculum oriented and the teachers that stood out were the ones, not for their teaching ability, more for their personality. There was one nun there who had come over and built the very first convent in Canada...she taught social studies. So it wasn't learning from her, it was listening to her.

Again, Leona's parents played a strong role in her upbringing, choosing to send her to a convent. The nun, who Leona speaks of, obviously had more to offer than her colleagues... and that is why she stands out in Leona's mind. Similarly, Leona remembers a grade 4 teacher in a positive light..."She first taught me about prejudice". Other teachers have made an impact on Leona's personal growth...she cites "different methods...teaching styles...and personality" as the reason for their influence.

At university, there were two teachers who stood out from the rest. One was a mammologist, the other was "into organic gardening and communicating with whales by flute."
So different ends of the spectrum". Leona was asked to describe what was different about them.

Leona: Dr. Thrafull came in and lectured. Big booming voice, lots of examples, and humour, sort of...and the other professor was you know, came in with work boots, manure up to his elbows and sort of sat around in big circular tables and discussed ecology.

Although appearance and style were different, both university professors were personable, and people with whom Leona could relate.

Leona does not feel that her previous teachers at any level have influenced her teaching. She indicates that she does not remember how they taught, she just enjoyed them or didn’t.

Summary

Leona has taught for about 8 years. She did not intend to be a teacher, but it seems that opportunities, and family (mother) pressures pushed her towards this career. Her family is very supportive of her decision to teach. Her experience as a swimming coach, and the influence of two teachers were also influencing factors. Leona is not dissatisfied with her career choice, but she would like to be able to have more control over things. She says that she is not firmly committed to the profession.

Although Leona does not feel that any of her past teachers influenced her teaching style, she does mention
some positive attributes of those teachers who still stand out in her mind...personality; used different methods; someone you could listen to; humorous; used lots of examples; could relate to them; more to offer; personable; taught about prejudice (positive values); different teaching styles; enjoyable...

(4) Pete:

Pete graduated from the University of Victoria with a Bachelor of Science degree in Physics. He went on to the University of Waterloo where he obtained a Master of Science degree in Geophysics and Astronomy. He completed his teacher training at U.Vic. Pete has taught for 10 years at Mountainview Secondary.

Pete is currently teaching one Physics 12, three Physics 11, one Earth Science 11, one Science and Technology 11, and one Science 9 class.

Pete is single, and about 36 years old. He does not have relatives in town; however, he does have relatives in nearby towns. His family is from Prince George, B.C. where his father was a lab technician. Pete attended a private Catholic school for most of his formative school years.
Pete chose to go into high school teaching following his graduate degree as a secondary career choice. However, teaching had always been in his mind.

Pete: ...the situation at the time, sort of demanded that I change what I had planned to do. I had planned to go into university teaching. Get my Ph.D. and get into a university and do research. However, NASA was shutting down about that time, their first big shutdown. They were laying off a lot of physics types and the job market was really crowded. So, I still intended to teach so I went into high school teaching instead.

Pete has an aunt who is a teacher. His family were ambivalent as far as his career choice, although they were supportive. Pete is firmly committed to teaching as a career. Teaching is a major component of his life.

Pete: I consider my life as a whole, so what you do in one affects the other.

Pete recalls one teacher, a priest at the Catholic school, who, he says, probably influenced his own teaching style. I asked him why he recalled this person.

Pete: He was an interesting guy. He did a lot with experimentation, so we did a lot of experiments in his class and you learned that way.

The classes were small, single-graded, and lab experiments were conducted without a lab book. Pete does not recollect any outstanding features of his university days. Classes were quite traditional involving mostly lectures. Pete does not lecture, and so he says that these courses had little bearing on his own teaching methodology.
He had little regard for his teacher training year, finding that the practicums were really the only positive aspect. Pete particularly remembers one in-service activity that definitely left an impression.

Pete: The only thing that really influenced me a lot in my teaching was going on a summer course in geology. It was sponsored by Shell Canada. It was a very hands-on thing. We got to deal a lot with, just looking at materials and going places and things like that. So once again, it was sort of a hands-on.

SC: ...did you find that you were able to use some of that experience in the classroom when you got back?

Pete: You can to some degree. Like I try to keep a lot of rocks around. I try to get people interested in doing projects with rocks.

Pete is interested in more creative and practical aspects of teaching. From personal experience, I would characterize him as a progressive teacher. He is willing to try new ideas. For instance, he still teaches science using an integrated approach. I would characterize Leona the same way, but less so.

Summary

Pete had always wanted to be some sort of teacher. Initially he had wanted to be a post-secondary teacher. However, the job market at the time closed that avenue for him. Pete has taught for about 10 years, and is firmly committed to his career. He has a relative who is a...
teacher. His family is ambivalent as to his career choice. They were generally supportive of whatever he chose to do.

Pete describes a teacher whom he recalls as...interesting; lots of experimentation without lab books... He says that a short-course that he took was an influence on his teaching. It was hands-on, going places, observing things...He says that the foregoing is how he likes to teach. He does not lecture.

Experienced teachers:

(5) Ron:

Ron has a Bachelor of Science degree in Kinesiology and a teaching diploma from Simon Fraser University (having travelled through Europe in between the two). Ron is neither an early, nor late entrant to teaching. He has taught for 13 years at Mountainview Secondary. This year, he is teaching Science 8, Science 9, and Biology 11. This is Ron's first time teaching full-time science. He has taught mostly physical education during his career, although he did teach a couple of junior science courses a number of years ago. He chose to teach science this year as a way of making himself more marketable, as he would like to move next year.
Ron is about 39. He is married with two young
cchildren. His wife is also a teacher at the secondary
school.

Ron was asked why he chose teaching as a career.
Coaching and teacher influence were cited as the
predominant reasons. Although there may have been other
extenuating circumstances. Apparently, Ron’s family was not
particularly supportive.

Ron: I’m the only member of my family who even went to
university, out of six kids...my family was very
noncommittal.

I detected a slight note of bitterness in Ron’s tone.
Ron’s career goals were set high. He was at one point
accepted to medical school in Newfoundland, but chose
teaching anyway. Perhaps there is a sense of disappointment
here -- both in Ron’s mind, and his parents.

Ron: I wanted to be an athlete. I wanted to be a doctor.
I wanted to be a teacher...I had to choose between
the two and it just came down to which took too
long.

In the end, time may not have been as much a factor
as financial considerations, and distance away from home --
although, I did not pursue this.

Ron had said that a couple of teachers had also
influenced his career choice. He was asked to expand on
this comment.
Ron: I had a former English sergeant-major who taught social studies and it was really exciting. Not only did he know a lot but he (had) lived a lot, quite a bit of it...He had fought in India and all over the place...he was an old-timer. He was strictly a lecturer and you work and you be quiet and work. But it was a dramatic, exciting lecture...I can't say that I've had a science teacher who excited me. I had some English teachers who were really exciting, who really got us going and we did really exciting things. I always liked P.E. too. Actually, I liked P.E. and I thought there were ways that it could be done better.

Clearly, Ron's description of his former teachers indicate that they had a marked impact on him. These memories stay with him because the teachers were able to add to the traditional lessons and capture Ron's attention. I would argue that Ron's espoused teaching methodology closely resembles the previous description. This becomes evident later on when Ron discusses his own teaching.

University courses did not hold much attraction for Ron, particularly his teacher training year.

Ron: I must admit that the education courses were the most boring I've ever experienced in my life. I took one course in physical education teaching that was exciting, when the guy was actually teaching us things that were useful. The science people were trying to tell us about how you could do directed studies and all this kind of stuff and then if you went and researched it a bit you found that they worked well as long as you had a "wasp" upper-class classroom, and if you had anything else they didn't work.

Again, there is a certain amount of frustration expressed here. It seems to be arising from Ron's personal background. There is a need to consider how these feelings have contributed to Ron's personal knowledge of teaching.
Summary

Ron has taught most of his 13 years in the P.E department. He chose to switch to science this year in order to improve his job prospects elsewhere. Ron's family do not seem to be very supportive of his career decision. Coaching and teacher influence were the reasons for him choosing teaching. Ron is committed to teaching. His wife is a teacher, and there are teachers in her family. Ron had the dilemma of choosing between teaching and medicine. He indicates that time was a factor in his final choice, although other reasons may also have swayed him. He is perhaps wondering what it might have been like if he had chosen the other career path.

Ron uses the following terminology to describe the sergeant-major/teacher whom he recalls vividly...exciting; dramatic; knew a lot; had lived a lot; strictly a lecturer; work...be quiet...work; did exciting things... Ron also remembers some negative aspects of schooling, mostly at university...boring, out of touch; didn't apply to the real world...

(6) Dave:

Dave has a Bachelor of Science degree in Biochemistry and a teacher training diploma, both from Simon Fraser
University. He was an early entrant to teaching (age about 22-23) and has taught for 16 years, all at Mountainview Secondary. Currently, Dave is teaching Chemistry 11 and 12, Science 8, Science 9, and Modified Science 9.

Dave is about 39. He is married with two young children. His wife is also a teacher, but has not taught for a few years. Dave does not have any other relatives in town.

Dave commented on why he chose teaching. He did not really have a clear career path in mind until late in his final year. He stated three reasons for his decision.

Dave: One, I liked working with young people. Two, I'd helped other people and found that I was successful at it...and three, I wasn't particularly interested in the other options available to me.

Dave was asked to elaborate on his reasons for choosing teaching.

Dave: I had...well, at that time I was young as well, but I had helped classmates in school, that sort of thing. I helped my brother with some things.

It seems that being "young" was a factor. Perhaps Dave considered himself young enough to try teaching...and if things didn't work out, then he could still try something else. Dave is pragmatic enough to consider these options. This logic is evidential in the previous few paragraphs. Family support in a general way was also present. Dave's brother was already accepting him as a
tutor. Dave also has four or five relatives who are in teaching. One is a superintendent in Saskatchewan. Dave was asked if his family accepted his career choice.

Dave: Oh I don't really have a problem with it. I enjoy teaching. I don't think that it was a particularly illustrious position or particularly distasteful or anything.

During his early years, Dave had always favoured the "science-technical" side. He had at times wanted to be a chemist and others, an architect. He did not mention teaching. He did expect to be working in some form of science. Interestingly, it seems that the post-sputnik era generally had an impact.

Dave: Yes. General law in the '60s, you were going to get a job in science.

When asked about whether any of his school teachers had made an impression on him, Dave described a math teacher in particular.

Dave: ...It was about halfway through the course before I realized we'd taken up anything new. It was just so smooth, effortless. A Chemistry teacher, he was very good. Had a very wry sense of humour. Same thing with junior high English teacher...and a Socials teacher. Sense of humour stands out, and efficiency.

Dave commented that the teachers were quite traditional in their style...lectures, labs...I asked him if he incorporates anything from those days in his classes.

Dave: I enjoyed people with a sense of humour, so I try to include that in my thing. But that's not because of a teacher, it's just the way I am.
We then turned to Dave's university years. He recalls that the only useful aspects of his teacher training year were the practica. His undergrad. experience, if anything, tended to reinforce Dave's own feelings for science.

Dave: Well, certainly love of science because I found many good topics really fascinating. I certainly value higher education and promoting students going on in education, if at all possible. More of a generalist approach to science questions in that they're not specifically a question, they were much broader than a practical question, whether it's how they relate to society or whatever.

Dave espouses a practical philosophy about science, science should have meaning...and yet, Dave is very traditionalist in his approach to science pedagogy. This is reflected further in his comments about one particular Chemistry teacher who springs to mind from time to time.

Dave: A certain happiness about...the one I'm thinking of right now is chemistry, (he) just seemed to be really happy about chemistry...happy of what he's doing, happy to teach it, happy to talk about it. Very good at it, to talk about it and explain it. So he just seemed to be, I don't know, he seemed to be enjoying it and the enthusiasm sort of was catching.

Dave was then asked to describe the teaching style of the Chemistry teacher in more detail.

Dave: I'd say probably straight forward would be the best. He was very well-organized. You could tell that he'd taught the course for a number of years and so he'd anticipate all the problems, and he had his notes all outlined, and he had his hand-outs, his patter or whatever you want to call it. Very well-organized and yet still enthusiastic about it.

SC: Did he use the overhead, blackboard...?
Dave: Yes, overhead. He came prepared with transparencies.

Although Dave commented later that he didn't feel that his university professors were of much "value" in terms of his own teaching, I would argue that Dave closely empathizes with this particular Chemistry teacher.

Summary

Dave has taught for about 16 years. He was an early entrant to the profession. His wife is a teacher, but has chosen to work at home while their children are young. For Dave, teaching is a lifetime career. Dave states three reasons for going into teaching: he liked working with young people; he had been successful in tutoring others; and he did not see any other careers of interest. There was general family support for his career choice. Four or five relatives are in the teaching profession. Dave favours the "science-technical" side of things. He had variously wanted to be a chemist, an architect...something in science.

Dave was able to describe the characteristics of teachers who he recalls from time to time...smooth; effortless; very good; humorous; efficient; traditional in style; lecture-lab approach; happiness; happiness about what he is doing; talks about it; explains it; enjoying it; enthusiasm; straight forward; anticipatory; prepared; well-organized...
4.2.2 Teachers' Perceptions of Teaching

This category is taken to mean a teacher's knowledge of what teachers should know; and what constitutes "good teaching"...What makes a teacher successful, and how does this arise.

I was interested in trying to get at their personal knowledge of teaching. In subsequent questions, I attempt to find more detail by asking the participants to clarify their own prior knowledge of teaching.

Apprentice teachers:

(1) Betty:

Some people enter teaching with a view of offering service to others. To a certain extent, Sam alluded to this in his reasoning for entering teaching. Some people enter teaching with almost a mission in mind. The following question was asked of all the participants.

SC: Some people have said that teaching is a calling. Others have said that you are born with the ability to teach. Can you comment on these notions?

Betty: I've always enjoyed working with people, even those people that are having difficulties. For most of the time, I feel that I was just an average student and I had to work for things...and so thinking back about how I was, I like to help those who are having difficulties.
Again, there is a service element in what Betty is trying to say. Betty was asked to clarify how she knew how to teach. In her response, she indicated her ability to relate well with others, especially with the younger "crop". She felt that her disposition was personable. When asked to consider the following question, Betty indicated that there is a commonality amongst teachers, in terms of their teaching methods, routines, and exemplars.

SC: Would you say if you considered all teachers, not just Science teachers, how would you think their teaching routines, and their ways of doing things, how common do you think they are? Is there a commonality there or is everyone quite different?

Betty: ...I think there is. I think a lot of it is fairly common because nowadays a lot of people use the lecture method, I mean, that’s the most used, so that’s going to be a common area. How they get it across to students is their own way, whether they’re alive or monotone or whatever.

Her expectation was that most teachers lecture, and it is how well that they do this that makes a teacher successful. Clearly, the "lecture method" in Betty’s terms is just a tool for teaching...a way of doing things. The performance is everything. Her response needed more clarification...

SC: Consider a P.E. teacher, for instance. What is similar between a P.E. teacher and a Science teacher, in their routines, their beliefs, strategies and so on?

Betty: I have to get across to the students that what they’re learning is important to them, and I have to tie that in somehow and get them to understand that
because that's a common question, "Why do I need this?" I do really believe that being physically active, like after you get past school is really important. So that's Physical Education...and then I do believe that the sciences ties into everyday life.

Betty is viewing education in a wholistic sense. In this case, she sees Physical Education and Science as being a part of the entire educational process. Without stating it, Betty intimates that the problems of both disciplines are similar...and the need to relate the importance of both strands to everyday life is a commonality.

As a follow-up to some previous questions, I wanted to find out what Betty thinks are the characteristics of a "good" teacher. I asked this question near the end of the interview, separated from the questions regarding her past teachers and her own teaching. I did not want Betty to immediately repeat previous responses. Following her initial response I pursued the questioning a little more.

Betty: Being able to understand where the students are coming from. You have to analyze them and try to determine what types of things they need to learn.

SC: I'd like to pursue the...relationship, I can see between your Science teacher that you recall, how that person taught and your perceptions of how you think you are and how you perceive a good teacher should be...

Betty: The teacher has to be understanding. That's the personality end, they have to understand...and they have to utilize different methods of getting something across to students especially when they are having difficulties...so they have to vary their teaching methods for the students.
I was trying to get a deeper sense of Betty's thoughts on teaching. I came back to this question again towards the end of the interview.

SC: I'd like to focus one more time on this...you've talked about the characteristics of a good teacher and your perceptions of who you recall perhaps influencing you. Can you comment a little further on that, in terms of how you feel teachers become good teachers?

Betty: They have to, I think, pass on the fact that this course can be interesting and why they'd enjoy it, and pass that on to the student...make it interesting for them...tie it into everyday living, if possible, because kids do not see, they can't understand why learning about this or that is important stuff, like they'll never use it again.

Summary

Betty enjoys working with people. She likes to help those people who are having difficulties. There is a certain "service" element to her perception of teaching. Betty feels that her ability to relate well with children, and her personable nature are the attributes that have enabled her to teach.

Betty believes that there is a commonality amongst teachers in terms of teaching methods, routines, and exemplars. She thinks that most teachers use the lecture method. She identifies differences in teaching style...lively or monotone... Betty believes that teachers have similar problems to address with students ("why do I
Betty used the following terminology to describe her constructs of a "good" teacher (paraphrased): able to understand the students; able to analyze the students, and ascertain their needs; understanding; personality; utilize different methods; vary their teaching methods to account for those with differing abilities; convey interest; relate to everyday living...

(2) Sam:

Sam was asked for his understanding of how a teacher becomes a teacher.

Sam: ...whether you're born or not to be a teacher, I'm not sure about that, but I think there are people that have this trait to get the point across a little bit differently or more than understandable for somebody that is maybe having difficulty learning or just starting to learn. Whether it's an ability, I'm not sure. I think with the environment that you're brought up in you could develop this trait. I think you have to, I'm not sure if you have to be out-going or not, but I think that if you can have this ability to communicate and whether it be at the teaching profession or something else, it depends on what the person's interested in.

Sam's response is similar to Betty's. He believes that there must be something called a "trait" -- not necessarily in a genetic sense. This ability is one that can evolve over time. His response gives an impression that
the refinement of these abilities takes place over the long term. I asked Sam how it was that he knew how to teach -- even before his practica. He didn’t question the assumption that, in fact, he did know how to teach at that stage.

Sam: ...the previous teachers that I had, the ones that I felt were successful in getting the point across, I tried to "idolize" them in a way...the courses that I found I enjoyed the most seemed to...there was something to do with their teaching strategies, not so much that they were knowledgeable in their subject but, they may not be as knowledgeable as one person, but they did something different to make it better.

I asked Sam to what extent he thought the beliefs, the routines, the practices of teachers are common (or dissimilar) between subject area teachers and even between levels of teachers?

Sam: I think if there is a commonality, one of them definitely has to be enthusiasm. If they are enjoying their job and letting the students see that they’re enjoying the job, I think the students probably enjoy the class better. Rather than somebody that just comes in and just goes, "Let’s do this and this". One of the ones that I can think of...gets involved. I think if a teacher gets involved on a little bit more personal level with the students, I think the students see that, "Hey, you know, this guy isn’t so high-powered, but you still have to respect him but he’s coming down to meet us at our level". I think that would be a commonality of successful teachers.

Sam has a clear vision of what constitutes a "good" teacher. I don’t believe that we really got at the intended question. His response is somewhat superficial, and a little similar to Betty’s feelings. He views "enthusiasm", and "involvement" as necessary characteristics of good
teaching, but does not refer to the commonality of function that I was trying to address.

I asked Sam what he felt were the qualities of a "good" teacher.

Sam: I think enthusiasm for sure. Sort of this personal touch, getting down on the kids level but still maintaining a hierarchy system, I guess. They have to...you can't get down to their level all the time, there's a respect in your class. Knowledgeable in your subject area. To be able to bring in interest and it's not just from things that the curriculum mentions but if you have things that you know you can bring in.

Summary

Sam believes that there is an ability, possibly innate, or knack to teaching...a trait that enables one to get the point across a little bit differently...more understandable for somebody that is maybe having difficulty learning or just starting to learn. Sam uses terms such as: out-going, communicative, and interested to describe this ability. It is environmentally enhanced, and develops over time. Sam tries to mimic his successful teachers...the ones that got the point across, or used different techniques.

Sam describes the commonality among successful teachers using words such as: enthusiasm; enjoying the job; gets involved; on a personal level; generates respect;
Sam used words like the following to depict his concept of a "good" teacher: enthusiasm; personal touch; down at the kids level; respect; rapport; knowledgeable; generate interest; go beyond the regular curriculum.

Post-apprentice teachers:

(3) Leona:

Leona was asked the opening question in this section. She commented on her views of teacher development.

Leona: I don't know. With me, obviously, my mom, you know, my parents and everybody around me saw it and sort of guided me along and I hesitated. You know, so I don't know, maybe. She saw it when I was in grade 3.

There is a feeling of "knowing teaching" at an early age. Leona again refers to the influence of her mother. When asked how she knew what to do when first faced with a room full of students, Leona indicated that her previous experiences as a swimming instructor, and from when she had worked with handicapped children had provided her with the requisite skills. She stated emphatically that her teacher training was not the source of her knowledge.

Leona was asked to describe her beliefs with regard to the commonality of teaching amongst different segments.
SC: In your opinion, to what extent do you think the beliefs, the routines, the way teachers act, are the same, are similar, in terms of say a Science teacher, a P.E. teacher, different levels of teachers? Do you think there are any similarities in terms of a general teacher?

Leona: ...I utilize a lot from what I see from other teachers that works with them. But I also know that, percentage-wise you can’t reach all the kids with your personality. Some people will like you or not like you. Some people will like the way you teach and learn from you. Unfortunately, we are teachers. We don’t get to go into other teachers’ classrooms and see what they do because we’re busy all the time.

Leona’s response reflected her greater teaching experience. She indicates that one’s "tricks-of-the-trade", so to speak, are learned while practicing the profession. Her comments regarding "personality" run counter to the beliefs held by the two apprentice teachers.

Leona believes that the qualities of a good teacher are the same as for any job...a commitment to the job. Being fully prepared ("110%"), ready to provide a service, and being flexible.

Summary

Leona has a feeling of being able to teach at an early age. Leona believes that she was more or less self taught in teaching skills. Her previous job experiences were more of an influence than her teacher training year. Leona sees a commonality amongst teaching because, as much
as we are able, we learn from each other. She thinks that personality is a common feature but it isn't the only factor.

Job commitment, being 110% prepared, flexibility, and ready to provide a service are the elements of a "good" teacher in Leona's opinion.

(4) Pete:

Pete did not accept the argument that "people are born with the ability to teach", yet he did feel that there are some basic prerequisites necessary to becoming an effective teacher.

Pete: ...some people feel better with children than other people do. I think that in order to run a classroom properly you have to be able to keep control and some people aren't able to do that or get their ideas across very well. I mean, you have to have some skills, anyway, to be a teacher...most of those people, first of all, want to teach.

Pete was asked why he teaches in the way that he does. He felt that by using "hands-on" activities, he would be able to circulate more and respond to more of the student's needs. I asked Pete if he saw a commonality amongst teachers in terms of their beliefs, routines, and practices. He finds that the basic methods are similar. I probed a little deeper, and asked him to compare two
completely different levels: a grade 12 class and a grade 1 class.

Pete: There's similarity of course. I mean, a course with younger children you can't keep them doing one thing for very long so you have to switch an awful lot of the time. But you know, you give them hands-on things to do, you talk to them, you get them to do things, you do things.

Pete seems to think that there is a good deal of overlap between segments of the organization. He sees many of the routines as being similar. There are similar ways of doing things and handling certain problems, whether you are a primary school teacher or a senior secondary teacher. I would surmise that even within a segment as small as a school department there is a degree of commonality. Pete's responses tend to support this notion. When questioned further, Pete explained that his basic repertoire of classroom management stemmed from his practicum experiences.

Pete: ...little things like class control, how to talk to the class, what to do, learn the order to do it in, stuff like that.

It is precisely these "little things" or "stuff" that Pete refers to that I believe are the essential elements of the core profession. If there is commonality in functional paradigms, it lies in these "tricks-of-the-trade", ways of dealing with the day to day necessities of teaching, the routines needed to get the message across.
Pete had a practice teacher (pre-apprentice teacher) in his classroom last year. I wanted to see if what he had just told me was also conveyed to the teacher on practicum.

Pete: ...I sort of did the same thing that one of my practice teachers did. What he did, was leave me alone for a while and then he came back and listened in on us and then gave me a few hints, went away again, and came back again...when you're first left alone in a course, you sweat...(you) make sure that the whole class is listening, that people aren't doing something that, you know, is inappropriate or whatever.

SC: If I was to take this idea of commonality between teachers,... how might this be of use to a person or a group of people who are planning a curriculum change in any topic area,...in this case...science?

Pete: You'd probably come up with some things that you couldn't do, or you couldn't do right off the bat. I think there always has to be that. A teacher is always looking for some sort of structure, at least at the very beginning, unless the students have been doing something in the last lesson that carries over, which you don't need very much then. But you always have to have some sort of structure at the start of a lesson. So if you're designing something, it always has to have something, I'm not saying there has to be a set, but there has to be something that gets everybody going.

In the above paragraph, Pete has identified another commonality that is understood to be a standard of practice. Structure and organization in terms of lesson preparation is the norm.

Pete commented on the qualities of a "good" teacher.

Pete: ...an interest in the kids. You usually get involved fairly well with the students. If you looked at what they call "master teachers" some of those have quite a flair to them. They have a very interesting personality which makes them above average.
Personality, involvement, and enthusiasm are common themes running through most of the responses. There is clearly a similar expectation of what is good in a teacher. Whether this image is a false, perhaps stereotypic picture remains to be seen.

Summary

Pete believes that there are some basic requisites or skills to be a teacher. He mentioned: being comfortable with children; maintaining classroom control; being able to communicate ideas; must want to be a teacher...

In terms of commonalities among teachers, Pete finds that there is overlap in terms of teachers' routines, but not necessarily in teaching style. He also finds that there are similar problems, and similar ways of solving the problems. For instance: maintaining interest with students; providing hands-on activities; communication; class control; organization; and structure are common.

Pete uses descriptors similar to the following to describe the qualities of a "good" teacher: interest in kids; involved; flair; interesting; personality; above average.
Experienced teachers:

(5) Ron:

Ron was asked to comment on the first question in this section. Essentially, how is it that people know how to teach?

SC: Some people have said that teaching is a calling. Others have said that you are born with the ability to teach. Can you comment on these notions?

Ron: I think it's partly true. I think that personality probably plays a more important role in teaching than in anything else. People who have boring personalities tend to teach with a boring style and people who are out-going tend to be quite successful. But I think people can be taught to teach. There are a lot of techniques out there that people can be taught that would really help them.

Ron was then asked how it came about that he knew how to teach. He said that he had learned a lot from the extended practica that he took at SFU. When commenting on the similarities between teachers, Ron thought that teachers have a lot in common...but they must be able to learn by watching others and practicing what they see. This is in keeping with Leona's comments earlier. She mentioned the lack of available time to learn from others by watching them teach.

Ron: ...I don't think you can categorize them. Like I don't think you can say, like the "Madeline Hunter" stuff. I don't think you can say that this is the only good way. Somebody might do everything
seemingly wrong and yet their kids may be learning a lot because their personality is such that that works for them. So I think it's impossible to categorize but on the other hand, I think that probably good teachers do a lot of things in common...and if you want teachers to do good things you have to expose them to them. This is an example. I know that in California they wanted "Madeline Hunter" in this one school district that my father-in-law was involved in. So what they did was they taught it to the principals, and they taught it to people that they considered master teachers in the schools and gave them time off school to go and learn it, and then...any teacher who wanted to be exposed to this could contact the administration, and then they and the master teacher got time off school to go and work...and what happened was that people in the school were using it and saying that, "Oh, this is really working well", and other people wanted to learn it and so they did.

SC: The same example has been put forward in this school district and others. For example in this school district, why do you think it has not taken off?

Ron: First of all, I don't think that the people at the top even understand it. They have no conception. They think it's an evaluation tool. Secondly, because they haven't given any lead time, they just drop things, and of course, everybody resists being dropped on...and thirdly, because they haven't given any time for people to learn it. If they had taken some examples and taught it to them and had people going around saying how well it worked, then probably everyone would want to use it.

Ron also felt there are similarities in teaching P.E. to Science.

Ron: I think it's very similar. The kids in P.E. are very interested in how their bodies work and why their bodies work. So you can often interest them in things that they might not be interested in just by building it up a little bit and giving them a little extra information.

Ron's comments here are interesting in terms of bringing about change at the classroom level. He is saying that to be fully implemented, teachers must be given the
chance to "know" the change. They must be given the opportunity to internalize the changes. To match them with the paradigms that they have built up over the years...and to adjust, if possible. Ron's reference to the "Madeline Hunter" and the "effective schools" movement is a good example of a major shift, which required significant changes by the practitioners. In some areas, the change contemplated may have been so radically different from the teachers' common functional paradigms that it was rejected holus-bolus, and yet the change was not rejected in other areas -- such as in California!

Ron responded to the question concerning the qualities of a "good" teacher. He felt that first and foremost, is that the teacher should like children. He went on to state that he believed that some teachers do not particularly like children.

Ron: ...a lot...don't really like children, they like their subject and the subject is probably the least important thing in the whole building. The second thing, I think, is that teachers have to be outgoing. It's really difficult to be a good teacher if you're a withdrawn kind of person because you're in front of thirty people, you've got to do something. The third thing I guess is, you've got to be willing to work. I come up with all kinds of classic stupid little things but to me they're the kinds of things that show you. A student comes to you and says, "I left my coat in your room can you come and open the door", and it's five hundred steps, teachers won't go, they're lazy. Teachers take the last cup of coffee and leave a quarter of an inch in the bottom of the pot and they're lazy,
right? I don't see how you can be a good teacher, and be lazy.

Ron was quite emphatic about the latter point. It had obviously been plaguing him for some time. He believes that "lots" of teachers are too subject-conscious. His willingness to give up 13 years of teaching P.E. to pick up full time science indicates to me that he is not in this category. Ron is certainly outgoing. His "gym-voice", coaching, willingness to speak out and express views are all characteristics that are counter to his second point above. Ron would likely classify himself as a "good" teacher using his criteria.

Summary

Ron believes that an out-going personality is an essential element of good teaching. He believes that there are increasing degrees of this characteristic, and people can acquire the techniques of teaching through learning experiences.

Ron's own ability to teach came through experience on his practica. He believes that there is a lot in common amongst teachers. However, their approaches may differ. Ron outlined three reasons for the failure in the implementation of certain innovations: a lack of understanding of the contemplated change by some of the
stake holders; the imposition of the change with no lead time; and the lack of release time to actually implement the innovation. He feels that these are problems common to the profession. Ron also sees a commonality across disciplines. For instance, developing an interest in students, the students own interests, and the need to provide enrichment are similar entities, no matter what the course is.

Ron feels that a "good" teacher can be characterized by the following sorts of features: likes children; child-centered rather than subject-centered; out-going; willing to work hard...

(6) Dave:

Dave does not believe that just anyone can teach. He thinks that above all, you must like children -- no matter what level you are teaching. A second requirement, according to Dave, is that you have to be "reasonably clever". Dave was asked how he knew how to teach in the beginning.

Dave: Well, I probably didn't...I just had the information. You have the information, you have the students, and then you have to match. You follow the stock plan, but then you always...like the first year of teaching was taking this plan and adapting it in your own words.
Dave feels that there is some sort of standard way of teaching. We use it to survive with during the first while in the classroom, and then revise it to suit our individual ways. I probed a little deeper, and asked Dave how common or idiosyncratic he thought the beliefs, goals, routines, or problems faced by teachers were.

Dave: ...I don't think that there is that much in common, besides the problems with the different courses you are teaching. You know, the difference between teaching P.E., teaching French, or something like that. There are basic things that you have to, that have to be there, respect and getting down to work, that sort of thing. But as far as the method of teaching or the actual approach you take, there's such a wide variation.

SC: Would you say that same variation exists in the Science Department or any department in this school?

Dave: Well, the closer an area you get the more overlap you get, I suppose. But still then, you're going to have a wide variation of teaching styles, teaching approaches.

Dave's response is similar to Pete's. Dave sees that there are certain aspects of teaching that must be common. However, even at the department level, there are basic differences in teaching styles, approaches and so forth.

Dave described what he considers to be some characteristics of a good teacher.

Dave: Well, patience. There are a lot of frustrating situations. There's a lot of work. Hard-working. Clever. A real warm love of students, whatever the students may be. Observant, dynamic, honest. A model.
Summary

Dave believes that there is something inherent in teachers that makes them what they are. He says that a real love for children is a common feature.

Teaching is an evolutionary process according to Dave...You have a stock plan (common to teachers) that is adapted as the situation requires. Dave sees a wide variation in methodology, but a commonality in terms of problems, need for respect, structure...getting down to work. He feels that the more narrowly defined the group, the more overlap there is in teaching.

In describing his conceptions of a "good" teacher, Dave used words like: patience; hard work; clever; love of students; observant; dynamic; honest; a role model.

4.2.2.1 Summary of teachers' perceptions of teaching

There are three elements within this category that emerge from the teacher interviews:

1. Effective teachers are perceived as being student-centered; they have a good personality; they are willing to go beyond the regular curriculum; and they relate topics to everyday living. Such teachers generate interest; they are hard-working and enthusiastic about
teaching; and are knowledgeable about their subject. They are structured and well-organized in their teaching.

The qualities that constitute effective teaching as described by the respondents are remarkably similar. Aspects of the preceding description were captured in each of the participant's perceptions of a "good" teacher. For example, Betty states that "the teacher has to be understanding. That's the personality end, they have to understand...and they have to utilize different methods of getting something across to students especially when they are having difficulties...so they have to vary their teaching methods for the students". Pete believes that one must have "an interest in kids". He goes on to say that "you usually get involved fairly well with the students. If you looked at what they call "master teachers", some of those have quite a flair to them. They have a very interesting personality which makes them above average". Ron feels that "the foremost quality of a good teacher is that they like children". He adds that they must also be outgoing, and hardworking.

2. **Teaching problems and routines** All the participants believe that there is a certain degree of commonality amongst teachers. However, the similarities are generally restricted to the kinds of problems that teachers face, and
the routines that they follow. One problem, for example, is in trying to make courses relevant. Betty, for instance, indicated:

I have to get across to the students that what they're learning is important to them, and I have to tie that in somehow and get them to understand that because that's a common question, 'Why do I need this?' I do really believe that being physically active, like after you get past school is really important. So that's Physical Education...and then I do believe that the Sciences ties into everyday life.

Similarly, Pete described the problems of classroom management:

...little things like class control, how to talk to the class, what to do, learn the order to do it in, stuff like that...a teacher is always looking for some sort of structure, at least at the very beginning, unless the students have been doing something in the last lesson that carries over, which you don't need very much then. But you always have to have some sort of structure at the start of a lesson. So if you're designing something, it always has to have something, I'm not saying there has to be a set, but there has to be something that gets everybody going.

3. Teaching methodology and style

Beyond the common problems in teaching, the participants had differing views. For instance, Dave believes that there is a "wide variation of teaching styles, teaching approaches...method(s) of teaching". Whereas, Betty sees a commonality in method, but not in teaching style: "Nowadays, a lot of people use the lecture method, I mean, that's the most used, so that's going to be a common area. How they get it across to
students is their own way, whether they're alive or monotone or whatever". Pete and Leona make similar comments. Pete believes that "all teachers use the same sorts of the different methods. They just use them in different amounts, and possibly in several different ways". Betty, Sam, Pete, and to a certain extent, Leona also indicated that having a good "personality" is a commonality amongst effective teachers. Pete calls this characteristic a "flair".

4. In terms of teacher development, all the participants believe that teachers have some sort of "built-in" ability in order to be able to teach successfully. The comments here mirrored those describing the essence of a "good" teacher. They all felt that there are certain skills that are prerequisites to becoming a successful teacher. Sam referred to this as a "trait". He thinks that there are people that have this trait to get the point across a little bit differently or more than understandable for somebody that is maybe having difficulty learning or just starting to learn. Whether it's an ability, I'm not sure. I think with the environment that you're brought up in you could develop this trait. I think you have to, I'm not sure if you have to be out-going or not, but I think that if you can have this ability to communicate and whether it be at the teaching profession or something else, it depends on what the person's interested in.
Ron made a similar comment with regard to the development of this ability. He believes that teaching techniques can be taught. Pete stated that "In order to run a classroom properly you have to be able to keep control and some people aren't able to do that or get their ideas across very well. I mean, you have to have some skills, anyway, to be a teacher...most of those people, first of all, want to teach".

4.2.3 Teachers' Perceptions of Subject Matter

This category is concerned with teachers' perceptions of high school science, in particular, junior science. The teachers were asked to explain their understanding of the various curriculum materials that they use. They were also asked to comment on their opinions about the development of science curricula.

Apprentice teachers:

(1) Betty:

Betty was asked how useful she found the curriculum guide. She indicates that she tries to follow the curriculum guide...
Betty: I pulled it out for, just for the basic outline of the course, and maybe some test items.

In retrospect, it appears that Betty equates "curriculum guide" with "teachers' guide" -- both were provided at the start of the year. Perhaps in this sense then, the curriculum guide per se is not useful at all for Betty. I asked Betty whether she saw any particular focus in terms of the junior science courses.

Betty: I think it's okay, like they're trying to focus on the basics and I think that's okay, in those units...I don't think there's good solid information inside...it touches on things and leaves you hanging. Like it just stops.

Betty sees the Junior Science Curriculum focusing on the "basics" -- meaning, chemical elements, body systems, forces, sedimentary rocks... The reference to "information" confirms that Betty views the textbook as the curriculum.

There are four goals in the B.C. Junior Science Curriculum (in short, they are: knowledge, skills and processes, critical thinking, and attitude -- see Table IV). Betty's understanding of the curriculum seems to be limited to the first goal.
<table>
<thead>
<tr>
<th>GOAL A:</th>
<th>The Junior Secondary Science Program should provide opportunities for students to develop positive science attitudes.</th>
</tr>
</thead>
<tbody>
<tr>
<td>GOAL B:</td>
<td>The Junior Secondary Science Program should provide opportunities for students to develop the skills and processes of science.</td>
</tr>
<tr>
<td>GOAL C:</td>
<td>The Junior Secondary Science Program should increase the students' knowledge.</td>
</tr>
<tr>
<td>GOAL D:</td>
<td>The Junior Secondary Science Program should provide opportunities for students to develop creative, critical and formal (i.e. abstract) thinking abilities.</td>
</tr>
</tbody>
</table>

I asked the participants when they believed curriculum should be revised. Most stated that this was a difficult question.

According to Betty, the curriculum should be revised whenever new books are required. Again, an indication that the textbooks "drive" the curriculum. Advancement in scientific knowledge, and student needs are the determinants for change. Committees of teachers should revise curricula at the provincial level (because of provincial exams). However, the curriculum should reflect a regional perspective.

Betty: I guess they have to look at their (the teacher's) feelings. What they believe is important. They should also look at the students' interest and take into account what they feel is important because if they're interested in a course then they'll take science right away... depending on different areas that we live in, we require different things to be taught.

In the next series of questions, I wanted to ascertain the participant's understanding of the similarities and differences between the previous and current junior science curriculum.

Ron and the two beginning teachers were not very familiar with the previous curriculum. I tried to find out from them what problems, or positive features they found with the new curriculum.
Betty: ...I find that in some cases, if the students have missed things and they have to study from the text, it's really difficult, so you have to supplement materials...They find it hard to pick up from just the text itself. In the Science 10, I've supplemented more, worksheets, notes and things like that.

I asked about the curriculum. However, Betty commented on problems with regard to the textbooks. Betty found the labs to be straightforward. Betty is wanting more information for the students to learn from the textbooks. She would also like to see more questions.

Summary

Betty does not seem to have a clear understanding of the curriculum guide. She does not make much use of it except in terms of a course outline. Betty finds that the junior science courses focus on the "basics". She feels that the course (textbook) lacks sufficient information...the coverage is superficial. Betty interprets the curriculum in terms of the lower level knowledge goal.

Betty believes that the curriculum should be revised when the textbooks need changing. She cites advances in science, the needs of students, and teacher's opinions as factors to consider in whether or not to revise the curriculum. Curriculum should be provincially determined, but with a regional perspective.
In describing the new curriculum, Betty finds the textbooks to be lacking in some respects (background information and supplementary questions). She finds that the labs are easy to understand.

(2) Sam:

Sam has a different view of curriculum than Betty. He believes that curriculum revision should be on-going. In his mind, curriculum is an evolving document that periodically undergoes a major revision.

Sam: I think there should be input every year, even if it's just sending something out to the teachers saying what's one thing they liked about the course, one thing they disliked. Then maybe after four years or something, compiling all the knowledge and maybe on the fifth or sixth year getting together a committee to kind of do the revisions or something like that.

Sam has some positive suggestions for how curricula should be revised.

Sam: I think teachers in the courses should. If there are volunteers or some people that are pulled out of assignments with pay, like leaves of absence or something like that...where they devote a year or six months of their teaching career somewhere else. Going down and meeting at a place, like working in a city for however long it takes.

Sam believes that curriculum revision should take place provincially to ensure the involvement of "reputable teachers", and for the financial cost-benefits (textbooks
can be bought provincially). However, Sam feels that there should still be some flexibility at the district, and classroom levels.

Sam: You can still as a district or in your own classroom, pull out things that you want to teach that you find your strength...as long as the overall picture is there that it's a good curriculum.

Sam has a better comprehension of curriculum than Betty. Possibly because he has just completed his teacher training, and these concepts are still fresh in his mind.

Sam was asked to comment on the new curriculum. Like Betty, he also described the textbooks. He felt that the reading material in the textbooks "jumped around" too much. He thought that some activities were misplaced, and some that were not there, should have been. He believes that the current course is too lab-oriented.

Sam: ...there's, I think, way too many of these (lab) activities. You can still incorporate a lot of labs in your course, but not all the ones that they mention. Even cutting out lots of the labs in the book, you can still do a lab every second day. It doesn't have to be the ones that they say. Even some of their labs take two days or something like that...Science 10 is very difficult to do because there isn't that reading material that they need. Maybe that's the (difference), this lack of scientific reading that they probably miss, maybe that's how they structure it so that when they get into the senior grades, this is what they're introduced to, maybe it's sort of scientific.

Sam seems to be backing up his earlier comment that the text is very lab-oriented. The lack of "scientific
"reading" seems to be a reference to a lack of academic rigor. This is similar to a feeling expressed by Betty regarding the text.

Summary

Sam believes that curriculum revision should be on-going, with continuing minor revisions as a result of input from the field, followed by periodic reviews on a larger scale. Revision committees should be composed of representative teachers from around the Province. Although the curriculum document should be mandated provincially, there needs to be flexibility at the local level.

Sam describes the new curriculum in terms of the textbook. He found that it jumps around a lot and is superficial in its coverage of science knowledge. Some lab activities shouldn't be in the text, whereas others are missing, and it is too lab-oriented.

Post-apprentice teachers:

(3) Leona:

Leona was questioned about her understanding of curriculum and when it should be revised.
Leona: ...curriculum is good because it's a guideline. If you follow it to the "t" and just sort of say, "That's all I'm going to teach", it doesn't really matter what they ask you, the methods they ask you, is what's important. I don't think the Chemistry and the Changes in Matter has changed since, you know, whoever went to school here. It's the method that you teach it in, the styles, how you present it, what you can do to the kids to make them understand better.

Leona views the curriculum as simply a guideline, albeit a useful one, to follow. Although she implies that the curriculum prescribes methods, Leona believes that it is the individual's teaching style, and methodology that is important. She feels that the content in the curriculum has not changed at all. So what changes, if any, is Leona suggesting have taken place? Textbooks, teaching practices, use of other teaching materials, use of media...

Curriculum committees should consist of a good cross-section of teachers. Leona reiterates that there needs to be more sharing of what actually transpires in classrooms. Curriculum committees must observe and know what it is that she does in her own classroom.

Leona: ...I've been in my classroom and the thing I keep harping on is that I would like to see other people in here, (learn) about other people's experiences. So a cross-section, obviously.

When asked what she would like to see in revised junior science curricula, Leona responded that there should be a core plus a lot of options, similar to the format in the new B.C. Senior Biology and Chemistry curricula.
Leona: ...in that way, they're (the teachers) more interested in the teaching, and in the learning aspects because it's a lot harder to prepare a government exam around those because you're accounting for the individuality of the teacher in the situation, more than if you establish an entire core.

There is a clear bias against province-wide exams here. Leona has never taught a provincially examinable course, but she is obviously feeling the pressure. Her arguments for a reduced core with many options illustrate the more progressive nature of Leona that was inferred in an earlier section. To some, the core is the "meat" of the course. The options are the "frills". Leona contends that the best teaching takes place outside the core -- in the area where the teacher can be more exuberant; where she can focus on her own areas of interest and expertise; where the "teachable moment" is not constrained by time.

Leona's described some of the similarities and differences that she sees between the old and new curricula.

Leona: It's a pendulum swing. The first curriculum was more reading and less lab work. The second one was a swing away from the reading and into labs. But both labs...you could predict the ending without actually even doing the lab.

SC: So you could see a similarity in terms of the labs?

Leona: The lab content was almost the same. Like instead of one lab every ten pages of notes, its (now) ten labs for every page of notes...the new curriculum has very little reading and lots of labs, but the labs didn't change that much.
Leona stated that she does not use the textbooks. She supplements the course with a lot of the old material.

Leona: ...I think the only reason we use the Probe sometimes is to do the labs, but even the labs I supplement with different labs out of other textbooks and workbooks.

I asked Leona to describe the old and new courses in terms of their approaches to learning about science. She said that the old course was "methodical", and the new course lacks continuity. Her comments with regard to the new course are quite similar to those of the beginning teachers.

Leona: Not sporadic, but more encompassing of different ideas, but in a helter-skelter approach. There isn’t a continuity that I found in the other course. I think we need something in-between.

Summary

Leona's impression of curriculum policy is that it just serves as a guideline. She feels that content in junior science has not changed a great deal over the years. In her mind, it is really the teacher who makes the curriculum. It is the individual’s teaching style, and methodology that is important.

Leona believes that curriculum committees should be broadly based. They should actually see classrooms in operation before recommending any curricular changes. Leona
likes the flexibility that comes with a core curriculum plus lots of options. She sees this as one way of getting away from teaching to the exam (provincial). Although Leona does not teach provincially examinable courses, she still feels the pressure, and sees the pressures encountered by others.

Leona finds that the new curriculum lacks continuity; it is superficial; consists of mostly labs; less reading; covers more ideas. Whereas she feels the reverse was the case with the previous course -- it was methodical. Both content and predictability of outcomes are similar for both sets of labs. Leona does not use the textbooks very much...she prefers to supplement with material from other sources, including the old textbooks.

(4) Peter:

Like Betty, Pete equates the "curriculum guide" with the "teachers' guide". When asked about the quality of the curriculum guide, he described the poor organization of the teachers' guide. However, his response to the question "When should a curriculum be revised?" indicates his general understanding of curriculum. Pete feels that curriculum should not be revised unless there are sound reasons. There must be a purpose behind the revision...for example if the subject matter is inappropriate, he cited
the Science 9 Forces unit). Concerns about the curriculum should be expressed to some central body, and if there is enough demand, the curriculum should be changed. Pete believes that the current system of provincially mandated curricula is too structured. He feels that there must be more flexibility in what content should be taught.

Pete: I think a lot of the curriculum is too separate now, myself. It's too rigid. There's not enough room to move. Like in a lot of things, there's just no room to move anywhere and in fact, there's too much to be done...I think they should give a fairly wide range of ideas and things that could be looked at...especially in the junior sciences. I don't think that it's necessary (that) everybody should have to know what Vitamin B_12 does or something like that.

Pete finds the specificity of knowledge required of students in the learning outcomes for the course are too much. He would like the autonomy to decide those details at the classroom level.

Pete was asked to respond to the question concerning the similarities or differences between the old and new junior science curricula. He finds that the subject matter has not changed a great deal; however, there is more emphasis on knowledge in the new textbook, whereas the old text focussed on discovery learning. We then turned to a brief discussion of the attitude goal in the junior science curriculum (see Table IV).
Pete: I think the attitude has to come with an interesting subject matter.

SC: Do you think that's achievable with a curriculum? How do you see those attitudes being gained by students? How can you make a course such that they will pick up some of the attitudes?

Pete: I don't think it's only the course. I mean, you can design a course for anything. I think it's the whole situation that has to come into account when you're trying to change attitudes.

SC: Such as?

Pete: Such as the attitude in the school, the attitude in the Province, everyone's attitude. I think the main attitude towards schools at the present time has been down. You know, "squash the schools" in a lot of cases. So I don't think we can, it's hard to foster a positive attitude when you get into that situation.

SC: How much influence does the teacher have in fostering that positive attitude towards science?

Pete: A fair bit, I think. But then it's very hard for the teacher to go into a school with a positive attitude when he or she is being stepped upon!

Pete was quite bitter in this part of the conversation. Evidently, general teacher morale is another factor that, in some way, is a constraint that Pete did not mention earlier. He believes that trying to teach attitudes is more of a global task. He is not even sure what is meant by "attitudes" or even if they can be taught.

Pete says that his teaching methods have not really changed since the implementation of the new curriculum. The only change that he noted was in providing students with notes.
Pete: I probably don't... give quite as many notes as I used to because the old science curriculum didn't give you any back-up at all in terms of textbook information.

This statement is interesting since it goes against what the previous participants have said. They find the new course requires a lot of supplementing... Pete does not.

Summary

Pete feels that a curriculum should not be revised unless there is a reason... i.e. if the subject matter is inappropriate. Curriculum should be a provincial matter. However, there should be less structure, rigidity, and specificity, and more individual flexibility. Revision committees should consider input from the field before deciding to make any changes.

Pete finds that the content of the new course has not changed remarkably from the previous one. He believes that the new course focusses more on knowledge, whereas the previous course emphasized discovery learning. There is more background reading material in the new text. He believes that parts of the new textbooks are poorly organized. According to Pete, the new attitudinal goal (see Table IV) in the Junior Science Curriculum will require a much broader shift in teaching.
Experienced teachers:

(5) Ron:

Ron was asked to comment on some of the problems he sees in curriculum implementation.

Ron: ...I think people who have been doing it one way for a long time really resist changing because they've got all this material that they like to work with. Secondly, I think the real problem is that the curriculum changes are mandated and there's no accountability. Nobody comes to check and see if you're doing the new curriculum. So if somebody feels like just staying with the old one, they just do it. Really, the only course that matters is the one that's a government examinable course and there they've gotten to, they're penalizing people, I mean fifty per cent of your mark on one test. It forces you to be a good test writer.

Ron talks of two extremes here. He is calling for more fidelity in achieving the curriculum intents. Yet, he is also saying don't go to the extent that the provincially examinable courses have gone. Rigidity, in this case, is achieved at the expense of the subjective nature of teaching.

Ron believes that curriculum should be constantly under revision. This is a similar line of thought expressed by other participants. He believes that suggested changes, and newly developed materials should be collected and only incorporated into a new book when there is a real basis to warrant rewriting the book. Ron did not distinguish the
curriculum guide from the textbook. I asked Ron what he thought curriculum writers should consider when revising the curriculum.

Ron: Well, I think they should stop worrying so much about content and start worrying more about...how it’s going to impact on students. Our job isn’t necessarily to teach kids that $E = mc^2$, or something like that. I mean, who really cares? Our job is to get people interested and to get them to think and you can’t do that if you have to, like say for academic Science 9, if kids have to know this massive amount of material...and...there was one lab in that whole course that was semi-interesting. The rest of them were...

Ron’s feelings closely match those of Pete. He wants to get away from the knowledge base, and concentrate on some of the other goals of the Junior Science Curriculum -- thinking abilities, attitudes. I asked Ron about that "one lab" that was "semi-interesting".

Ron: I did one where I brought fish into the room and they had to figure out how the fish were using their fins and they were quite interested. They got quite keen on that.

Ron does not find anything wrong with the curriculum. But he finds the labs in the textbooks to be boring. I asked him what he thought was missing.

Ron: Action, you know...like there’s no action. We’re trying to excite kids about science and you give them labs where nothing happens. I’m not saying all of them, but they need some labs, some "whiz-bang" labs.

In comparing what he recalls of the old curriculum to the new curriculum, Ron finds a few positive changes.
Ron: ...in terms of the fact that the (Science) 8, 9, and 10 are more related. That's a definite advantage because there didn't use to be any relationship. Kids didn't have to take Science 8 or 9 to pass Science 10...and so now there is a build-up of knowledge, which is very good. I find the course outlines and the objectives quite frustrating because they're not very good, they're too philosophical. I find the Biology 11 course outline excellent. There is a list of learning outcomes for every section and those are the things the kids have to know. Cut and dry. Kids must know these things. I really like it that way and I think kids really like it that way.

SC: Do you see much of a transition between the Science 10 curriculum and the senior sciences, Biology 11 for instance?

Ron: Not a tremendous difference. Just in terms of the amount of work they have to do. The Science 10, they're still not working very hard and then all of a sudden in Bi. 11 they have to do a lot of work.

In previous sections and here, Ron infers that he is a hard worker. He likes a lot of structure...almost regimental. He likes to have a clear purpose and direction in mind.

Summary

Ron contends that there is a real resistance to change. Especially, when teachers have developed a way of doing things that works for them. He finds that at one extreme, there is no accountability, in that teachers do what they want...and the other extreme forces strict adherence to the curriculum objectives. He sees both ends
of the spectrum in terms of implementation as being unacceptable.

Ron believes that curriculum revision should be on-going. He seems to equate the curriculum with the textbook. New texts shouldn't be written until sufficient material has accumulated. Curriculum writers should focus less on content, and more on student learning. He says that curriculum should be written to stimulate student interest...i.e. better labs.

Ron finds the textbooks for the junior science curriculum are okay. But the labs are boring...they lack action and excitement. He finds that the new course is more sequenced from grade 8 to 10. The course outlines and objectives are too philosophical; they are unclear in their intents.

(6) Dave:

Dave understands "curriculum" to be a set of guidelines to follow. He feels that the curriculum is changed for reasons other than simply factually updating the material to be taught. I detected a note of sarcasm in his response. Perhaps Dave sees the political side of curriculum. The "other reasons" which we did not pursue could be politically motivated...or certainly, in Dave's mind for less important reasons. Dave does not agree with
revising curricula in response to current trends or "fashions". He does not want to lose touch with that which he considers to be the core of science education.

Dave: I don't know if it (curriculum) should or not (be revised) according to a new fashion that comes in, whether it's energy conservation, whether it's AIDS, or whatever. No doubt the next curriculum will have all kinds of sections about AIDS in it. I don't think at the high school we have to worry about changes in technical advances. The curriculum will be changed for other reasons before it's actually necessitated by the accuracy of information that's being taught.

I asked Dave how he would react to a radical change in curriculum.

SC: If tomorrow you were faced with a new curriculum in junior science that was perhaps a little bit more radical compared to the normal approach that you've been asked to do before, how would you adapt to that?

Dave: ...I always find that with curriculum change the biggest pain in the neck is that there's no money to buy the equipment that we're supposed to have. So the actual curriculum doesn't matter that much because all you're left with is the content anyway. But supposing I did have access to the lab end of it, if in fact this radical method used labs, I don't know. I'd probably start off with the same approach that I organize the course, set to these different expectations...first year you'd give it a shot and see where you went wrong, and then second year you'd adopt, you know, change your style, your expectations, your methods.

SC: If you had to teach Science & Tech 11 for instance, how would you approach that?

Dave: That would probably be fairly radical from what I've taught in senior grades before. You'd have to really stop and think about what it is you want to get done and then you've got to build your course around that. I think the first time you go through it
you're going to have...turn out to be some expectations that you have no right having. You know, it was just silly to expect this out of the students. I think you're also going to have some things where you under-estimated the students. But I think getting straight in your mind what exactly you want and getting it accomplished is probably the biggest problem.

SC: A course that would include some debate, some values clarification, simulations, different approaches rather than the traditional science lab and lecture approach. Would you find those to be more difficult than perhaps the curriculum changes you've seen before?

Dave: ...you'd have to learn how to organize the class...whether it's debate or if it's, what do you call it, valuating things, making a judgement.

SC: Would you be good at teaching those kinds of courses?

Dave: Not the first time. First time would be a learning experience. Second time, probably better. Now whether or not I was, you know...didn't have any problems organizing the class, teaching it and so on, whether I enjoyed teaching that...could be a lot of fun, could be a pain in the neck. Depends on what kind of students, (they) would make it.

Dave sees a number of changes with the new junior science curriculum. Although he finds that the content remains the same, the structure of the course has changed a lot.

Dave: The labs are different in that they're more like mini-labs, I'm thinking of grade 8 right now. I find that the theory isn't explained as well as it used to be -- so it's harder to prepare lessons for it. I find that it seems to have a far greater variety of materials, which we don't seem to have. It's broken into more modules...I think it's broken into too many modules. There seems to be a bit more difficulty in covering the course with all these little modules...There certainly seems to be a lot of emphasis on energy. A new emphasis...I don't find
it as organized as...I find it's incomplete. They introduce a topic, they give you the name of the topic, and then they run away and start a new topic...

Many of the problems, that Dave sees with the new course, coincide with the impressions of the other participants. I asked Dave to describe the kind of science anticipated by the new course.

SC: Would you say it's an experimental or experiencial kind of science that you're doing...is it discovery, or is it the recipe approach?

Dave: No, I find it's probably the most unfortunate mixture of the two. I think it's going for more hands-on science, but they've done it in such a way as to expose the students to it without them understanding it...then once they've actually experienced it they still don't have the student understand it. So, the student just ends up wondering what he's doing and why he's doing it. Unless, of course, you take and spend time on it, time to back it up. But then,...the labs aren't organized in a way that you can take the time to back up every little thing that they mention. So either you end up not doing the experiences, just so you can build up the skeleton that remains, the material. Or else, if you do all these things then the students will really understand what you did and why you did it.

Dave finds the course to be frustrating in this sense. His teaching style requires him to follow a fairly structured approach, and yet he feels the text/lab activities do not provide the necessary organization and background. It is then a time consuming process to prepare material and provide that material to the students.
Summary

Dave sees the curriculum as a set of guidelines to be followed. He does not believe the curriculum should be revised for every new issue that develops. He seems to prefer a curriculum that focusses on the real "academic" side of science, and not on the frills. He doesn't believe that curriculum is revised to reflect more accurately (factually) advances in science. He believes that there are other motives. Dave sees curriculum revision committees in terms of "them and us".

In terms of the new Junior Science curriculum, Dave sees changes mostly in approach, and very little in content: the labs are shorter; theory is superficially explained; requires supplementing; requires more materials; there are more modules; takes longer to cover the course; time-consuming; has a marked emphasis on energy; unorganized; incomplete; insufficient detail; unfortunate mixture of experimental and experiential science...

4.2.3.1 Summary of teachers' perceptions of subject matter

1. Curriculum materials Despite the intended changes contemplated by the Ministry of Education in terms of the new junior science course (see Table I), the participants in this study find surprisingly little difference between
the previous course and the current junior science course! Most of the comments are concerned with the textbook itself. Individually, the participants are in agreement concerning the similarities and differences between the new course and the old junior science course. They do not see much change in content, in fact, most see the greatest change to be more of an emphasis on labs rather than theory. This appears to go against what the curriculum writers had envisaged! Pete, on the other hand, feels that the reverse is true. He comments that the new course has a renewed emphasis on knowledge (perhaps too much!), and a shift away from the previous discovery learning approach. Not one of the participants mentioned what is probably the major difference between the two curricula -- and that is the shift towards an integrated form of science education away from the disciplined approach.

**Content:** Betty sees the new course as focussing more on the "basics". This seems to be contrary to the emphasis of the new course -- which leans towards a more practical science with applications to everyday life. Similarly, Dave, Ron and Leona find that the content has not changed much. For example, Leona states: "I don't think the Chemistry and the Changes in Matter has changed since, you know, whoever went to school here. It's the method that you teach it in, the styles, how you present it, what you can
do to the kids to make them understand better". Leona does see an evolution in teaching methods to suit the present day needs of students. Both Pete and Ron also commented that the course focuses too much on content. Pete finds that the curriculum is too rigid now -- he would prefer more flexibility. Leona also echoed this comment.

Course Emphasis: Leona has a view that seems to be opposite to the curriculum intents:

The first curriculum was more reading and less lab work. The second one was a swing away from the reading and into labs. But both labs...you could predict the ending without actually even doing the lab...The lab content was almost the same. Like instead of one lab every ten pages of notes, its (now) ten labs for every page of notes...the new curriculum has very little reading and lots of labs, but the labs didn’t change that much...even the labs I supplement with different labs out of other textbooks and workbooks.

These comments are repeated by Sam: "...there’s, I think, way too many of these (lab) activities. You can still incorporate a lot of labs in your course, but not all the ones that they mention...Science 10 is very difficult to do because there isn’t that reading material that they need. Maybe that’s the (difference), this lack of scientific reading that they probably miss". Dave also has this view that the material is more superficial:

The labs are different in that they’re more like mini-labs, I’m thinking of grade 8 right now. I find that the theory isn’t explained as well as it used
to be -- so it's harder to prepare lessons for it...There certainly seems to be a lot of emphasis on energy -- a new emphasis...It's going for more hands-on science, but they've done it in such a way as to expose the students to it without them understanding it...then once they've actually experienced it they still don't have the student understand it. So, the student just ends up wondering what he's doing and why he's doing it. Unless, of course, you take and spend time on it, time to back it up.

These comments are consistent with those made by Pete, Betty, and Leona. Betty responded: "I don't think there's good solid information inside...It touches on things and leaves you hanging. Like it just stops". Ron suggested that the course needs more "whiz-bang labs".

**Organization:** Dave feels that the new course lacks sufficient organization:

I find that it seems to have a far greater variety of materials, which we don't seem to have. It's broken into more modules...I think it's broken into too many modules. There seems to be a bit more difficulty in covering the course with all these little modules...But then,...the labs aren't organized in a way that you can take the time to back up every little thing that they mention. So either you end up not doing the experiences, just so you can build up the skeleton that remains, the material. Or else, if you do all these things then the students will really understand what you did and why you did it...I don't find it as organized as...I find it's incomplete. They introduce a topic, they give you the name of the topic, and then they run away and start a new topic...

Leona also finds that the new course lacks organization: "(the course is) more encompassing of different ideas, but in a helter-skelter approach. There isn't a continuity that I found in the other course. I
think we need something in-between". Pete echoed this comment. Ron finds that the course is at least organized sequentially through the grade levels.

2. In terms of curriculum policy most participants believe the curriculum guide is simply a guideline to follow. Betty sees the guide as a course outline. Similarly, Leona describes the curriculum as a guideline: "If you follow it to the 't' and just sort of say, 'That's all I'm going to teach', it doesn't really matter what they ask you...". Their conceptions of the curriculum seem to be limited to coverage of what is prescribed by the curriculum document. Sam, on the other hand, feels that the provincially mandated curriculum provides a core for the course which can be manipulated and/or supplemented. He states that: "You can still as a district or in your own classroom, pull out things that you want to teach that you find your strength...as long as the overall picture is there...". Ron believes strongly in curriculum "fidelity". However, he does not see this being possible right now. He thinks that "the real problem is that curriculum changes are mandated and there's no accountability. Nobody comes to check and see if you're doing the new curriculum. So if somebody feels like just staying with the old one, they just do it". Ron seems to hold an extreme position in his relentless adherence to the prescribed curriculum. He would
like to be granted more freedom to act within the stated curriculum. Pete also feels that the intentions of the junior science curriculum are too rigid for his liking. He states that "Science involves the World, so I think that any way we can show that it involves the World, and that its very important to what happens to them is more important than what's happening in the curriculum". Besides some basic science knowledge, Pete feels that students should learn that "science is a part of life". He perceives a definite relationship between science and society. Dave would like high school science to include a core of basic science or fundamentals, which includes topics such as "measurement science". This must be imparted to all students. He distinguishes this science from "sophisticated" sciences such as Chemistry 12, or Astronomy. Dave feels that the curriculum should "cover more topics of interest that would make the people more rounded" in their education. From this perception, one can see that Dave would value a more applied science course.

3. In terms of curriculum policy revision there is general agreement that it should be on-going. Dave indicates that curriculum policy seems to be initiated by changes in current trends or "fashions" rather than due to more legitimate changes in factual knowledge. He states that he is unsure if "it (curriculum) should or should not
(be revised) according to a new fashion that comes in, whether it's energy conservation, whether it's AIDS, or whatever. No doubt the next curriculum will have all kinds of sections about AIDS in it. Dave adds that "at the high school, I don't think we have to worry about changes in technical advances. The curriculum will be changed for other reasons before it's actually necessitated by the accuracy of information that's being taught". These comments do not seem to support his aforementioned desire for more applied science. Dave is quite pessimistic about curriculum innovations. He has experienced a few changes through his career, and comments that they all essentially boil down to merely content changes anyway. This is in keeping with his earlier points concerning the recent changes in the junior science program. Perhaps Dave sums up his feelings best by the following comment: "I always find that with curriculum change the biggest pain in the neck is that there's no money to buy the equipment that we're supposed to have. So the actual curriculum doesn't matter that much because all you're left with is the content anyway!" Leona calls for much more input at the classroom level before contemplating a curriculum revision. She comments, "I've been in my classroom and the thing I keep harping on is that I would like to see other people in here, (learn) about other people's experiences".
4.2.4 Teachers' Perceptions of School Setting

Schwab (1973, p.503) refers to this category as the "milieus". He uses this term to denote all the relevant environments that impact on the educational process. Schwab states that the "milieus are manifold, nesting one within another like Chinese boxes". They encompass the community, the school, and the classroom. They also include the religious, social, economic, and political communities within the setting. Lantz and Kass (1987) use this category in a less comprehensive sense to include the school facilities, local community concerns, and broader social issues. While cognizant of the broader view, this study follows a narrower definition. Teachers participating in the study were asked to comment on what kinds of pressures they experience within the setting. Although the questions were quite focussed, the responses tended to be much more diverse.

Apprentice teachers:

(1) Betty:

Betty found that a major constraint on her teaching this year was the room itself. The science room in which she was located was small and inadequately equipped.
Betty: I did not like using the bunsen burners with my grade 8's, not when I had twenty-eight students in there...they're looking outside and what's happening with their faces? So I really kept away from that...a few of my students got to use it and some of them didn't...and that would be because of my concerns with safety.

Apart from the actual physical constraints, Betty comments on the large class size, and her concerns for safety in the lab.

Betty finds that her working conditions are the biggest constraint on her teaching practices.

(2) Sam:

Sam felt that the major constraint on him as a first year teacher was the paperwork. Coupled with this, was the need for more time to do the job effectively. He also stated that although he wasn't in the job for money, higher pay would be an incentive.

Sam found the paperwork to be the biggest problem for him during his first year. He felt that time to accomplish things would have alleviated this constraint. The salary level of a beginning teacher in today's market is also inappropriate, and Sam commented on that fact.
Post-apprentice teachers:

(3) Leona:

I asked Leona if I could change ‘X’ to make her teaching situation better, what would it be?

Leona: What I would like to do, really would like to do, is to have people come in and work with me in my classroom, like for three months or six months and put me on a pilot project of some sort because you can read and you can read until your heart’s content but to be able to implement something is really difficult if you haven’t seen it. I would like to do that or have that done with my classes next year. I would like to...and what else? What would make my life easier? I often thought it would be a professional marker, you know, so you didn’t have to mark the stuff. But when I mark, I prepare the next days lesson from what I can see from the marking. Do I have to do a review or is there mastery in the work that they’ve submitted and I can pace myself. So that’s not even a good idea anymore because that’s part of the overall evaluation of the kids. If I don’t do it, then I’m sort of the blind leading the blind.

Leona is echoing an earlier statement. Her view of curriculum implementation is a process of peer assistance. Colleagues come into the classroom and work alongside the regular classroom teacher. This requires a team teaching approach whereby a group shares the trials and tribulations of an innovation. They can share their common knowledge, and also contribute that personal knowledge that has been acquired through their own teaching experiences.
Leona's second comment with regard to a professional marker is one that I am sure many teachers have desired! The real problem that was not stated, but inferred is the work load. Leona either desires smaller classes, or more time to do the job...or both! These sentiments seem to be in keeping with Sam, and others in the study.

Leona would like more interaction with the field. She would favour some form of peer teaching approach. At the moment she feels like she is teaching in a vacuum. Leona would also like to manage her time more effectively, she finds marking to be a time-consuming element of her day. She finds her workload to be a constraint.

(4) Pete:

Pete finds the pressure of government exams to be his biggest constraint. He experiences the pressure even at the grade 10 level.

Pete: ...there's pressures within the school on how you teach, what you teach...there is a little bit of pressure once you get to, say grade 10. Because in physics, if you want to cover the material in grade 12 quickly, then what they should have done is had a very good background in electricity. That lets you cover a section very, very quickly in grade 12 and so you can spend more time on the others.

The pressure of government exams...even at grade 10, and the political climate in teaching are Pete's biggest
constraints. He also finds the workload (marking and prep.) to be time-consuming aspects of his day.

Experienced teachers:

(5) Ron:

Ron did not respond directly to this question. However, throughout the interview, he commented on the need for more time in order to properly come to grips with new innovations.

(6) Dave:

Dave finds curriculum changes to be a hassle. To paraphrase, you are handed a curriculum with no in-service, and no back-up in terms of supplies and equipment. He feels that curriculum changes simplify down to "content" changes anyway. The physical job of reorganizing yourself for the new curriculum is the biggest problem in Dave's view.

4.2.4.1 Summary of teachers' perceptions of school setting

There are two identifiable constraints on teaching for the participants in this study: internal influences;
and external influences. There is some overlap between the two groupings.

1. **Internal influences** There is a range of factors at play within this element. Although working conditions tend to be influenced both externally and internally, this aspect was considered to be an internal factor. This was a concern expressed in varying degrees by all the participants.

   Betty has a concern about science safety. She feels that the physical size and layout of her classroom, and class-size are impediments to successful teaching. The following statement exemplifies her frustrations: "I did not like using the bunsen burners with my grade 8's, not when I had twenty-eight students in there...they're looking outside and what's happening with their faces? So I really kept away from that...a few of my students got to use it and some of them didn't...and that would be because of my concerns with safety". Sam was constrained by work load. He indicated that the amount of "paper work to be incredible...a lot of reading, stuff you have to follow through". He felt that beginning teachers should have at least three spares (preparation periods)! Time constraints (work load) are not just restricted to new teachers. Leona, Pete, and Ron also commented that they needed more time.
2. **External influences** Both Pete and Leona find that provincially mandated exams constrain their teaching. Evidently, school and community pressures to perform well on the government exams influence their teaching. Although, to a certain extent, there is again a time pressure here to get the course completed. The following comment by Pete is indicative of this concern:

...there's pressures within the school on how you teach, (and) what you teach...there is...a pressure once you get to, say grade 10, because in physics, if you want to cover the material in grade 12 quickly, then what they should have done is had a very good background in electricity. That lets you cover a section very, very quickly in grade 12 and so you can spend more time on the others.

At the junior science level, Pete is not as faithful to the curriculum as he is forced to be in the senior, provincially examinable grades. This clearly supports his value for academic freedom as stated above.

Ron considers that there is an expectation for him to ensure that all his students meet the intended learning outcomes for a course. Dave, Leona, and Ron also felt that curriculum change is an important consideration in terms of their job. However, both Leona and Ron indicate at various points during their interviews that time is the biggest constraint in trying to properly implement a new course. Dave feels that there is never enough funding support for new equipment and supplies. Pete also indicated that there are "equipment constraints" -- these constraints tend to
Impinge on their ability to do lab work. Perhaps curriculum change is not a factor with Betty and Sam simply because they have not yet experienced such a change!

Pete has found the political turmoil over the last few years to have been demanding on his teaching. Although this is an externally created pressure, he finds that it has affected the school environment. He commented on the difficulties in promoting positive attitudes among children:

I think it's the whole situation that has to come into account when you're trying to change attitudes...such as the attitudes in the school, the attitude in the Province, everyone's attitude. I think the main attitude towards school at the present time has been down. You know, "squash the schools" in a lot of cases. So I don't think you can. it's harder to foster a positive attitude when you get into that situation...it's very hard for the teacher to go into the school with a positive attitude when he or she is being stepped upon!

Similarly, Leona stated that the "outside issues are starting to play on me, and I almost feel like a puppet where I would like to be in some sort of control of what I'm teaching and how I teach". Sam indicated that his pay should be more. This is indicative of a general feeling that the salaries, especially of beginning teachers are too low in B.C.
4.2.5 Teachers' Perceptions of Students

Schwab (1973, p.502) refers to this category as the "learners". He believes that in order to consider a curriculum change, one must know the clients. Besides a general knowledge about the children, Schwab states that one must also take into account a knowledge of children's attitudes, competences, and propensities. Lantz (1984, p.7) similarly describes this category as an "individual teacher's views of the needs, abilities, and interests of students". The foregoing definition for this category is also applicable to the current study.

4.2.5.1 Summary of teachers' perceptions of students

There are three identifiable elements in this category. Concerns for the needs, abilities, and interests of the students. The elements within this category emerged as the most prominent themes throughout the interviews. All the participants have student-centered philosophies, but in differing degrees. This becomes clear in the first section below, when the continuum of needs ranges from student perceived needs to teacher perceived needs. The three concerns for students were not as independent as the Lantz and Kass (1987) study portrayed. In fact there seems to be a great deal of overlap among the participants.
Concern for students' needs  A concern for the students' needs, and a consideration of students' abilities are closely related themes. In an earlier section, Dave stated that he "values higher education and promoting students going on in education". This seems to agree with Betty who indicates that "learning is important to them (students), and I have to tie that in somehow and get them to understand that...Being able to understand where the students are coming from. You have to analyze them and try to determine what types of things they need to learn". In the latter part of this statement, Betty is clearly indicating that she values the needs of students. Perhaps she is also concerned with what she perceives the needs of students to be, rather than what the students perceive their needs to be. Leona feels that teaching methods and styles are "what you can do to the kids to make them understand better" -- again, this seems to be almost a forced approach. It is more of a concern for what teachers perceive students need, rather than the reverse. Ron also implies that a teacher's view of students' needs is important. When commenting on the recently revised senior Biology course, he describes the following: "There is a list of learning outcomes...and those are the things the kids have to know...kids must know these things. I really like it that way, and I think kids really like it that way". Ron's comments clearly support a teacher's concern
for the needs of students -- as perceived by that teacher!
One can see then that there is an array of perceptions
about students' needs.

2. Concern for students' abilities Betty also has a
concern for students' abilities. She likes "working with
people, even those people that are having difficulties". Ron
has a similar perspective. He described a situation
that he had observed in another school as follows:

I went and saw a course called "Terminal Science
10" in White Rock, where the guy had set-up, it
wasn't individualized, but the guy had written his
own course and he had everything all set-up for the
whole year. The day we walked in there, every student
in there was a student that you would expect to
be...or you know, some other kind of problem...they
were working really industriously. He had the course
set up so that there was a sheet of paper for every
day and it would say what they were doing, why they
were doing it, what they were trying to learn and
then it would have, it would almost like program
learning. There would be a sentence with a blank and
they would go through it, whether it was labs or
whatever they were doing it. The day I was there they
were doing labs with acids and metals and it would
say take this metal and put it with this acid and
what happens, that kind of thing. But it was on a
level that kids were really having a good time, they
were really learning something. If that could be
individualized so that you had that lab set up in a
bin and one day, you might only have one kid doing
that lab one day if he's ahead. Then I can see that
the student who gets into a modified class because
they're not intelligent enough to do academic but who
still wants to work, could really push through. The
student who is in a modified class because they just
won't work, well they're going to go on slowly and I
think what they're going to see is that they see
other students moving faster and they're way behind
they're going to want to keep up.
The foregoing is a good example of a teacher's concern for teaching according to student abilities. Leona feels that one must be flexible in teaching. She perceives that "you treat students differently and act differently...just from the composition of the class".

The overlap between elements is evident with Dave. He has already indicated that he values consideration of student needs. He also favors taking into account students' abilities. For instance, he comments on the implementation of a new "radical" curriculum..."I think the first time you go through it you're going to have (problems)...turn out to be some expectations that you have no right having. It was silly to expect this out of the students. I think you're also going to have some things where you underestimated the students..." Dave is saying that one must be quite clear on what the abilities of the students are before one can embark on a curriculum change. He adds that a new curriculum "could be a lot of fun, could be a pain in the neck. Depends on what kind of students (you have, they) would make it (or break it)".

3. Concern for students' interests  All the participants at some point or another expressed a concern for students' interests. Ron complains that "we're trying to excite kids about science, and you give them labs where nothing happens". He argues that "our job isn't necessarily
'to teach kids that \( E = mc^2 \), or something like that. I mean who really cares? Our job is to get people interested, and to get them to think...and you can't do that...if kids have to know this massive amount of material". Ron describes the cross-disciplinary nature of this concern in relating students' interests about how and why their bodies work, and his ability to build on the information in P.E. and Science. Betty made a similar comment with regard to her concern that students need to be physically active and mentally active in their everyday lives, and the roles that P.E. and Science play in achieving these needs.

Sam believes that if the "kids can be entertained in some way, they don't find the class as boring or as...I think they will also learn...something". Elsewhere, Sam states that "if they (teachers) are enjoying their job, and letting the students see that they're enjoying the job, I think the students (will) probably enjoy the class better". In both these statements, Sam is alluding to the maintenance of student interest, but not necessarily selecting curriculum materials and teaching according to what students are interested in. I would argue that the two points of view are on either ends of a continuum. This is somewhat akin to the earlier concerns for students' needs as perceived by the student, and as perceived by the teacher. Leona feels that this element cannot be taken to the extreme that perhaps Sam is suggesting. She warns that
"you can't reach all the kids with your personality. Some people will like you or not like you". In a similar respect, Dave believes that focussing a course strictly on the basis of student interests is not that easy, and it can possibly be detrimental to the whole program. He states that

Students forming loyalties to their own teachers and they don't necessarily judge them. Certainly if there are experiences they will form judgements. If there are good experiences or bad experiences. I've certainly noticed it. I think there's a certain loyalty to their teacher as being good. I guess it's probably the benefit of the doubt. If there are stand-out aspects of a teacher the student will certainly notice that. If a teacher has gone out of the way for the student, you know, or if the teacher has really helped the student,...Students are aware of that.

But, of course, the reverse is also true and negative images can develop -- possibly for those who choose not to teach topics that students enjoy, but rather teach topics according to the perceived needs of students. Dave feels that the new senior Chemistry textbook does not provide topics that might be more interesting. He states that "they could have spent more students' time covering topics of interest that would make the people more rounded in chemical education".
4.2.6 Current Teaching Practices, Methods, and Style

There is a perception that one of the factors which influences the development of teachers' functional paradigms is current classroom practice. In this study, the view is modified, for it is assumed that there is a dynamic interplay between what occurs in the classroom, and the evolution of teacher's functional paradigms. It is of interest to discover the bidirectional relationship between the two factors. It is appropriate then at this stage to examine the espoused practices of the participants taking part in the study. The relationship between classroom practices and teachers' functional paradigms will be examined further in the following chapter.

Apprentice teachers:

(1) Betty:

Betty claims that her teaching is eclectic, in that she "thinks" that she incorporates all sorts of methods. She explained that when she lectures, or does lab activities, she uses the overhead projector -- partly because of her height, and partly out of general preference. When asked about the use of computers and other media, her answer indicates that perhaps she is not yet
comfortable in using the computer, especially as a learning tool.

Betty: I've used the computer, but I like filmstrips and I try to tie it in with anything I can find in the lesson.

Betty likes to emphasize lab technique in her teaching. She views her role as preparing students for the next course...especially for the transition from grade 10 to the senior courses. Betty sees a hierarchy here both in knowledge, and in teaching itself.

Betty: For example, in the grade 8's one of the things that I emphasize is lab technique. In grade 10, I try to teach them something about lab equipment. I think that's important because once we get everything solved in that area then we'll be okay for senior courses and doing proper lab technique...what science is all about, observing, and things like that.

Summary

Betty thinks that she uses a variety of teaching methods. She uses the following sort of terms to describe her teaching: lecture; labs; overhead projector; film strips; preparing students for their next course; emphasis on lab technique; observing; lab safety; supplements with worksheets, and notes...
Sam "thinks" that he is a progressive teacher.

Sam: ...traditional (is) just the sit-down type, do the work, and go over the problems and that. I've tried to use different strategies to get them motivated because I think that in this day and age it's hard to get the kids interested in certain things especially like for example, women in science. You have to do something different to get them interested in that. Progressive I guess, in a sense that I do different things outside of traditional things, if it means dressing up stupid one day or walking on your hands!

Both Sam and Betty were tentative in their descriptions of their teaching. They perhaps do not have the self-confidence yet to be able to describe themselves. There is also probably a bit of modesty, or even reluctance here in describing their teaching, especially to the department head. Sam's reference to "women in science" indicates a feeling for some of the current issues in science education.

Sam went on to describe a typical lesson for him. He described a structured approach, typical of the "recipe" styles outlined in teacher training years...the kind that Ron was talking about earlier. He was then asked to comment on the resources, props, media that he incorporates into his teaching.

Sam: I prefer the overhead for just straight notes...I usually have them prepared...I put them on the overhead...walk around the classroom to make sure
that people are on-task, and then it also gives me time to take a quick attendance in that first few minutes or sometime during the class, it frees up a few minutes and then I can explain it once I see everyone's done. The blackboard, I like to use when we're going over problems, like follow them along, write it big so that everyone can see because I knew that there were kids that had problems with eyesight in my class. So step-by-step problem solving I use the blackboard, sometimes overhead because my arm gets sore I go to the overhead. On a number of occasions I use slide presentations because I have a slide set that I use for Earth Science and Astronomy. Films and videos, this district I found very limited in the material for chemistry, but for Science 10 there was lots of stuff and the same for Science 8. I used a lot of them! Computers, for me, it didn't seem like the software totally satisfied the course. We just got it in, I haven't had a chance to test it out too much for chemistry and plus the availability of the computers wasn't that good for my class, like G-H (classes) for chemistry it was occupied by the Business Ed. (classes).

Sam describes a typical approach to science teaching. The routines described in the first section above are routines that I would argue are common to most teachers, in most segments of our "society". Not all people use all of the resources that he uses, but there is some overlap. He seems to be comfortable with the idea of using computers for instructional purposes, even though he hasn't had time to try out the software available.

Summary

Sam thinks that he is a progressive type of teacher. He describes a traditionalist as a sit-down...do your work...do some problems type of person. The following terms paraphrase Sam's description of his own teaching: different
strategies; this day and age; get kids interested; women in science; do something different; outside of the traditional/normal (i.e. dressing up); structured approach; typical lesson format; prefers the overhead for straight notes, but uses the board for problems; walk around the classroom; on-task; step-by-step problem solving; writes "big"; uses videos and films; limited use of computers...

Post-apprentice teachers:

(3) Leona:

Probably for the same reasons discussed previously, Leona is hesitant when she describes herself as being a progressive teacher. She states that she tries to be more progressive, but "thinks" that she falls more into the traditional category. Leona feels that it is difficult to place herself without having the benefit of comparisons. Again, she feels that peer observation would help. Her description, from another section of the interview, of what is meant by "traditional" and "progressive" indicates a deeper understanding than she cares to admit.

SC: How would you categorize a traditional teacher? What would you say is traditional?

Leona: Well, the thing is too, I'm concentrating on approaches in the classroom more than how they teach the curriculum. Structure, set guidelines with
flexibility (in each) case by case situation. So that when you walk in you know what the expectations are. That to me is a more traditional approach, but whether we're talking teaching styles, I'm not sure.

SC: And how about the progressive side of things?

Leona: I would suspect you could work with that in group learning situations instead of, you know, class. More with the peer tutoring, group learning, the thing that we got from England. You know, teaching Science in a problem-solving fashion more than just labs supplementing the written.

Leona described some of her teaching methods. She has a similar problem with the blackboard as Betty. I would describe her espoused teaching methods as progressive from the account given.

Leona: ...supplemental reading resources. I teach them how to do notes. Right, so I give them three or four different chapters and we go through the thing and do "how to take notes", we do labs, we do the use of equipment, we do qualitative and quantitative essays, then descriptions about things, worksheets, group work, posters, model building. All those kind of things.

SC: Do you use the blackboard at all or do you...?

Leona: No, I'm too short, simple as that. I can't utilize the blackboard well enough...(I use the)...overhead, so I can face the kids and answer questions as I'm writing notes and I can look for eye contact and classroom behaviour management. You know, the minute you turn your back you don't know what's going on.

Leona does not use the computer as an instructional tool. Leona explained why she did not use videos as much as she had in the past.

Leona: ...because when we were allowed to tape them off... (the air) I found them a lot more informative than the stuff we can get now...and it's really hard to
get NFB films to arrive on the scheduled day and then the equipment to be in here. Kids are not interested in videos as much as they were because they get to see t.v. a lot. So they do a comparison, if you’re not entertaining then I’m not going to listen...I would rather them make a video on their own than watch one. My Biology 11 kids do that with life cycles. They made up videos this year.

SC: Was that successful?

Leona: It was, it was good...they were really impressed with their work and the other kids enjoyed seeing what could be accomplished.

A picture is emerging of the teachers at Mountainview. They seem to have common problems, their day-to-day routines are very similar, and yet there are differences in terms of their own teaching approaches, and ways of getting the message across.

Summary

Leona categorizes herself as a traditional teacher...but she leans towards being progressive. She defines a traditional style of teaching as follows: structure; some flexibility; guidelines; clear expectations; labs and written materials...Her description of a more progressive approach uses the following words: group learning styles; peer tutoring; science by problem-solving; more than notes and labs...

In describing her own teaching, Leona uses the following terminology: supplemental reading resources; supplemental labs; notes taking; chapter readings; labs;
use equipment; qualitative and quantitative essays; descriptions; worksheets; group work; model building; uses overhead projector; question and answer; monitors classroom behaviour; making videos...

(4) Pete:

Pete believes that his teaching style is definitely not traditional. I asked him to describe a typical lesson in more detail.

Pete: It's not a traditional lecture method or anything like that. It's more of a...I try to do more one-on-one with the students, if I can...I usually tend to introduce a subject with just a small talk about what it's about and then we do a few notes. Then I bring up problems in the way of labs as a way of determining what is going on. Using question and answer type things after that, and look at the lab a little bit more.

I questioned Pete on the use of other resources to supplement his teaching. He said that he would use computers to assist instruction if he had enough of them -- he has no problem using computers. Pete utilizes the overhead and blackboard for different uses. He does not use filmstrips, or videotapes very much. I asked for more detail.

Pete: I think that unless the videotape is very good or the film is very good, I think they're sort of an overflow or an overload in terms of that...I use the overhead for notes and some problems and I do put my
problems on the board because there's more room to show the whole thing.

Pete also incorporates other approaches to teaching Science. He mentioned "word-playing", "debates", but not in the so-called traditional courses like physics -- due to the time constraints, and group work or small group work. He likes this arrangement because the slower learners can pick up a lot more from the faster learners. Pete encourages students to bring materials to do with current events into class. Especially if they are topical.

SC: How important do you think that is? Is that more important than sticking to the curriculum or do you think it's appropriate?

Pete: ...science involves the world, so I think that any way we can show that it involves the world and that it's very important to what happens to them is more important than what's happening in the curriculum.

Pete's concept of science and science education is quite different from Betty's concept. Previously, Betty let on that science was learning about "observation, and things like that...", and her science teaching was important in terms of preparation for the next grade. Pete has a much broader view of science. He places science in a societal context. Elsewhere in the interview he commented on the need to improve thinking abilities in order to increase interest in science.

Pete: ...in some cases, give them problems to solve. So that they have to try to discover the answer themselves. That is very difficult for a lot of
them. A lot of them can't do it. For those that can, I think it increases their interest in science.

Pete was asked to comment generally on the teaching styles of his colleagues within the department.

Pete: I think they're fairly diverse actually. I mean, everybody teaches the same sorts of things but I think that a lot of them emphasize one style more than the other...there's some that emphasize the lecture type approach in their class, that are almost wholly lecture oriented and they do very, very few labs. Whereas there are some of us who do a lot of labs...especially grade 11 where you have more labs, I do, for the first part of the course I probably do, almost a lab a day, which is a lot.

Pete sees diversity of style, even within a relatively small segment of the school. The subject matter is the same; however, the methods are quite different.

Summary

Pete believes that he is not a traditional type of teacher. He uses terms like the following to describe himself: not a lecture method; more one-on-one; a few notes; problem-solving through lab work; emphasis on lab investigations; hands-on activities; circulates; responds to individual student needs; question and answer...would use computers; uses the blackboard and overhead for different purposes; does not use filmstrips or videos much; uses word-playing; debates; group work; current events;
shows the relationship between science and society; improve thinking skills...

Pete does not believe that you should adhere to the curriculum religiously.

Experienced teachers:

(5) Ron:

I did not go into much detail concerning Ron's teaching style.

Ron: I'm very lab oriented, and I do a lot of relating with things to how human beings work. I find that kids are more interested that way.

Ron chose to dissect rats in his Biology 11 class this year. It was something that has not been done at that grade level for a number of years. He managed to attract quite a following of non-registered students who simply were interested in what was going on, and what the students in his class were doing.

Summary

Ron says that he is very lab oriented. He claims to be anthropocentric, and child-centered in his teaching (P.E. or Science) in that he likes to relate all things to
the human being. Ron feels that this is a good way of stimulating student interest. He has a "gym-voice", he coaches, and he is opinionated. Ron likes to have a clear purpose and direction; he is highly structured (cut and dry); and does things "his way".

(6) **Dave:**

Dave was asked to describe his approach to teaching.

Dave: The way I go about it? Well, it's more of an empirical method on how I can get the idea, get the message across. Keep looking at what works, what doesn't, and what doesn't work will be, we'll try to avoid that, get another approach, and what does work then we'll try to incorporate it more.

Dave's explanation shows the possibility of paradigm development in flux. He uses a trial-and-error method. Experience has given Dave a series of routines to try at any one time, and after trying them all, he will resort to something new. Dave is using the blackboard this year, although he has used the overhead in the past. He has moved the overhead projector onto a raised trolley, which he keeps at the side of the room.

Dave: No, we don't use it (overhead). It's just sometimes you walk around and the kids have to move their heads.

I asked Dave to outline a typical lesson that he might follow. There was some confusion. Dave distinguishes
a lab from a lesson. The two are separate entities.

Similarly, Dave has a different approach to teaching juniors, as opposed to senior students.

Dave: A lab, not a lab?

SC: Yes, it may incorporate a lab. What sort of materials would you use? Generally, not one lesson during your teaching day. What kinds of...?

Dave: Is this for the junior or for the senior? Or it doesn't matter?

SC: Both. It doesn't matter.

Dave: Okay, start if off. Get them settled. Attendance and all that, any special announcements, and then I start the lesson. Let's suppose that it's going to be a demo. So then...you review the ideas that you're going to be talking about. You run the demo with continuous conversation about what they should be looking for, what do they see, what does this mean, that sort of thing. And then at the end, we'd have to wrap it up so that everybody knew what they saw so that we're all talking about it from the same point of view. Iron out any problems that arise in the demonstration. And then go through and relate this to the idea that you're trying to get across, where this demonstration ties in. And then I would give them some kind of assignment.

Dave operates a fairly structured class. Without detracting from what he does, or the end results, I would argue that his methodology is quite traditional. He runs through the lesson using a standard format. His schedule involves taking care of the administrivia at the outset, informing the students of the events that will transpire, walking them through the demonstration lab (with comments throughout), checking for understanding at the end of the
demo, relating the demo to the concepts to be learned, and using an assignment to reinforce the lesson.

Although most teachers use demonstration labs from time to time as part of their teaching strategies, Dave was the only one to refer to this method during the interviews. It seems to be a technique that he favours, since it works well for him.

Dave uses films more than videos. He is beginning to use the computer as a teaching tool for his senior chemistry students. In light of an earlier point in which Dave stated that he teaches using an "empirical method", I asked him how his teaching has changed over the years.

Dave: I'm more...I'm slow at the beginning of the course. I really stress the fundamentals, and then later on we really move along. So that's like timing or whatever you want to call it. As far as the actual methods, I'm set out the course in a set way and repeat it year after year, with refinements as I go through. Whereas before I was more...see how the class was going and tailor it more to them.

Dave has developed an ordered way of teaching over the years. His personal knowledge of teaching has evolved as he has refined his ideas.

Summary

Dave describes his method of teaching as being empirical. He operates by trial and error until he finds a
routine that works, then he sticks with it. Dave describes his teaching using words like the following: prefers the blackboard; settle the students; demo labs; lesson; structured format; talk about it; relate the parts; assignments; uses films more than videos; stresses the fundamentals; timing; set out the course in a set way; repeat the practice year after year; refined; measurement science; common-sense stuff about how things work; sophistication...senior chemistry...

4.3 Summary of Analysis

This chapter focussed on the functional paradigms of individuals taking part in the study with respect to a number of categories and sub-categories. The individuals were also grouped according to their teaching experience. Each category was analyzed in the context of "why" teachers select, interpret, and utilize curriculum materials in certain ways.

The main categories analyzed included teachers' perceptions of teaching; subject matter; school setting; and students. Current teaching practices; teachers' backgrounds, teaching experiences, and current teaching situation were also considered as separate categories. It was anticipated that elements of teachers' functional
paradigms would emerge from a consideration of these categories.

This chapter provided an analysis of individual cases. In the next chapter, these results will be brought together, and discussed with respect to the research questions. Where Chapter 4 focussed on specifics, Chapter 5 will address the more general case, utilizing specific examples from this chapter. Consistencies will be sought between categories, and comparisons will be made in terms of career position. It is important to distinguish between the common categories for describing teachers' functional paradigms that have been identified, and utilized in this chapter, and the commonality that may or may not exist among teachers with regard to the elements of those categories which constitute teachers' functional paradigms. A broader discussion in terms of the "nature" of teachers' functional paradigms will follow in Chapter 5. It is intended that the next chapter will provide some answers to such questions as "Why do teachers teach in certain ways?...Why do teachers select, interpret, and utilize curriculum materials in certain ways?...How stable are these factors in the context of a curriculum change?"
CHAPTER 5

CONCLUSIONS AND IMPLICATIONS

5.1 Introduction:

The purpose of this study was to determine the nature of teachers' functional paradigms in terms of how they interpret, select, and use curriculum materials. The recent changes in the junior secondary school science curriculum in British Columbia were considered. It is believed that one way in which teachers manifest their functional paradigms, is through their interpretation and use of curriculum materials in everyday teaching practices.

A subsidiary purpose was to examine teachers' backgrounds and determine what aspects of their backgrounds might influence the formation of their functional paradigms. Of particular interest is the nature of teachers' past educational experiences in terms of how these might shape their functional paradigms.
The following specific research questions were examined:

1. What are some of the factors which influence the formulation of teachers' functional paradigms?

2. What is the nature of teachers' functional paradigms?

3. a) What are the perceptions of teachers with regard to curriculum change?

   b) What is the relationship between teachers' functional paradigms and their perceptions of curriculum change?

   c) To what extent do teachers' functional paradigms become idiosyncratic when they are faced with a curriculum change?

This study focusses on shared goals, problems, exemplars, and routines, which constitute "functional paradigms", rather than the more traditional focus on differences between teachers. The term "functional paradigm" is meant to convey the idea that the characteristics which unite a community of practitioners are likely to be centered on practical matters: Why do teachers function in particular ways? Do teachers attach "common meanings" to particular situations or entities?
In the previous chapter, the six interviews were analyzed in terms of the following categories:

1. Teachers' backgrounds and experiences.
2. Perceptions of teaching.
4. Perceptions of school setting.
5. Perceptions of students.

In the first part of Chapter 5, the results will be discussed with respect to the research questions. The second part of the chapter will summarize the findings. Finally, the implications of this study, and suggestions for further research will be outlined.

5.2 Factors which Influence the Formulation of Teachers' Functional Paradigms

This section addresses the first research question. The following outlines some of the factors which influence the formulation of teachers' functional paradigms.

One could perhaps argue that if a functional paradigm implies a commonality, then the paradigms must have been arrived at similarly. The data indicate that this is clearly not the case. There seem to be some common factors which together help formulate teachers' functional paradigms. Woods (1984, p.260) refers to this as the "conjunction of a number of coordinates".
Lantz and Kass (1987) postulate that there are three sets of factors which influence teachers' translation of curriculum materials into classroom practice. These are: elements of teachers' functional paradigms; teachers' background; and teaching situation. This study takes the interpretation one step further to suggest that there is a dynamic interplay between teachers' functional paradigms, teaching situation, classroom practices, and to a certain extent, the curriculum materials. Teachers' functional paradigms both influence and are influenced themselves by each of the other factors. The dialectic that emerges is something that needs to be studied in greater detail.

Teachers' functional paradigms are also a function of the teachers' backgrounds. This historical relationship logically can only be in one direction. However, it is also true that teachers' current functional paradigms lead to decisions which become the backgrounds for the future.

The Lantz and Kass model depicted in Figure 1 can be extended to incorporate these findings. This is illustrated in Figure 2 later in this chapter.

5.2.1 Teachers' Backgrounds and Experiences

Within this category, there appears to be a number of elements which predominate in each teacher's background and experience.
1. There were several reasons expressed for why the participants chose teaching as a career:

- work with young people (either teaching directly, or coaching).
- one of several career options.
- had always wanted to be a teacher.
- satisfy family pressures (socio-economic).
- influence of others (teachers...)
- provide a service to others.

No one expressed the often heard view that they couldn't do anything else. There was a lot of overlap, in that Betty, Sam, and Ron felt that the opportunity to be involved in sports influenced their decision, and Betty, Sam, Dave, and possibly Leona felt that the chance to work with young people drew them to teaching. Sam, Leona, Ron, and Dave also chose teaching because it was one of several options open to them (the reasons for their final decisions, however, varied). Betty and Pete had always wanted to be teachers. Family pressures of various kinds were significant with Leona, Ron, and possibly Dave and Sam. The influence of other teachers had an impact on Betty, Leona, and possibly Sam. Sam believes that he is providing some sort of service for others.

2. All the participants have university degrees. All except Betty have degrees in their prime subject area plus a year of teacher training. Betty has a Bachelor's degree in Education. Pete has an M.Sc. in his prime subject area. In
general, type of university degree does not seem to be of any consequence. Sam and Dave are early entrants to teaching. Ron and Leona are neither early nor late entrants to the profession. Betty and Pete can be considered to be late entrants to teaching. This does not seem to be a factor in this study.

3. All the participants were influenced to a greater or lesser degree by their previous teachers. Some recall high school teachers, and others recall university teachers. There is a great deal of commonality in the terminology used to describe why these teachers had an impact.

The descriptions of these teachers fell into two groups: traditional; and progressive (as outlined previously). Both Ron and Dave, and to a certain extent, Betty described the teachers who stand out in their minds as being traditional ("strictly a lecturer; work...be quiet...work; traditional in style; lecture-lab approach; notes...").

Based on the descriptions used by the other participants, one can classify the teachers who they recollect as being progressive ("not just notes; use of different methods; used a combination of theoretical and practical approaches; hands-on, going places, observing things...")
However, there are certain over-riding qualities which were not restricted to the traditional or progressive teacher concept. The participants used surprisingly similar descriptors of the teachers who stood out in a positive light. The following summarizes these qualities. In some cases, they are paraphrased:

Betty ...they were fun; enjoyable; interesting; good; the labs were enjoyable; structured; demanding; expected a lot.

Sam...personable; humorous; involved in school activities; very enthusiastic; discussed things with you; circulated around the class; effective communicators; good at question and answer; entertaining.

Leona...personality; someone you could listen to; humorous; used lots of examples; could relate to them; more to offer; personable; taught about prejudice (positive values); enjoyable.

Pete...interesting; lots of experimentation without lab books.

Ron...exciting; dramatic; knew a lot; had lived a lot; did exciting things.

Dave...smooth; effortless; very good; humorous; efficient; happiness; happiness about what he is doing;
talks about it; explains it; enjoying it; enthusiasm; straightforward; anticipatory; prepared; well-organized.

Participants also used similar phrases to describe those negative qualities of certain teachers whom they recollect:

...monotone voice; poor communicators; could not answer questions clearly; were "above" the students...boring, out of touch; didn't apply to the real world...

4. In terms of teaching as a lifetime career, Pete, Ron, and Dave are firmly committed to the profession. They do not seem to have ambitions beyond being a classroom teacher. Both Sam and Leona indicated that they would not like to teach in the high school forever. Leona would consider a completely different career if the opportunity arose. Sam would consider teaching at a college or university. Betty is committed to teaching. However, family pressures may result in her taking leave, perhaps for an indefinite period. Career position seems to have a mitigating influence on teachers' interpretations of curriculum. Teachers who are at an early stage in their career, seem to have a more open mind to new curricula. It is perceived that beginning teachers interpret curriculum in a more flexible manner. In the same sense, it is
perceived that the functional paradigms of "apprentice" teachers are more fluid as compared to those of well-established, experienced teachers. This category will be considered in more detail in a subsequent section.

In summary, past experiences can be considered to be a major determinant of a personal paradigm. But each individual's experiences are different, and these lived experiences contribute to the emerging paradigms in different manners.

Within the "past experience" strand, there seems to be a myriad of lesser elements. Family history, financial considerations, social status, age, gender, marital status, political background...to name a few. Each contributes in some way to the formulation, development, and maintenance of the functional paradigms. Similar personal factors were identified in Sikes, Measor and Woods (1985).

The influence of schooling, both high school and at university are significant components of paradigm development. Certain teachers from each individual's past have also played a role. The teacher training year itself did not appear to be influential. However, the practicum experiences played a large part in the establishment of teacher's initial models for teaching.
A subsidiary purpose of the study was to determine the relationship between teachers' past educational experiences and their current teaching practices. It was perhaps the most interesting aspect of the study. It appears that previous teachers had a marked effect on the formation of teachers' functional paradigms. The descriptions of teachers who come to mind occasionally (presumably because they impressed the individual in some way) bear a striking resemblance to the descriptions of the teachers' own teaching practices. These findings seem to support the work of Lantz and Kass (1987), Ball (1982), Spector (1984a), Klein (1980, p.5), and Lortle (1975). Another relationship that seems to emerge is that the participants' concept of what constitutes a "good" teacher also has its basis in their espoused theories of action.

5.2.2 Current Teaching Practices

It is appropriate at this point to examine the espoused practices of the participants taking part in the study. The relationship between classroom practices and teachers' functional paradigms will be examined further.

Once teachers' functional paradigms have been established, they do not remain static. Instead, they are molded, shaped, refined, and perfected by everyday
experiences. Therefore, current teaching practices are helping to further develop the existing paradigms of the teachers. This seems to support the work of Roehler et al. (1988). For the most part, it appears from the data, that once established, these paradigms are relatively stable. The four more experienced teachers considered in the study had each formulated their own teaching routines. They all have ways of dealing with the standard day to day problems that crop up during their teaching. These patterns, tricks-of-the-trade, exemplars, and models are developed in isolation -- personally, but it is evident that much of the paradigm evolution is analogous. That is the paradigms, while developing independently, emerge with many common elements. The nature of these elements will be discussed in the following section.

1. The participants held common views on their perceptions of what constitutes a "traditional" teacher (see part 4.2.1). Sam describes a traditionalist as follows: "Just the sit-down type, do the work, and go over the problems and that". Similarly, Leona feels that a traditional teacher is one who has "structure, sets guidelines with flexibility (in each) case by case situation. So that when you walk in you know what the expectations are". Her description of a progressive teacher, is one who utilizes "group learning situations
Instead of, you know, class. More with the peer tutoring, group learning...teaching science in a problem-solving fashion more than just labs supplementing the written.

2. In describing their own teaching, the participants fell into two groups: traditional (in the sense outlined in an earlier section), and progressive. This, of course, is not intended to imply that one way is better or worse than any other way of teaching. In fact, Ron aptly pointed out the effectiveness of differing styles when commenting on the use of the Madeline Hunter teaching strategies. He said, "I don't think you can say that this is the only good way. Somebody might do everything seemingly wrong and yet their kids may be learning a lot because their personality (style) is such that that works for them".

**Traditional** Betty is a traditional teacher. The following statement seems to support such a view:

In the grade 8's one of the things that I emphasize is lab technique. In grade 10, I try to teach them something about lab equipment. I think that's important because once we get everything solved in that area then we'll be okay for senior courses and doing proper lab technique...what science is all about, observing, and things like that.

Sam would like to be more progressive in his teaching. However, based on his description of his own
teaching, one would generally classify Sam as a traditional teacher. The following typifies Sam's teaching style:

I prefer the overhead for just straight notes...I usually have them prepared...I put them on the overhead...walk around the classroom to make sure that people are on-task, and then it also gives me time to take a quick attendance in that first few minutes or sometime during the class, it frees up a few minutes and then I can explain it once I see everyone's done. The blackboard, I like to use when we're going over problems, like follow them along, write it big so that everyone can see because I knew that there were kids that had problems with eyesight in my class. So step-by-step problem solving I use the blackboard, sometimes overhead because my arm gets sore I go to the overhead. On a number of occasions I use slide presentations because I have a slide set that I use for Earth Science and Astronomy. Films and videos...this district I found very limited in the material for chemistry, but for Science 10 there was lots of stuff and the same for Science 8. I used a lot of them!

Sam also likes to inject a little humour into his classes, his comments implied that humour, enthusiasm, and personality are aspects of a "progressive" teacher. Ron is also a very traditional teacher. he supplements his lectures with lots of labs. "I'm very lab oriented". Ron tries to stimulate interest by doing more interesting labs. The following description typifies Dave's approach to teaching. Again, it is a traditional method which Dave has found to be successful for him over the years:

Okay, start if off. Get them settled. Attendance and all that, any special announcements, and then I start the lesson. Let's suppose that it's going to be a demo. So then...you review the ideas that you're going to be talking about. You run the demo with continuous conversation about what they should
be looking for, what do they see, what does this mean, that sort of thing. And then at the end, we'd have to wrap it up so that everybody knew what they saw so that we're all talking about it from the same point of view. Iron out any problems that arise in the demonstration. And then go through and relate this to the idea that you're trying to get across, where this demonstration ties in. And then I would give them some kind of assignment.

**Progressive** Leona uses a variety of teaching approaches. Her teaching can be classified as nontraditional. Although Leona is concerned with common tasks such as note writing and classroom behaviour, she also describes a number of alternate strategies:

...supplemental reading resources. I teach them how to do notes. Right, so I give them three or four different chapters and we go through the thing and do 'how to take notes', we do labs, we do the use of equipment, we do qualitative and quantitative essays, then descriptions about things, worksheets, group work, posters, model building. All those kind of things.

Leona described one particular project using video cameras -- certainly not a traditional teaching method:

When we were allowed to tape them off... (the air) I found them (videos) a lot more informative than the stuff we can get now...and it's really hard to get NFB films to arrive on the scheduled day and then the equipment to be in here. Kids are not interested in videos as much as they were because they get to see t.v. a lot. So they do a comparison, if you're not entertaining then I'm (the kids are) not going to listen...I would rather them make a video on their own than watch one. My Biology 11 kids do that with life cycles. They made up videos this year.

**Pete** can perhaps be classified as a nontraditional teacher. He describes such activities as word-games,
debates, and various forms of group work. Pete says that his teaching does not involve the traditional lecture method. The following describes one of his typical lessons:

I try to do more one-on-one with the students, if I can...I usually tend to introduce a subject with just a small talk about what it's about and then we do a few notes. Then I bring up problems in the way of labs as a way of determining what is going on. Using question and answer type things after that, and look at the lab a little bit more.

Pete does a lot of labs, especially with the senior classes. Both Betty and Ron also like to do a lot of labs.

Other factors that currently impact on teachers' functional paradigms, but which were not studied in great detail in this study include the school-based influence of students, administration and other teachers, the influence of family, and external influences such as community held beliefs, politics, and religion.

5.3 The Nature of Teachers’ Functional Paradigms

This section outlines some of the findings with regard to the second research question. There are two dimensions that are examined in trying to explicate the nature of teachers' functional paradigms. The first describes the relationships across the categories. The second focusses on
the nature of teachers' functional paradigms in relation to their career positions.

With regard to the data, this particular research question is really asking: Is there a commonality of goals, beliefs, problems, exemplars, and routines which constitute "functional paradigms" among the science teachers, who constitute a small segment of the staff at Mountainview Secondary?

5.3.1 Consistencies Across Categories

The purpose of this section is to show consistencies or inconsistencies in the perceptions of the participants across the categories used to define the teachers' functional paradigms. The elements of each teacher's functional paradigms should emerge from such an analysis. The intent is to explain how teachers interpret and use curriculum materials in terms of their own perceptions. The following points summarize each teacher with respect to their perceptions of teaching; subject matter; school setting; and students (in that order):
Apprentice teachers:

(1) Betty:

Betty subscribes to a view of that effective teaching involves understanding students and using a variety of teaching methods dependent on students' abilities. However, she perceives that most teaching involves the lecture method with varied teaching styles (in terms of personality and presentation). She feels that there are common problems encountered in teaching. For example, Betty recognizes "relevancy" as an important component in teaching, but believes that a common problem is in trying to get this across. Betty indicates that in order to become a teacher, one must already be personable, and enjoy helping people who are having difficulties.

Betty feels that the junior science course includes the "basics" which are delineated in a strict sense by the curriculum guide. She has to supplement the course in areas where the textbook does not supply sufficient background information. In keeping with this, Betty believes that the curriculum should only be revised to reflect advances in scientific knowledge. These beliefs are consistent with the foregoing perceptions of teaching. Betty values a comprehensive knowledge of science.
Betty views the school setting in terms of her ability to do lab work. Even though Betty likes to stress this activity, her working conditions are such that she finds that she must curtail this endeavor because of a concern for lab safety.

In planning her teaching, Betty considers it important to determine the needs of the students. Closely intertwined with this focus is Betty's concern for students who are having difficulties. She will tailor her lessons to suit the abilities of her students. Betty is less concerned with focussing on selecting materials and teaching according to the interests of the children. This supports the contention above that Betty favors providing students with a strong knowledge base in the science disciplines.

(2) Sam:

Sam believes that teaching can be effective when students are motivated. He suggests two ways in which this can be done: by bringing in things of interest that may go beyond the curriculum; and by being involved in activities that extend beyond the required curriculum. Sam sees motivation as a common difficulty for teachers. His solution to this problem is to have a sense of humour and an enthusiasm for the topic at hand. Sam indicates that teaching involves using a variety of teaching strategies.
He views teaching using a different style as important. Sam feels that in order to become a teacher, one must first be a good communicator.

Sam believes that the junior science course does not have enough scientific reading material. He includes other issues in science which may not be in the prescribed curriculum -- for example, a unit on "Women in Science". He considers the course to be lab-oriented, and he chooses the labs which he feels belong in his course. In keeping with this flexible interpretation of the course materials, Sam views the curriculum itself as a guideline which does not have to be followed religiously. This also agrees with his opinion of curriculum policy revision. Sam indicates that revision should be on-going, with periodic major changes according to the "grass-roots" wishes of the teachers in the field.

Sam's perceptions of the school setting were largely internally focussed. All beginning teachers are evaluated in their first year at Mountainview Secondary. Sam was also under a lot of pressure from the administration to perform well according to their wishes.

Sam focusses his teaching primarily on students' interests -- even to the point of entertaining students. This is consistent with the earlier comment regarding Sam's perception of successful teaching.
Post-apprentice teachers:

(3) Leona:

In her teaching, Leona stresses both efficiency and to a certain extent, academic rigor. For example, she describes marking students' work, and using that as a basis for next day's lesson. In addition, Leona mentions the need to be 110% prepared, and she supplements most of her courses with additional learning material -- in fact she does not use the prescribed textbook. However, Leona also feels that motivation is an essential ingredient to good teaching. She mentions teachers who are good at motivating students, and she also uses a variety of teaching strategies which generate enthusiasm. Leona sees classroom management as a common problem among teachers.

Leona contends that the content of the recently revised junior science curriculum has not changed a great deal, although perhaps teaching styles have. She believes that the curriculum is "just" a guideline, albeit an inflexible guide. Curriculum policy should be less prescriptive. It should be revised following more direct input at the classroom level. She supports the notion of a core curriculum plus options which she can choose. The new course emphasizes labs and there is insufficient reading material to suit her perception of the subject matter. The
new course lacks organization and continuity, which is in keeping with the efficiency which Leona values.

Community and school expectations are important considerations for Leona. She finds that the necessity of preparing students for future provincially examinable courses is a pressure on her teaching. The disruptive political situation is an external influence, and time pressures seem to be an internal influence on Leona's teaching. This is supportive of her need for efficiency in her job.

In considering the students, Leona focuses her attention on their needs and abilities. She sees the need to be flexible in teaching and selecting materials for students according to the composition of the class. Leona has a perception that students must be made to understand, and this can be accomplished by varying teaching methods and styles.

(4) **Pete:**

Pete subscribes to the philosophy that effective teaching involves motivating students. He does this by using a variety of teaching strategies beyond a traditional lecture-lab approach. He also emphasizes labs, and problem-solving activities. Pete feels that there are similar problems faced by all teachers, including himself,
In terms of class control, communication, and organization of a lesson. He also indicates that teachers use the same kinds of teaching methods. They just vary the way that they present the material. Pete believes that there must be evidence of some basic skills such as group management, and communication in order to become a teacher.

Pete does not think the junior science course should focus on theory as much as it does. He feels that besides providing some basic knowledge, science should also be presented as a part of life -- he perceives a definite link between science and society. Pete finds that the new course focusses on knowledge (too much so), whereas he says the old course emphasized discovery learning. He does not see much difference in subject matter, but feels that the new course has a new focus on "attitudes". He thinks that the present course materials are poorly organized, but they provide sufficient back-up. His comments here are consistent with the foregoing perceptions of teaching. He encourages students to bring things in that are topical. Pete values science as a part of the World -- and so prefers to treat the science curriculum with some flexibility. In commenting on when curricula should be revised, Pete indicates that it should only be changed to reflect necessary changes. For example, when the subject matter is no longer appropriate. Again, this is in keeping
with Pete's earlier feelings with regard to his perceptions of teaching.

Pete considers community and school administration expectations in terms of performance on government exams influence his teaching. He indicates that he must adjust his teaching for senior classes because of these pressures. Another external force which he perceives to have an adverse affected on his teaching is the current political situation. Pete feels that both these external influences restrict his abilities to be effective according to his perceptions.

Pete focusses his teaching on students' interests in that he tends to select materials which he perceives will be of interest to the students. Pete also considers students' abilities. For example, he groups the students according to abilities. Both these factors seem to be motivational teaching approaches, and they coincide with Pete's perceptions of high school science.

Experienced teachers:

(5) **Ron:**

Ron perceives student inspiration as the essential component in teaching. Ron believes that effective teaching involves hard work, an outgoing personality, and the
teacher must like children. He feels that this can be accomplished by doing exciting labs. Ron states that he is very lab oriented. He follows a lecture-lab teaching method. He likes labs that motivate students, and he mentioned two labs using preserved fish, and a demo lab using the Van de Graaf electrostatic generator. However, most of the labs that he described in the interview are typically rote. Ron assumes that people must have an outgoing personality in order to teach; although, he is also of the opinion that most teaching techniques can be taught (and learned).

Ron does not see much difference between the old and new junior science curriculum in terms of content. He perceives the curriculum itself as a document to be followed closely. In his mind, classroom instruction must follow the curriculum inexorably. Although it was not stated directly, Ron sees the new course in terms of an emphasis on content. He would prefer a lab emphasis, and feels that the current labs in the course are mostly boring! Ron states that the curriculum should be revised on a continual basis, with constant input from classroom teachers. Periodic major rewrites should occur as the material from the field accumulates. Curriculum revision seems to be textbook driven in Ron's mind. He finds that the course is well organized in terms of a hierarchical knowledge of science. In both his perceptions of teaching
and subject matter, there seems to be an underlying value for basic scientific concepts -- an inclination towards pure science.

Ron perceives that there is an expectation in terms of what he teaches the students in his care. He feels that he has a responsibility and obligation to ensure that his students know all the learning objectives for the courses that he teaches. To this end, he selects materials and resources which will enable his students to achieve this goal.

Ron values students' interests, abilities, and needs. He tries to relate his science and P.E instruction to the human, because that is what students are interested in. He thinks it would be a good idea to provide individualized instruction and self-paced instructional packages for students who have learning difficulties -- although he has not followed through with this, it shows a concern for students' abilities. He also addresses the perceived needs of students by striving to provide them with the necessary science knowledge as determined by the curriculum.

6) Dave:

Aside from having a "love of children", Dave perceives successful teaching in terms of timing and organization. He believes that good teachers must be
patient, hardworking, and clever. Dave finds that there are some common problems for teachers, such as generating respect, and motivating students -- making them get down to work. However, he feels that there is a wide variation in teaching methods and approach. Dave follows a set teaching pattern that has been refined over the years. He teaches using what he calls an empirical method, where he continually adjusts the course material until he finds an approach that works best for him. Dave considers timing to be important. He also likes to stress the fundamentals. As a prerequisite for teaching, individuals must first like working with other people, and they must be clever (capable, resourceful, and responsible).

Dave finds that although the content of the new junior science course has not changed that much, he believes the course emphasis has changed to one stressing lab activities. He does not feel that the theory is explained as well as before. He believes that the course is broken up into too many modules which are unorganized. He also finds that the topics are incomplete. Dave subscribes to a fairly rigorous interpretation of the curriculum guide. He believes his primary focus should be on science theory. However, he also values applied science. For example, Dave contends that curriculum policy should be revised not just to reflect popularized science issues; but also to reflect changes in scientific knowledge.
Dave considers external influences such as curriculum change to be a constraint on his teaching. This is mostly because it is disruptive to a well-established teaching routine. The lack of equipment support also has a negative impact on his teaching, in that Dave may not be able to carry out certain labs if he does not have the necessary supplies and equipment.

In his perception of students, Dave does not seem to focus on any one element. He values higher education, and so he provides the educational opportunities which will enable students to achieve this goal. He is, in this case, focussing on students' needs. Elsewhere during the interview, Dave describes how students' abilities influence the nature of the curriculum materials that he chooses. He indicates that the students are the ones who make the course fun or just a "pain in the neck". Although Dave believes that students' interests are important, this element does not seem to be valued as highly as students' needs and abilities. Dave feels that the new senior Chemistry textbook does not include topics of interest that would provide a more rounded chemical education. However, he chooses not to supplement the course with extra materials that might provide this added interest.

The interviews showed that there is a variety of constraints on teachers. However, the over-riding factor
was the need for more time. Whether teachers were talking about curriculum implementation, preparation, marking, provincial exams, paperwork, or classroom administrivia, sufficient time to get the job done was a common theme. It seems that these factors have a tremendous influence on how a teacher functions. Therefore, constraints on teaching must also be considered as major influences on paradigm development. This seems to be in keeping with Shymansky and Kyle (1988). In their analysis, they found that inadequate funds, supplies, facilities, and time were the reasons for teachers teaching in certain ways.

The high school curriculum, especially the subject-area curriculum appears to impact on teachers' functional paradigms. Again, each innovation affects each teacher differently. The participants had a common perception of curriculum, although some said that revision should be on-going, whilst others said it should only occur as needed. In describing their own teaching style, and their ideas of what constitutes a "good" teacher, the participants again used similar phrases. The terminology used closely resembles the descriptors used to form a profile of an "outstanding science teacher" in a study conducted by Searles and Kudeki (1987).
The evidence from the data seems to support the contention that many of the elements making up an individual's functional paradigms are shared by other teachers within the segment of the population. However, the overlap between individual's functional paradigms is not clearly defined. There are certainly similarities among the participants, in terms of their stated beliefs about teaching, problems in teaching, exemplars or ways of doing things, and daily routines or patterns of behaviour. Yet, the constellation of elements making up one person's functional paradigms does not exactly mirror other teachers functional paradigms. It is as if one is viewing the night sky from two different locations on Earth. The myriads of stars may be the same. However, the ultimate patterns that they form in the night sky may appear differently. This concept is summarized in Figure 3 later on in the chapter.

5.3.2 Teachers' Functional Paradigms and Career Position

The purpose of this section is to determine if there is a relationship between teachers' functional paradigms, and their career positions.
Apprentice teachers

Betty believes that teaching involves presenting a comprehensive knowledge of science. She sees variations of the lecture method as the most effective approach. Betty adheres to the topics prescribed by the curriculum guide. Betty stresses lab work. In selecting curriculum materials for her courses, she looks for resources which can add to the textbook in terms of more detailed information. Betty focusses her attention on her perceived needs of the students. She adjusts her lessons to suit the abilities of the students.

Sam, on the other hand, values motivation. He does not see a need to follow the curriculum guide in totality. Rather, he supplements his courses with materials which he sees as being of interest to the students. He believes that a variety of teaching strategies must be used in order to be an effective teacher.

The differences observed here can perhaps be attributed to the fact that Betty has been involved in teaching as a substitute for a number of years. Whereas Sam is fresh out of university.
Post apprentice teachers

Leona values organizational efficiency. She supplements her courses with materials designed to facilitate learning...and to alleviate her marking load. Leona also believes that teaching involves presenting a comprehensive knowledge of science. The course materials that she selects are generally limited to the curriculum guide, although Leona would prefer more flexibility. Leona selects her course materials to reflect students' needs and abilities.

Pete values motivation. He teaches using a variety of teaching approaches. Pete is flexible in his interpretation of the curriculum. He selects learning materials which emphasize the link between science and society. Pete focuses his use of curriculum materials in terms of students' interests and abilities.

In this experience category, the teachers seem to be quite different. Evidence presented in an earlier section indicates that both are relatively progressive teachers. However, the two post-apprentice teachers do not seem to have a great deal in common with respect to their interpretation of curriculum. This disparity illustrates the important difference between the categories and sub-categories that describe teachers' functional
paradigms, and the elements of those categories. Clearly, the two post-apprentice teachers share some common categories; however, the ways in which they interpret curriculum through their teaching, and even the relative stability of their ideas about teaching differ.

**Experienced teachers**

Ron values pure science and motivational teaching. He stimulates students by doing interesting labs. He adheres strictly to the curriculum, and so he selects learning materials which reflect this position. Ron also believes that he has an obligation to provide activities which will ensure that students have a complete knowledge of the intended curriculum. Even though he has this seemingly restrictive philosophy, Ron considers the needs, abilities, and interests of students when selecting resources.

Dave values organizational efficiency in his teaching. He considers timing to be important. He has a fairly strict interpretation of the curriculum, and so selects materials for the students accordingly. Dave's teaching focuses firstly on science theory. Dave does not do many labs. He chooses activities which enable him to get across what it is students need to know. Students' needs
and abilities seem to be of primary concern when selecting activities or resources.

Although the findings are tentative, it seems that teachers do become less flexible as their career progresses. Beginning teachers have not yet had a chance to fully develop their teaching routines, and exemplars. Their functional paradigms are still relatively fluid. These teachers are more easily influenced by their peers, administration, curriculum changes, students, and the school setting. These "apprentice" teachers are also influenced by their own teaching practices. Their patterns of teaching evolve as they try different methods, and as they experience different situations.

Experienced teachers seem to be much more "set in their ways". They have established routines that have been molded over the years. These ways of teaching have been refined through experience.

One aspect of the teacher's career which was not a focus of this study, but which should be followed up, is the notion of "critical incidents" in the life history of teachers. Measor states that "there are critical incidents which are the key events in the individual's life, and around which pivotal decisions revolve. These events provoke the individual into selecting particular kinds of actions, they in turn lead them in particular directions,"
and they end up having implications for identity" (in Ball and Goodson, 1985, p.61). Perhaps career position plays a much more significant role in the development and maintenance of teachers' functional paradigms than was previously surmised. If this is the case, then many aspects of the individual's personal life come to bear. Diamond (1988, p.133) refers to the stages of teacher development through a career as preconjectural, dogmatic, decision-making, inventive, and emancipatory. Teachers do not necessarily progress through these stages at the same rate. For this reason, it is possible to locate teachers at different stages irrespective of their age or teaching experience. This is perhaps the reason why there are some inconsistencies between teachers at each experience level. Again, this is an area that needs to be looked at in more detail.

5.4 Teachers' Functional Paradigms and Curriculum Change

This section considers the relationship between teachers' functional paradigms and curriculum change. The following questions were considered in this study:

a) What are the perceptions of teachers with regard to curriculum change?

b) What is the relationship between teachers' functional paradigms and their perceptions of curriculum change?
c) To what extent do teachers' functional paradigms become idiosyncratic when they are faced with a curriculum change?

The final three research questions are considered together. The participant's notions of curriculum ranged from the textbook as curriculum, to an outline or set of guidelines. There were conflicting opinions on when curriculum should be revised. Some thought that courses should be revised only as needed, whereas others felt that revision should be on-going. Similarly, the reasons for a curriculum change evoked a number of different responses. For example, some believed change is necessary when textbooks become outdated due to advances in science. One believed that the foregoing would be the least likely reason for change. Others thought that the curriculum should be revised only when sufficient material or comments had been received by a central curriculum committee. These curriculum committees should be regionally representative, broadly based, and composed of "reputable" teachers. Most participants consider curriculum to be provincially mandated, but there should be more flexibility at the local level i.e. less core, more options; reduced emphasis on content. A common thread within the group of teachers who had taught for more than one year was that curriculum changes have really amounted to nothing anyway, with very little change in content. The participants had similar descriptions of the new junior science course i.e. lacking
information...labs are uninteresting, without substance, disorganized, or misplaced... Evidently, there are common meanings regarding the curriculum and its concomitant textbooks. Most did not distinguish clearly between the two.

Curriculum is viewed differently by each of the participants depending on their own functional paradigms. In terms of their perceptions of the subject matter, some perceive science as a distinct body of knowledge that must be inculcated. Their teaching focuses on topics which are restricted to the curriculum guide. They tend to add materials where they feel the prescribed textbook is weak in scientific information. Others view science in terms of its connections with everyday problems in society. These teachers include extra materials which emphasize the practicality of science, and its relationship with technology and society.

With regard to the teachers' perceptions of teaching, some individuals in this study value motivation. They design their teaching so that it includes materials, demos, and labs which excite the students about science. These teachers also tend to base their teaching on students' interests. However, there is some overlap in this sub-category. Other teachers believe in a more academic pursuit of knowledge. Their teaching reflects this, in that
they utilize additional materials which enhance scientific knowledge. There is a great deal of consistency between individual's perceptions of the subject matter, and their perceptions of teaching. This consistency is less marked with respect to the other two categories within teachers' functional paradigms.

Teachers' perceptions of students influenced their decisions with regard to their teaching approach. Some selected materials in order to reflect the perceived needs of the students. Others adjusted their teaching according to the abilities or interests of the students.

There were both external and internal environmental factors which influenced the teachers' perceptions of the setting in this study. The teachers altered their teaching to match these perceptions. For example, labs were curtailed due to the safety element involved with large class sizes. Some labs were not done because they were boring, misplaced in the curriculum, or lack of equipment. The nature of the timetable (semestered) coupled with expectations for a good showing on provincial exams may also have restricted lab work. In this regard, there was insufficient time to do labs and cover the course material.

The extent to which teachers' functional paradigms become idiosyncratic when faced with a curriculum change was difficult to address in the study. There is some
indication from the more experienced teachers that they would first try their own tried and true methods to implement the change prior to any change in their established routines. Concern was expressed over the lack of accountability in terms of fidelity to the curriculum. A comparable finding was reported by Crocker (1979). Similarly, feelings were expressed that curriculum tends to be generated top-down, and implemented without the benefits of time, money, or consultation with teachers. The more experienced teachers also intimated that most curriculum changes were essentially cosmetic, and the change amounted to nothing more than a reorganization of the subject matter. One of the emerging problems in this study was that only three of the teachers experienced the change-over from the old to the new junior science curriculum. Furthermore, it became apparent that for most participants, the contemplated change amounted to little more than a restructuring of the subject matter. Ron did briefly mention the effective schools movement which might be considered as requiring a more radical shift in methodology.

If teachers do resort to their own routines, exemplars, and methods as a way of solving problems when faced with a new curriculum, one must realize that those internalized patterns of operation are not wholly peculiar
to each teacher. It has been shown in this study, and elsewhere that there is a certain degree of commonality among teachers' functional paradigms both in terms of common categories and sub-categories, and in terms of the elements within each category. However, this seems to be very limited. It appears that there are different emphases for each category with each individual. Not all teachers even within the same segment share all of the same elements, and even if there is some commonality, they do not seem to share the same elements to the same degree. This concept is summarized in Figure 3 in the next section.

5.5 Summary of Research Findings

This study used recent changes in science curricula in British Columbia as a backdrop in which to consider the nature of teachers' functional paradigms. Six science teachers in a relatively closed setting were interviewed. The interviews were conducted using a predefined schedule of questions.

In the analysis of the data, categories similar to those used by Lantz and Kass (1987) were described. A number of sub-categories were also identified. Table V that follows lists these sub-categories.
TABLE V

Sub-categories of Teachers' Functional Paradigms

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<thead>
<tr>
<th>Sub-category</th>
<th>Elements</th>
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<td>1. Teachers' perceptions of teaching:</td>
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<td>o perceptions of effective teaching.</td>
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<td>o perceptions of teaching problems and routines.</td>
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<td>o perceptions of teaching methodology and style.</td>
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<td>o perceptions of teacher development.</td>
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<td>2. Teachers' perceptions of the subject matter:</td>
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<td>o perceptions of curriculum materials.</td>
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<td>o perceptions of curriculum policy.</td>
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<td>o perceptions of curriculum policy revision.</td>
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<td>3. Teachers' perceptions of the school setting:</td>
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<td>o perceptions of the external school environment.</td>
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<td>4. Teachers' perceptions of the students:</td>
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<td>o perceptions of students' needs.</td>
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<td>o perceptions of students' abilities.</td>
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<td>o perceptions of students' interests.</td>
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Within each of the sub-categories, elements in the functional paradigms of the science teachers emerged. These elements varied between teachers. There were some shared elements. However, the teachers in this study did not all share the same elements. They interpret and use curriculum materials in different ways. Some believe the curriculum to be merely a set of suggested guidelines. They supplement their courses with other topics that stress applied
science, inquiry science, and technological science. Other teachers in the study maintain a strong link between the prescribed curriculum and their own teaching practices. In their teaching, some teachers value motivation. They do a lot of labs, they try to incorporate critical thinking, problem solving, and other varied approaches into their teaching. They focus their teaching on students' interests. Others prefer efficiency and organization. They are concerned with how the course is organized. They adjust their teaching according to students' abilities, and they are more conscious of the expectations of others. However, the previous descriptions do not separate the teachers in the study into identifiable groups. In fact, it appears that certain elements of one category may be similar with two teachers. But, the elements within another category may not be the same for those same two teachers.

As was discussed in section 5.2, the findings suggest that the model illustrated in Figure 1 proposed by Lantz and Kass (1987) needs to be broadened to account for the two-way relationship that seems to exist between the various categories and teachers' functional paradigms. This concept is more easily explained in a diagram. Figure 2, which follows, illustrates this notion of the dialectical relationship that exists between the categories, and teachers' functional paradigms.
FIGURE 2

An illustration showing the major factors which influence the formation, development, and maintenance of teachers' functional paradigms.
It is apparent from the findings described in section 5.2, that there are a number of factors which influence teachers' functional paradigms. It seems that current classroom practices, which involve the selection of topics, learning materials, teaching methods and approaches, are largely influenced by teachers' perceptions of high school science, teaching, students, and the school setting. However, it also appears that conversely, current classroom practices have an impact on teachers' functional paradigms. Similarly, there is probably a dynamic relationship between other categories, such as curriculum materials, current teaching situation, and teachers' functional paradigms. For example, teachers' beliefs about teaching and the subject matter will influence their interpretation of curriculum materials. The study identified both traditionalist teachers and progressive teachers. These two orientations develop because of differing constellations of beliefs, values, routines and exemplars. They view curriculum differently, and they treat curriculum materials differently. Another factor, that is influenced by, and influences teachers' functional paradigms is the current teaching situation. For example, the data indicate that the nature of the teaching assignment, the type of courses to be taught (mainstream science or science with technological and societal connections; junior or senior science...), the work load (class size; marking and preparation; modified science...), and other factors such as
provincial exams, timetable (semester or nonsemester), prep. time, and availability of resources, all directly influence the teacher's selection of curriculum materials, topics, and teaching approach.

It has been shown in this study that there are many differences that exist among the participants. There are apparent differences in university training, family backgrounds, gender, age, teaching experience, age of entry into the profession, reasons for entering the profession, career ambitions, commitment to teaching, and teaching methodology (traditional/progressive). These differences have been described throughout the study. The various factors described influence teachers' functional paradigms to greater or lesser extents. Therefore, it seems that even though common categories can be identified within the functional paradigms of a segment of teachers, the degree of influence of each category, and sub-category varies between teachers. Figure 3, which follows, illustrates this concept. In the schematic, the different strands represent the various categories which as a group, represent the constellation of beliefs, values, problems, and exemplars which compose an individual's functional paradigms. The length of each strand signifies the notion that the various factors have differing impacts on the teacher.
An illustration depicting the relationship between various influencing factors and teachers' functional paradigms.

NOTE: Each strand represents the elements within a different category. The degree of influence is depicted by the length of the strand.
Many of the foregoing categories described in this study are consistent with the findings of Lortie (1975). However, there are similarities even within these groups. Each category is not necessarily universal to the entire group. One cannot typify each individual, but as a group, one can identify common categories. This seems to support the work of Lantz and Kass (1987). For example, there is a commonality of language and terms used to describe past teachers who have influenced the participants. Similarly, when the participants were asked to describe what they thought were commonalities within the organization, they used many of the same words. Bucher and Strauss (1976) say that "segments of an organization have a core of professional activity". It is this concept that seems to be defined by the data at hand. There is a core of common categories within this particular segment (the teachers in the science department at Mountainview Secondary School).

Accepting that there are teachers’ functional paradigms at the personal level, then one can visualize certain degrees of commonality at the various segmental levels (Olson’s sub-culture levels), and perhaps some commonality at the organizational level (Olson’s culture level) of the profession. Figure 4, which follows, illustrates this concept.
FIGURE 4

An illustration showing the possible emergence of a commonality of teachers' functional paradigms within the hierarchy of groupings within the profession.

NOTE: 'TFP' refers to a teacher's functional paradigms. 'C' refers to the commonality among teachers' functional paradigms at the segmental and organizational levels.
The degree of commonality at each stratum is determined by the intersection of teachers' functional paradigms. This is also depicted in Figure 4. The model outlined in the previous figure, uses the Lantz and Kass' model as a basis upon which to extend the idea. It is important to understand that this commonality includes the categories and sub-categories outlined in this study. This can also be extended to include the elements of these categories within teachers' functional paradigms. In other words, the way that individuals teach, select, interpret, utilize curriculum materials, and respond to teaching constraints. However, the extension of these elements to the organizational level should be considered to be tenuous.

5.6 Implications of the Study

This research has possibly shed some light on the gap between the mandated and translated curriculum by explicating the nature of teachers' functional paradigms. The findings of this study may provide practical knowledge for those interested in some form of organizational change whose impact is at the classroom level. One possible outcome may be to suggest to curriculum developers some alternate approaches to designing new curricula for the worker in the classroom.
The study may also provide an insight into why teachers and classrooms function as they do. For example, is a teacher most likely to teach using an eclectic model of teaching which has its roots predominantly in the teacher's own experiences as a student? Another possible outcome may be to propose significant changes to the teacher training programs that currently exist in British Columbia.

The study suggests that there is a relationship between teachers' functional paradigms and career position. This is of value to curriculum developers. They must consider the career stage of teachers when contemplating an innovative change in curriculum.

5.7 Suggestions for Further Research

A similar study should be conducted to determine the nature of the functional paradigms of those involved in major curriculum development activities. From my own experiences on curriculum committees and other Ministry of Education initiated projects, it becomes apparent that the individual teachers who apply for and are selected for these activities also share a common set of characteristics. The degree to which this group of teachers' shared functional paradigms coincide with those of practicing classroom teachers (who are not involved in
curriculum development) may account for some of the recent difficulties that have been experienced in curriculum implementation.

The nature of the functional paradigms of teachers at teacher training institutes should also be investigated. Similarly, the influence of school, students, and colleagues on teachers' functional paradigms needs investigation.

This study has focussed on the espoused theories of science teachers. Another study should be carried out to determine the teacher's theories-in-use. In their summary of research in science education, Shymansky and Kyle (1988) warn that without such parallel studies of what is taking place in classrooms, "serious misconceptions about the state of science teaching"...may result (p.259).

A study could be conducted to compare the degree of similarity between teachers' descriptions of their previous teachers, and their own teaching. Another study could be conducted to find the relationship between teachers' understanding of what constitutes a "good" teacher, and their own teaching.

This study did not examine pre-apprentice teachers (still in teacher training institutes), nor did it investigate the pre-retirement or retired sub-groups. Such a study should be conducted. Comparative studies should
also be conducted in other schools, and in other disciplines.

There is a need for further work to determine the relationship between teachers' functional paradigms, career position, and critical incidents within teachers' life histories.

5.8 Concluding Remarks

This study has focussed on the nature of teachers' functional paradigms.

The results seem to indicate firstly that there are common categories and sub-categories that can be used to describe teachers. These common categories have enabled the researcher to analyze the data to determine what factors influence the development of teachers' functional paradigms. There appears to be a number of main categories contributing to the formation, development, and maintenance of teachers' functional paradigms. Within each category, there are a number of lesser elements. These factors seem to coincide with those of Lantz and Kass (1987). They include:

1. past educational experiences (previous teachers..).
2. background in general (family history,...)
3. practicum experiences.
4. past and present teaching experiences.
5. curriculum materials.
6. constraints on teaching.
7. school, students, and other workers in the school.
There seems to be a "core" of common categories among teachers. The intersection of the elements within these factors composes the functional paradigms of teachers in general. Although the paradigms are functional in an active sense, they are relatively stable within the "culture", and over the long term. It is this stability that must be considered if innovators in education ever contemplate a change which would require a shift in teachers' functional paradigms. This commonality of beliefs, routines, problems, and exemplars is probably greater among teachers within the same small segment of the organization than within the entire profession (Figure 4).

Evidently, teachers select, interpret, and utilize learning materials in different ways dependent on the nature of their personal functional paradigms. A number of differing elements in teachers' functional paradigms have been identified. These elements determine how teachers teach in terms of their use of curriculum materials. Curriculum change agents must consider the functional paradigms of individuals and determine how common these paradigms are before attempting a major pedagogical change. This study has shown that if these factors are not considered, then the curriculum change that is contemplated will be reduced to a mere change in content. The teachers will utilize the curriculum materials according to their
own functional paradigms. The inertia against curriculum change is most difficult to overcome with more experienced teachers, and more easily overcome with beginning teachers. This suggests that the focus of curriculum implementation needs to be aimed at certain segments of the profession. Somehow the change agents must assist educators to change their functional paradigms to meet the desired ends of the new curriculum prior to implementation. The alternative is the disparity that seems to exist between the curriculum that is intended by the policy makers, the curriculum that is implemented by the teachers, and the curriculum that is ultimately attained by the students.
REFERENCES


APPENDIX A

SAMPLE SCHEDULE OF INTERVIEW QUESTIONS USED IN MAIN STUDY

INTERVIEW SCHEDULE

Preamble

Science teachers in British Columbia have experienced a number of curriculum changes over the last few years. These include revisions to the Senior Biology and Chemistry courses, Junior Science and the addition of a new course called Science and Technology 11. Some researchers suggest that in order to effect a curriculum change, there must be some compatibility between teachers' belief systems and the nature of the curriculum innovation.

One aspect of this study will be to investigate how teachers deal with new curricula, and in particular, why teachers deal with new curricula in certain ways -- What are the influences which may have shaped an individual's belief systems such that they govern how a curriculum change is implemented? Of particular interest, is the degree of commonality that may exist among teachers in terms of their belief systems, routines, patterns and problems in the context of a curriculum innovation. In
other words, what interpretations and meanings do individual teachers attach to a new situation -- in this case, a curriculum change? And to what extent are these thoughts, judgements and decisions common to a group of teachers?

The purpose of this study is to determine the nature of teachers' functional paradigms in terms of how they interpret curriculum change. More specifically, the following questions shall be examined:

1. What are some of the factors which influence the formulation of teachers' functional paradigms?

2. What is the nature of teachers' functional paradigms?

3. a) What are the perceptions of teachers with regard to curriculum change?

   b) What is the relationship between teachers' functional paradigms and their perceptions of curriculum change?

   c) To what extent do teachers' functional paradigms become idiosyncratic when they are faced with a curriculum change?

A subsidiary purpose is to examine teachers' backgrounds and determine what aspects of their backgrounds might influence the formation of their functional paradigms. In particular, I am interested in investigating the nature of teachers' past experiences in terms of how they might shape their functional paradigms in the context of a curriculum innovation.
QUESTIONS TO BE USED AS A GUIDELINE FOR THE INTERVIEWER.

TEACHER CODE: _______________ DATE: __________

PART A  BACKGROUND AND EXPERIENCE

1. What were the influences on you that made you become a teacher? Why did you become a teacher?

2. a) How long have you taught (in general, science)?
   
b) Have you taught other subjects beside science? Explain.

3. a) Describe your academic background.
   
b) Have you taken any courses in Science Education? When? Comment.
   
c) Do you have any other training or experience that has helped prepare you to teach science? Explain.
   
d) How would you describe your science related background? ("Practical" or "Theoretical"?) Explain.
   
e) How would you describe the science courses that you recall taking in university? ("Traditional" or "Nontraditional" science-type courses?) Explain.
   
f) What influence, if any, did your academic university training have on your teaching practices? Explain.
   
g) What influence, if any, did your Science Education/Education training have on your teaching practices? Explain.

4. a) Please describe the university professor(s) that you thought was the best (most admired?).
   
b) Why was he/she so great?
   
c) Did you enjoy his/her classes? Why?
   
d) How would you describe his/her teaching approach?
e) Can you describe the classroom setting in this case?

5. Which year at university do you think about the most? Why?

6. a) Describe the general kinds of in-service that you have participated in with respect to science teaching.

b) How has the in-service influenced your teaching? Comment.

7. What were your favourite courses during your high school years? Why?

8. a) When you think of all the teachers that you had during your early school years (elem./sec.) who do you think of? Why?

b) Why was he/she so great?

c) Did you enjoy his/her classes? Why?

d) How would you describe his/her teaching approach?

e) How would you describe the classroom setting in this case? (traditional, open, shared, groupings, lab oriented, ...).

PART B TEACHER VIEWS AND OPINIONS

1. How did you know "how" to teach?

2. Why do you teach science the way that you do?
3. In your opinion, to what extent do you think the beliefs, goals, problems, teaching practices and routines of teachers are common to all teachers? (or are they idiosyncratic?)

4. What was the major influence on your teaching style?

5. What should curriculum developers consider when they are developing new curricula?

6. What factors influence your teaching style in terms of the school environment, students, and staff?

7. How do you view your teaching as a career in the context of your outside school life?

8. What did you want to be when you grew up?

9. Some people have said that teaching is a "calling". Others have said that you have to be born with the ability to teach. Please comment on these notions.

PART C CURRICULUM PERCEPTIONS, EMPHASES AND MEANINGS

1. Under what circumstances should a curriculum be revised? Comment.

2. Has the new curriculum influenced your teaching in any way?

3. Can you comment on the transition between the junior science and senior science program?

4. How useful is a curriculum guide to your teaching?

5. Who should decide curriculum policy? (provincial, district, school, department, individual)
6. a) Do you feel any pressure to "cover" the course? Explain.
   
b) Do you feel any pressure to spend more time on any one topic? Explain.
   
c) Which topics do you prefer to teach? Why?
   
7. What influence, if any, have the provincial exams had on your classroom teaching? Explain.

PART D  TEACHING PRACTICES, METHODS, AND STYLE

1. What aspects of Junior Science (at each grade level) do you emphasize the most during your teaching. Why?

2. How would you characterize the kind of classroom situation in which you teach? Comment.

3. Could you describe a typical science lesson, or the type of lesson that you use most often (grouping, materials, teaching approach, questioning techniques...)

4. a) To what extent do you have students manipulate lab apparatus?
   
b) Do you perform teacher demonstrations of labs?
   
c) Do you have any preference for one form of teaching strategy over another?
   
d) What problems, if any, do you have in organising your classroom for a lab?

5. a) Do your students enjoy doing labs? Do you?
   
b) Do you prefer to lecture, give notes on the board, give notes on the overhead projector, hand out notes, or do you use a combination of the preceding? Comment.
c) Do your students enjoy doing projects, debates, oral reports...?

d) Do you ever have students role-play, do simulations, play games, do case studies, build models, make posters or mobiles...?

e) Do your students ever go on field trips?

f) Do you ever have guest speakers or resource people come into your classroom?

g) Do you have any plants/animals in your classroom?

6. How would you characterise your teaching style?
(traditional/ nontraditional)

7. Have your teaching methods/style changed since the new junior science course was implemented? [not for beginning teachers]

8. If you were given all the resources, space, facilities, equipment and time necessary to implement a new junior science course, how would you teach the course? (types of activities, classroom organization...)

9. Do you prefer students to work individually, or in groups? Why?

10. Do you use computers with your science students? Do you use a computer for your personal/school work?
1. In general, do you believe that students are interested in science or disinterested? Why?

2. Should all students take science, or do you think that science should really be for those students who are capable of learning science?

3. How do you adjust your teaching of science for slow learners? Comment.

4. a) Do you see any similarities or differences between the new Junior/Senior (Chemistry, Biology) Science curriculum and the previous curriculum? Explain.

   b) Is there any particular emphasis with the new curriculum that you perceive to be the same or different from the previous curriculum? Explain.

5. If __X__ had been different, what would your feelings be towards the new curriculum/teaching in general?

6. In your opinion, what are the qualities of a good teacher?

7. Do you find that there are certain school-based influences on how you teach? Explain.

Thank you. Closing comments.
APPENDIX B

SAMPLE TRANSCRIPT OF PILOT STUDY INTERVIEWS

INTERVIEW #1

INTERVIEW #1 -- SUBJECT IS SCIENCE DEPARTMENT HEAD AT A
GRADE 8 TO 10 JUNIOR SECONDARY IN A SMALL NORTHERN BRITISH
COLUMBIA CITY (pop. 12000). (unedited for grammar or style)

SC: Some of the first questions I am going to look at are
(to do with) academic background and experience. They
will be very general questions as opposed to specific
yes and no kinds of questions. Number one, what were
the influences on you that made you chose teaching
itself? In other words, why did you become a teacher?

1: Well, my family, a lot of them were in teaching. I
feel that it's a really worthwhile job, an important
job.

SC: Your family, parental or your . . .?

1: My mother, my sister, my wife, and her family.

SC: Do you have teachers in the family?

1: Yes, they were all teachers. Not all, no, but they
were. I think it's just a really worthwhile job and
my wife also thought so.

SC: Has anyone in particular influenced you in becoming a
teacher, either directly or indirectly?

1: No, I don't think so. No.

SC: So when you were going through school, I guess
university mainly, had you in mind that you wanted to
become a teacher at that time?

1: No.

SC: At what point did you?

1: After a year of grad studies.

SC: Chemistry?
1: Chemistry, yes.

SC: You chose teaching as an option for a job or a career goal from that point?

1: Well, not as a job, I mean I guess as a job, but not really because I just couldn’t see being a chemist, I suppose.

SC: In terms of your academic background at university, how would you describe that background?

1: It was chemistry.

SC: Would you describe it as a very practical sort of training or more theoretical, or . . .?

1: I found getting into education was really a . . ., I thought it really was exciting. I think a lot of people find the fifth year program, which was what I took, as being not very good. But I really liked it because I’ve been in . . ., I took honours chemistry and then grad studies, and I felt that I was ready for a change, and it was really almost stifling.

SC: The academic portion?

1: Yes.

SC: And then when you got into the fifth year it was a bit more . . .

1: Yes, I felt I could see myself doing science instead of . . ., but like I really felt quite remote from science.

SC: You were at UBC for your fifth year?

1: Yes.

SC: Was there any particular aspect of your teacher training or academic training that stands out in the way that you teach? Has it had an influence on your teaching?

1: Probably. I think that JY (UBC prof) did.

SC: Yes, I know J.

1: He was my seminar advisor and also I’ve known him for a long time now. He’s a good friend.
SC: I did my practice teaching with FY (JY's son), and he was on the biology committee with me, and RW (UBC prof) too, people like that, . . . good influences.

1: I mean I remember of others too that I thought were . . .

SC: Apart from JY . . . What was it about JY perhaps that you feel was . . .

1: I liked his enthusiasm.

SC: His teaching style, how would you classify that?

1: Well, I think he's influenced me a lot as far as teaching style too. I like his depth of knowledge more than anything.

SC: What are you doing right now in your teaching?

1: We're doing respiration of grade 9.

SC: I just finished that. They like that, the human body stuff.

1: I like it too.

SC: Do you run a modified program?

1: Yes, I have grade 8 modified. I taught 9's last year, modified.

SC: You've been out here for quite a while?

1: Well, I have and I haven't. My wife and I just moved back not last September, not August, but a year before. We went to .......... for a few years. I guess I started teaching here in '72 so . . .

SC: Is this your first assignment here?

1: Yes. Well, since coming back.

SC: How do you like ........... (place)?
1: Well, I do. I think there are many very nice things about it. I think as a place to teach I prefer here. I much prefer here. I think it's a very beautiful place.

SC: For the experiences?

1: Good experiences. But I didn't enjoy teaching the same as here.

SC: It's funny, in this area quite a few teachers have been and gone from that area.

1: I found it too closed and too . . ., if you fit in there it's a great place. I never felt really that I fit, and I do here more. I think there are more people interested in these sorts of things.

SC: It's a bit like the (place) in terms of insular sort of approach. Maybe we can move onto your views and opinions about teachers. Here's a really general sort of question. How did you know how to teach?

1: I don't know if I do yet. I think a lot of the times it's just something that comes naturally, but I'm not sure that it does. But I'm not sure that there's any one style that works either. I feel that I'm able to relate well to some kids and not so well to other kids. I'm really not sure what makes a difference.

SC: Do you find that the teachers at this school are very similar in their teaching approaches?

1: I don't know. I really have very little experience over here because I'm concerned about my day to day stuff, and I don't get a chance to see . . .

SC: Do you find the time constraints are kind of a difficulty in keeping going in teaching science?

1: Oh yes. I think everybody does.

SC: Yes, I think it's much the same. How about funding? If you had more funding here would that elevate the problems?
1: Well, I think when you talk about funding our yearly budgets are fine. It's more in the facilities, like you notice how our science rooms are. Those are major expenditures.

SC: Being split apart that's one problem, plus actually maintaining the labs. I think that could be a real difficulty.

1: I think that money could be spent to make things more convenient is what I'm trying to say. But as far as the . . . do we have not beakers and stuff like that . . .

SC: You feel that's sufficient?

1: Yes.

SC: You don't have a science technician or a science aide, do you?

1: No.

SC: You mentioned something just briefly a minute ago related to that. Some people say that teaching is perhaps a calling, and others have said that you are born with the ability to teach. How do you feel about those sort of comments? Do you have any idea if it's a calling or were you born to be able to teach whereas some people just . . .?

1: Well, I think it's certainly . . . You know you have to have a lot of commitment to it. I think you have to have a belief in kids and a desire to help kids. I don't know if you're born with an ability to teach, I'm not sure. I think you can learn to teach. I think if you're interested you can probably teach, if you're interested and willing to put in the work. If you're not, then probably you can't. I think we all make mistakes in our way of teaching and I don't think that probably everybody has their share of things that are their strengths and their weaknesses. I think that's probably less important than the commitment.

SC: You mentioned JY as being an influence on, or someone that you recall. How would you describe your teaching style for teaching science?
1: Well, I think in some ways it's like some of the things he does. I don't know if I'm as good at it as him. In some ways I feel, I think maybe less certain about a lot of my views than I think he is. In some ways I find that hard to deal with. I think if you're pretty convinced about things you can ignore those and get on with other things.

SC: Do you find the "whiz-bang" approach to teaching, it's hard to maintain day after day after day?

1: Yes. I don't know if I'd quite say I'm "wiz-bang" but I like doing things that I think are interesting. It is hard to maintain, so I don't everyday.

SC: Yes, right. It comes back to that task.

1: But I certainly think that you have to have an enthusiasm for what you're doing. I hope I've got that.

SC: When curriculum developers are developing curriculum, what should they take into account then, when they're thinking of yourself in the classroom?

1: I don't know. You see, I had something to do with the grade 9 stuff, so I don't know. I mean I know what I did. I tried to think of things that I thought were really interesting, that made sense, and that fit together, that had some continuity to it.

SC: Maybe we'll look at the Science 9. What aspects of that, was that the chemistry unit that you developed?

1: Yes, chapter one. The stars . . .

SC: Yes, the stars and the . . . When you developed that, was it from your own experiences that you developed it?

1: Yes it was. In some ways I think that's really good, in some ways I'm not so sure. There are lots of things that I like about that series, and I think given the... I don't know too much about the politics behind it and I'm sure there's some politics behind it all. I know very little about that. The people I worked with at Wiley and the other people who were writing on it, I thought were doing the best they could given the constraints.
SC: They were constrained by their time and the funding available for the text, and so on.

1: I felt that I was writing very much in a vacuum often. A lot would go out to reviewers, but then we never sat down often as a group, never as a group of people, like say two or three chemistry teachers writing a section, or something like that. It was sort of my ideas and whether that suits everybody, I'm not sure. Yet, there wasn't the money put aside, and we were writing with no certainty of royalties at all. There's a lot of time and effort that goes in and we've got no guarantee of any monetary return. To me, it would have been a much better idea to say, you know if we want a really good program for B.C. to hire some people for a year.

SC: This was done during . . . You wrote it during your teaching time as well?

1: Yes, although I did take a year off partly through, because I felt I needed a break and to finish it up. It was done very much on a part-time basis and I was the only one, as a matter of fact, that took a year off. I mean here we are talking about a program that must have cost several million dollars.

SC: A big investment.

1: Yes, and yet the people who were doing it were doing it in their spare time, and I find that you know . . . The same with curriculum committees. I'm sure you've been on one. They're the same. Here you're making million buck decisions.

SC: Yes. How much of an influence do you think the Curriculum Guide has on what happens in the classroom?
Well, you see, if you look at the Curriculum Guide, I mean I didn’t, but a lot of people did. They think the thing is incredibly poor as far as what it says. It says we think there should be some discussion of this topic, but it doesn’t say how or what. It directs the thing, I guess, in a very overall way. But if the textbook is written to match the Curriculum Guide, which is how it’s supposed to be, then I think that the textbook really has defined the . . . it’s pinned it down. The Curriculum Guide might say, okay this is what it’s supposed to be, but the textbook has pinned it down.

SC: So that the curriculum just becomes a policy item. The textbook really drives the course.

1: Yes.

SC: It’s interesting when they remove the Publications Branch where the wards will actually stay with the textbooks that we’ve got are eventually . . .

1: Throw them out maybe?

SC: I think so, yes. I think they’re going to go that far and prioritize it. I don’t know how much control we’ll have over it though.

1: The districts have millions of dollars invested in this.

SC: Yes, I’m trying to get backup copies if they’ve already committed to a program and all of a sudden it dries up, the supply dries up.

1: I can see real . . . For all the thoughts, I mean like Science Probe series isn’t perfect there’s some parts I like. I happen to really like the grade 9 book. I think it’s easily the best.

SC: Well, this is the first time I’m teaching just this. I’ve done the chemistry and I’ve just started the space science. I thought maybe we’d get some clear nights.

1: It would be really interesting to know what you think after.
SC: Yes. Well, the chemistry was fine. I liked that. The reason I liked it was because there were a lot of questions and I think that was lacking in the grade 8.

1: I find that a bit in grade 8 too. I think this year given the problems, that the people did a pretty good job.

SC: I'm writing the correspondence course for that Bi 12. It's a vacuum too and time pressures and the money's not there, I mean if they want a good job. They're going to be using it for small schools too, so it's not just correspondence. It's a shame, you know, you have visions at the start. I imagine you probably had a vision of what great job you can do and I don't know if it's frustrating.

1: Well, I'm really glad I worked on it. I'm sure you feel the same way about what you're doing. As a teacher it's a really beneficial thing. I'm really concerned about the direction it's going. The role of education really bothers me quite a lot because I think that we could be in real danger. One person's using one text and the next is...Pretty soon everybody, nobody knows what course they're talking about. In some ways I don't really think it matters as long as we give kids a feeling of enthusiasm for what they're doing and everything. It does matter in a point. You know, if we say that the curriculum's not important then I think we're doing ourselves a disservice.

SC: Just back on the enthusiasm. Do you recall from your high school years any particular teachers that stand out?

1: Yes I do, a number of them actually. It's funny that one of the teachers that I remember quite well, and one of my friends who... There's a pretty similar training to me, in fact very similar. we thought this guy was really boring and I really liked the guy. I don't know whether he was boring or not boring, but I think as a person he was a good person.

SC: Was he a science teacher?

1: Yes.

SC: And his teaching style, how would you categorize that?
1: It's funny, I don't remember very much from my high school days as far as the fact class stuff, I mean that's one of the good things actually, when I think about it. Maybe we could do less.

SC: Maybe we don't need fact that much.

1: Probably not. But I think we do in a sense. With the day to day stuff I think kids forget. Certainly we do.

SC: Your teaching style, I can see you use the chalkboard. Do you use other tools? Do you use the media, you've got the t.v. there, the overhead projector?

1: Yes.

SC: How about access to computers in this school?

1: I've used them a couple times this year. I gain to feel that we've got to be very careful with the use of those things. I don't know if you've seen science tool kit just as a...Have you seen that? I'm really excited about that.

SC: We just bought it. It's amazing. That's where a lot of the science software will be going so you can't copy the programs without having all the profiles.

1: What I like about it is that to me it's a...I don't know about other aspects of the program, but what I like about it is that to me that's really a science use of computers. I'm not really excited about... I think it's really neat to use them as a word processor, but I'm not going to bother teaching kids in science I've got enough else to do. Same with a number of other uses of computers like data bases and all those things. I think scientists use those but to me, you know, if I've got to be a computer teacher too then the heck with it. As far as using computers like the Science Tool Kit thing, I'm really excited about making use of that for some kinds of things because I think that as really using it as a science instrument rather than just a glorified typewriter or . . .

SC: Yes, maybe a bit more than . . . Some of the programs are pretty wrote . . . You see some instructions and you feed back some answers from the information, that sort of thing.
1: Yes.

SC: How about the junior science group? What sort of similarities or differences do you see between the newer curriculum and the previous curriculum?

1: I see a lot. When I started in '72 . . . I've taught long enough now to begin to see how it gets developed. The original stuff when I started, I don't know how long you've been teaching, but developing science concepts . . .

SC: Yes, 1978 to 88, starting when the worksheets got published.

1: Those were a response to the B.C. Science Teacher's Association, a desire to have more labs in the courses. When I started teaching, I remember feeling that there were far too many labs. I mean, I made a mistake in teaching far too many labs, having far too many labs and far too little reading and stuff. The reading books that went along with the course were really not matched to the course, they weren't that great. Then they always had this other book you had to refer to. I think there were a lot of difficulties with that.

SC: Are there any similarities then . . .?

1: I think there are a lot. I think they cover a lot of the same stuff. In some ways not as much, in some way more, and in some ways many different topics that weren't in the . . . The original ones were more sort of straightforward, physics, chemistry, biology, geology, astronomy. They didn't have ecology and they didn't have other things.

SC: Do you see the approach as being . . . How would you categorize it?

1: I like the present ones as a good blend of the experiments and the reading. I think there has to be some time between experiments.

SC: Lab, lab, lab.

1: Yes, kids can't keep up with it and if you want them to write about it, they can just get lost in it. I think too many kids do get lost.

SC: How is your marking work similar?
1: Now or . . .?

SC: Yes.

1: It's really DW, you've got to talk to him. He and I started the same year, actually we had the same two rooms except I was there and he was here. We were talking the other day about it. I said to him, do you remember when we started out. We had no spare, neither of us, none of the science teachers did. The year before the science department made this decision that they would have no spares. That way we'd get smaller classes, and smaller classes was 28 kids. I taught a physics section in junior high, DW taught the geology section, there was a guy who taught the biology section, and another guy taught the chemistry section. Then we switched kids a quarter of the year, kids, not rooms or anything. We ran through about 900 kids a year, each of us. It was really something.

SC: It's a large amount at the end. Things've changed.

1: Yes. So I think they're a lot better.

SC: You have spares now?

1: Yes, we have six spares in eight periods.

SC: What are your courses then?

1: I have two Science 8 modified, Science 8, Vocational Science, two Science 9, and Science 10. I think it's a fairly heavy load.

SC: Four or five preps.
Yes. I only have about six kids in my Vocational Science. It's been up to about twelve or more, but it can be quite a hassle. It has a teacher aide in there too because one of the kids really has some problems, but it's a whole separate course. So there's some way of writing something every night. There's no text.

SC: No. You modified? Do you just modify the regular curriculum? No expectations?

1: That's what I do. I change my expectations, I pick and choose the questions, I pick and choose what I expect them to do. I find it works all right. We're hoping to spend a bit of time as a department on the modified course this year. Myself, I'm not uncomfortable with that approach because I think we've got to be careful not to water it down too much, and yet make it the kids that have reading difficulties combined as well.

SC: When should a curriculum be revised?

1: Good question. It seems to me that there's sort of a realization somehow by consensus on this that there's a need. I don't know. I've been out of teaching junior science for quite a while because I was teaching elementary for a while, then I was teaching senior high and so I haven't... It's too bad. Doug might be somebody that's got more continuity to it. But I know when I taught the Extending Developing Science Concepts back in '72, '73, that it was beginning to be felt that there was a need, for the reasons that I was saying. Too many labs. It was sort of at the area of discovery science, with these bits and pieces in front and you're supposed to discover all these...

SC: Yes, like the light bulb.

1: Yes. I think that was realized. Some people still think it's great, but I think it was realized to be a bit of a mistake, to that degree anyway.

SC: Sometimes we have these blocked tangents. Do you see us coming back into the disciplinary approach to teaching science?
1: Well, you know, Science Probe was supposed to be and integrated approach. I'm not sure that it is. In fact, the grade 9 book isn't at all. I never had that impression, that I was writing an integrated book. I think as teachers, we should try and integrate things. I'm not against that in the least because I think that, you know, my background's chemistry and yet I feel that really any physical science is really comfortable. I know myself, I'm much more interested. It surprised me a little bit. You must find that the same.

SC: When you go in more . . .

1: Yes, when I really start thinking about it. Like I'm not a biologist and I'll never be a biologist. It's not that I'm not interested in biology, it's just that to me physical science is really what I can go on to, and yet I feel that I could go either way. With a chemistry background I find that I understand astronomy much better, physics much better. I think kids should be encouraged to see things that way to.

SC: How do you see the kids changing over the years in terms of the course's changed?

1: How are they different you mean?

SC: Yes. They're the same?

1: I think so.

SC: They adapt well to the new curriculum?

1: Yes.

SC: Have you seen the new chemistry course?

1: Yes, I have. Quite a lot of detail. I like it well. I have a couple of friends that were on the committee. I like what they've done. They said that they wanted 25% of the time on experiments. I really agree with that. I think that's very, very important. I think there's a real move to getting away from experiments and I'm totally against that.
SC: I find that. You don’t have the provincial exams, do you? But, I guess, with your colleagues in the other schools, you hear that is often the pressure covering the course.

1: I have a former student who was telling me last summer, this guy was a doctor but I found him here, he was telling me that it wasn’t until he got to grad studies that he again worked with chemicals. When I had him he’d done some neat things with chemicals, he really enjoyed that. I find that really upsetting. I know that was true in my experience. I find that while I gained a lot from UBC, and I don’t want to sound like I’m really critical, I think the lab program was pretty bad, except for one guy. My friend that I keep mentioning, he’s a teacher also, he and I both went through honours chem and we both went into organic chemistry because of one lab instructor. We felt we were getting a lot from this person.

SC: Do you know Dave at Mountainview Secondary?

1: No, no I don’t.

SC: He went through organic chem together at SFU, in the early ‘70’s, mid ‘70’s. Somewhere around there. How would you categorize teachers in terms if goals, problems, philosophies? Would you say there is some commonality?

1: I don’t know. I think there’s a lot of really thoughtful teachers and probably some that aren’t. I would hope that teachers are really concerned about kids and where they’re going. But I think they’re just as guilty of being misguided in our views as everybody else. I don’t think we have the answers, necessarily.

SC: Do you think there are certain routines or tricks that teachers use in being a teacher, whether you’re a science teacher or not?

1: Oh, probably. What kinds of things?

SC: Well, what is it about that teacher that makes them a teacher?

1: I suppose the way they organize their classes. I think it helps to be pretty organized, which I’m not to.
SC: In terms of your planning?

1: Yes, I think that helps a lot. I don't know. I was just wondering in this school. I don't know if there's a lot of common things.

SC: There's a fair turnover it seems, from year to year in this school.

1: I would've said that there is but I also feel that there's quite a lot of disagreement. I think it's almost like there are two counts or three counts of teachers and their expectations. I think as you get older, at least as I get older, I see more what I think are better direction. I'm more careful how I use my energy.

SC: Time management and what your priorities are. How does teaching fit in your life?

1: I think it takes up a big proportion. I mean, you say about common things amongst teachers and I'm sure they're are and yet I'm not sure. Some teachers, I feel, I can sit down and discuss with them and they'll share. I can say, you know what I mean and they do know what I mean. Where other people I'll say, do you know what I mean and they think not. That's what I mean when I say I don't really know whether I can pin it down and say well, there are common things amongst teachers.

SC: Have you been talking to PF? Has he called you about the Science Fair?

1: Yes, we got a notice about it.

SC: Are you going to send a group up, do you think?

1: Well, you see, we're sort of busy involved with our own one. I really am glad to see what he's doing except that I feel more than busy enough with the one here.
SC: We had to change our dates in order to fit his. In fact, we've got six weeks, basically, to get a project together to get ready for going out there. Spring break cuts right in. We have to be ready before spring break in order for the regionals. It's nice to see it happening up here.

1: Yes. This is the 23rd annual one here.

SC: Really? Great.

1: So I'd hate to see that go.

SC: Yes. Sometimes it's more important to have. Do you run it in all the schools, k through . . .?

1: Yes. I won't give it as a . . . I'm not sure that I want to give it as an assigned thing, so the number of entries I'm going to get . . . See, I run the Science Club at school and we're making some things. I hope that I'll get a few entries of kids on their own, that are interested in something. But I might only get four or five entries with that. But that's okay. But the elementary schools, they enter a lot of stuff.

SC: We've had it, '84 was our last one. We're just trying to get it going again. Kids aren't used to it. It's a new thing and they're being asked to do it. We're asking them to do it as a project for their third term. They have to think. We're requiring them that it not be a project but be an experiment of some kind. A bit more exciting.

1: It's hard to get something like that established.

SC: It takes a lot of energy from teachers too, time, and so on, just organizing it all. I think the Science Club is pretty valuable.

1: I do too. The other thing that worries me a little bit, I mean I really support what you're doing. You see kids in band and they're in basketball and they're in this and that. The ones that are going to do a really good job, they're in so many things already.

SC: Yes, that's true. It's a time commitment.
1: But we try. Our Science Fair, I think, is actually more consuming. We get a lot of the younger kids especially. It's good for them.

SC: Well, thank you very much.

1: It's nice talking with you.

SC: It's too bad we don't talk more often, the teachers in the region. I think we've probably got common problems anyway. This is the first time I've realized you're spread out in two wing like we are.

1: It's just a big school. It used to be senior high. This is the new part. The old part's down there. I think that second floor was put on after.

SC: Now I know why it's difficult for us to get the Board to move and the Ministry to move on it. We're probably not the only school, then, that's split between two wings. We've just got a science aide back this time since the first round of cuts. It's sure making a difference.

1: We're hoping to in our contract. I think the Science Safety Guide . . . , have you heard anything about that?

SC: No. I saw a draft version that ...... did a few years ago.

1: I've got an '83 copy.

SC: Yes, it's probably a similar one.

1: There's one that's a little more recent but I heard that . . . I was at that Chemistry Summer Institute. There, they were talking about having a Safety Guide come in. It was the end of '87, early '88. You haven't heard anything about that?

SC: No. I heard there was money coming in for the new courses and that it's gone. I don't know if you know MH or DW (curriculum coordinators), they're under similar pressures, time pressures and so on.

1: I would hate to be on the Ministry of Education right now. There's just so many things that are going on.
SC: They’re jumping, hopping. I mean, the Science Tech 11 course was put together in a very short time. I think it could have been a good course.

1: And it’s not?

SC: Well, at least from my experience in at Mountainview, we see the kids have to take a grade 11 Science. Which one do they take if they don’t really want to take science? They’ll take the Science Tech. So, it’s the type of kids who get in there. So the course is not really designed for those students. We need an ultimate Science Tech. for those students, a science course.

1: What about this new Family Life program?

SC: Oh, all kinds of changes. Family Life is impacting on our regular programs. I heard you talking and I think it’s the same thing here. In our group, it’s Science 10 for the grade 10’s, so they lose a block of time for the Family Life. English, I think the grade 12’s lose.

1: What we’ve tried to do is ease Science 10 into the biology part there, so it overlaps. We’ve tried to say well, we’ll teach the biology part and that will cover so many of those lessons in Family Life. I know I feel really strongly about that program. It really bothers me a lot because it’s sort of... It’s not that I’m against the content. But I don’t really think all the kids need to know all the things that are in that program. If kids want to know, we have people in the school who are able to help them or give them advice or do whatever’s necessary to help them.

SC: You find the politics of curriculum, that’s the influence there. It’s not a cry from teachers to have the course.
1: Well, that may have been for a long time and they've been ignored. Here is this AIDS business comes up. It's really interesting. I went to the public health nurse to get some pamphlets because I want my kids to do a project on related topics. So I picked up samples to show kids what was available there. In one of them it says, and this is almost a direct quote, it says that if you're in one of the low risk groups for getting AIDS that your chances of getting AIDS are virtually nil. You know, this is the justification. That's what the pamphlet says.

SC: The AIDS business is bothering me in teaching. I don't know if you saw the circular that came out . . .

1: About not using blood samples?

SC: Yes. Those are pretty exciting labs. I like doing them. Blood testing, urine analysis, scraping the mouth saliva. That's one of the . . .

1: I did that this year. I thought afterwards maybe I shouldn't have.

SC: I got the circular almost days after I'd just done it. I don't know if the risk is that great.

1: I can't see that it is. I really can't. I can maybe see the blood type because of the stuff you use.

SC: It's a direct . . . I guess the saliva technique...

1: The serum of the blood type.

END OF THE FIRST INTERVIEW -- CLOSING COMMENTS.
APPENDIX C

SAMPLE TRANSCRIPT OF INTERVIEWS FROM THE MAIN STUDY
INTERVIEW #7 -- PETE

INTERVIEW #7 -- SUBJECT IS A SCIENCE TEACHER AT A GRADE 8 TO 12 SECONDARY SCHOOL (Mountainview Secondary) IN A SMALL NORTHERN BRITISH COLUMBIA CITY (pop. 12000).

FOR THE PURPOSES OF CONFIDENTIALITY, THIS TEACHER IS REFERRED TO AS 'PETE' IN THE TEXT OF THIS STUDY.

SC: What were the influences on you that made you choose teaching? In other words, why did you become a teacher?

7: I suppose there was a number of reasons. First of all, it was the situation at the time, sort of demanded that I change what I had planned to do. I had planned to go into university teaching. Get my Ph.D. and get into a university and do research. However, NASA was shutting down about that time, their first big shutdown. They were laying off a lot of physics types and the job market was really crowded. So, I still intended to teach so I went into high school teaching instead.

SC: And when was that about?

7: Somewhere around '74, '75.

SC: Where did you take your university training?

7: Waterloo for my masters and my bachelors I got at UVIC.

SC: And your teacher training?

7: At UVIC.

SC: Is there anyone that you can recall that has influenced you as a teacher, either directly or indirectly?

7: Possibly one of my grade 11 teachers in chemistry.
SC: Can you describe that teacher?

7: He was a priest at a catholic high school I went to. He was an interesting guy. He did a lot with experimentation, so we did a lot of experiments in his class and you learned that way.

SC: Did you find that his teaching approach to teach science is a similar approach that you perhaps like to use?

7: I don't remember, but probably yes.

SC: That was one teacher, which other teachers stand out in your mind from high school perhaps?

7: I remember my physics teacher. He was terrible. He didn't know a thing about physics, not a thing. And so, for the last part of Physics 11, like we only did half the year of Physics 11 and I can't remember what we did then, but I know the last half of the year we spent developing a movie for the school.

SC: Wasn't really physics?

7: No.

SC: How would you describe your science related background? Is it practical or theoretical?

7: Mostly theoretical. Although I guess you consider it, in my masters, when I did my thesis, a lot of that was practical.

SC: How would you describe the science courses that you recall taking in university? Would you say they were traditional science type courses or non-traditional?

7: I would say mostly traditional.

SC: Can you explain in terms of . . .?

7: Well, lecture, lecture method with labs. There was only, there was one lab oriented course where you got to do, basically, what you wanted in terms of labs. That was a fourth year honours course in physics. But other than that, everything was very traditional.

SC: What influence, if any, did your academic training at university have on your teaching practices? Is there any influence . . .?
7: I don't think there's very much. Like I don't lecture very much and so I don't really follow their methods.

SC: Can you recall any particular university professor that you thought was a good professor as a teacher?

7: My first year physics teacher. Like I was going in for chemistry. I was very interested in chemistry.

SC: And yet the physics teacher explained . . .

7: But the physics teacher, well, I got bored with the chemistry. Chemistry was very boring as far as I was concerned. The physics teacher was very good.

SC: Why did you admire that person?

7: It was probably the way he introduced the concepts or something. I can't remember now, exactly. He was just interesting.

SC: How did he approach the course? How did he present the course?

7: It was basically a lecture approach.

SC: Did he use blackboard, did he talk, did he use . . .?

7: He talked a lot.

SC: And basically, you had to take notes from his discussions?

7: Yes, but it was a fairly small class so you got to interact quite a bit.

SC: So there was some interaction in terms of how he taught. How about in the labs, was there a lab that went with the course?

7: Yes, there was. He wasn't involved with the labs. The labs were separate, like most university courses are.

SC: Why is it then, that he was such an influence?

7: It was just his presentation. Possibly it was the subject matter itself. I find some of it really interesting.
SC: Which year at university do you think about most if you were to reflect back?

7: Most interesting?

SC: Yes.

7: I think when I did my masters degree was most interesting. There was one-on-one contact with the professor and with students that were doing graduate degrees and research type things. I think it was just excellent.

SC: What, this is kind of a little away from what we're talking about, what kind of in-service training do you see that you have taken, would influence your teaching, the professional development or any other sort of in-service that you've taken?

7: The only thing that really influenced me a lot in my teaching was going on a summer course in geology. It was sponsored by Shell Canada. It was a very hands-on thing. We got to deal a lot with, just looking at materials and going places and things like that. So once again, it was sort of a hands-on.

SC: Practical, more practical. Did you find that you were able to use some of that experience in the classroom when you got back?

7: You can to some degree. Like I try to keep a lot of rocks around. I try to get people interested in doing projects with rocks.

SC: Can you, just for the record, just tell us what your teaching world is right now, what sort of teaching experience you've got?

7: Okay. Well this year, I've got one Physics 12, I had three Physics 11, one Earth Science 11, one Science & Tech 11, and one Science 9.

SC: And you've taught for ten years?

7: This is my eleventh year.

SC: And Mountainview Secondary is the only place that you've taught?

7: Yes it is.
SC: Now, how is it that you knew how to teach? How did you know that you could teach?

7: Well, probably the first practicum I did. I think I knew then that I could get up in front of a class and show them something and maybe they could learn something.

SC: Why do you teach science the way that you do? In other words, you seem, from what your answers have been, you seem to like practical, hands-on, that sort of teaching approach rather than the direct lecture.

7: Well, if you teach with more hands-on things, I think you can get to see more of the students a lot more of the time. So if they’re having troubles and if they’re willing to, if they’re interested in the subject, then they’re willing to ask questions if they’re having problems in a particular area.

SC: Here’s a little question. It’s perhaps a difficult one but it’s related to what I’m trying to find out with all the teachers. In your opinion, to what extent do you think the beliefs, goals, problems, teaching practices, teaching routines, strategies, and so on, are common to all teachers, or are they kind of individual?

7: Well, I think all teachers use the same sorts, basically, of the different methods. They just use them in different amounts and possibly several different ways.

SC: So you would say, perhaps, an art teacher uses certain tricks of the trade that perhaps a science teacher might use? Do you see that as similar?

7: Yes, I think they’d be similar.

SC: Do you see any dissimilar things between teachers and so on?

7: Not really. I don’t think so.

SC: If I were to compare, I was just comparing subject areas, but if I were to compare levels of teaching, grades 1 to 12, do you see that there are similarities there and dissimilar things?
7: There's similarity of course. I mean, a course with younger children you can't keep them doing one thing for very long so you have to switch an awful lot of the time. But you know, you give them hands-on things to do, you talk to them, you get them to do things, you do things.

SC: How do you view your teaching as a career in the context of your outside school life? In other words, how much of teaching is a part of your outside life?

7: I consider my life as a whole, so what you do in one affects the other.

SC: Does teaching have a big influence on what you do after school?

7: In terms of marking and preparation, yes.

SC: What did you want to be when you grew up? When you were little what did you want to be?

7: Very small?

SC: Yes.

7: I don't even know. I can't remember.

SC: And as you were going through university, you said you were interested in pursuing a career in . . .

7: In research in university and teaching university.

SC: Do you have any family members that are teachers?

7: My aunt was.

SC: Have you had any influences from your family in terms of getting into teaching or any other career direction?

7: I don't think so.

SC: So it was left fairly well open to you?

7: Yes.

SC: Were they supportive of you being a teacher?

7: Oh yes. I don't think it would have mattered what I chose. They would have been supportive.
SC: Can you tell me a little bit more about your personal history? In other words, where you grew up, that sort of thing?

7: I grew up in Prince George. My father was born there and most of all the family was born there. Well, I stayed there up until I went to university, the University of Victoria.

SC: So you took elementary school, was that a private school as well?

7: Yes. Well, I went to public school for the first three years. I was raised, I grew up at the airport in Prince George first of all. They used to have families on the airport. My father was a lab technician, so we were up there for, well, I was up there in public school up until grade 3. Then I was bused to Prince George to a private school up until the end of high school. Well, except that we moved into Prince George when I was in grade 8.

SC: What courses in high school did you find as being most interesting, most exciting?

7: Well, I mentioned before the Chemistry 11 course. I remember an electricity course and math courses, I found interesting.

SC: And again can we go back onto the high school and elementary school teachers. Do you ever think of any particular high school or elementary school teacher that might stand out?

7: Just the one that I mentioned or the couple that I mentioned.

SC: Their classroom, how would you describe their classroom setting? Was it traditional, was it open-ended, how did they conduct the lesson?

7: The classes were very small at the private school, they were really small. So there was a lot of one-on-one interaction.

SC: Were they split classes? Did you have sort of . . .?

7: No, they were single grade level classes.
SC: How were the labs conducted? Were they with a discovery kind of learning or a more directed approach?

7: Well, chemistry labs, I can't really remember whether we were told beforehand what you were doing or whatever. I can't remember.

SC: Did you work out of a lab book?

7: Not that I remember, no.

SC: Now, in terms of curriculum. I'm going to ask you a couple of questions about curriculum. Do you see any similarities or differences between the new junior science curriculum and the old curriculum?

7: Well, there's similarities.

SC: Can you tell me what's similar?

7: I think that in terms of subject matter, it's very similar. A lot of the others, like Biology 10, for instance, I don't think there's very much difference in the subject matter itself.

SC: How about differences, do you see . . . ?

7: Of course the textbooks are slightly different. There's a little bit more emphasis on knowledge, in the textbook itself, whereas the old textbooks were completely discovery learning.

SC: Do you see any particular emphasis in the new curriculum that is the same as the old curriculum?

7: What do you mean by emphasis?

SC: Well, you mentioned discovery learning and I guess the other half of my question is do you see any differences between the old and the new in terms of what it is emphasizing in the new curriculum that is not emphasized in the old?
7: Well, I think the old just emphasized that or just tried to emphasize that. I think the new curriculum tries to emphasize more, it's more well-rounded, I guess you could call it, a little bit anyway. Like you do knowledge, attitudes, supposedly attitude's in there although whether or not is the question. I think the attitude has to come with an interesting subject matter. Somehow once you get to university subject matter . . .

SC: Do you think that's achievable with a curriculum?

7: With some of it, yes, with some of it, no. Like I don't particularly like the way they're still dealing with that, courses and things in the grade 9 level.

SC: Why? You think it should be moved up?

7: No. It has to be changed somehow. I don't like the way it's been going.

SC: How do you see those attitudes being gained by students? How can you make a course such that they will pick up some of the attitudes?

7: I don't think it's only the course. I mean, you can design a course for anything. I think it's the whole situation that has to come into account when you're trying to change attitudes.

SC: Such as?

7: Such as the attitude in the school, the attitude in the province, everyone's attitude. I think the main attitude towards schools at the present time has been down. You know, squash the schools in a lot of cases. So I don't think we can, it's hard to foster a positive attitude when you get into that situation.

SC: How much influence does the teacher have in fostering that positive attitude towards science?

7: A fair bit, I think. But then it's very hard for the teacher to go into a school with a positive attitude when he or she is being stepped upon.
SC: If we were to remove the outside perimeters, all of a sudden you now have all the requirements that you would need for your, for teaching Science 9, for instance. How would you improve the learning and the positive attitudes of students towards science? What is it about a teacher that he's able to, that they are able to do that?

7: I think you have to generate some interest somehow. The way I try to do it is, in some cases, give them problems to solve. So that they have to try to discover the answer themselves. That is very difficult for a lot of them. A lot of them can't do it. For those that can, I think it increases their interest in science.

SC: Under what circumstances should a curriculum be revised?

7: Well, it's hard to measure. It depends what the curriculum is intending to achieve or solve.

SC: Say the junior science curriculum, when do you think that should be revised, how often, for what reasons?

7: I don't think it should be just every so often. I mean, there has to be reasons behind it.

SC: What kind of reasons?

7: If the subject matter isn't appropriate. Like I don't really think the Forces section in Science 9 is appropriate. I don't like it. I think it somehow should be changed into something else.

SC: Where should that change come from or be initiated?

7: I think the concerns have to be, firstly, expressed to some body, but I don't know what that body should be. But I think there should be some body that's involved, where the concerns are expressed to and if there are enough concerns about a particular thing, I think that it should be at least looked at.

SC: Do you find the curriculum guide to be useful for your teaching?
7: I think, at least the Science 9 curriculum guide isn't laid out all that well. I think the way it has question, answer, question, answer, question, answer, all the way through it, I think that is very poorly laid out and it could be condensed a lot. Maybe a whole section with the question, answer business and then another section that as you go through the labs or whatever, hints or whatever, in that part, rather than having everything combined in one group.

SC: Can you tell me a little bit about your teaching? What aspects of junior science, grade 9 for instance, do you emphasize most during your teaching?

7: I hate to say this, but it's the biology section in Science 9.

SC: Interesting. Why?

7: I think the nutrition and the parts of the body, the bodily systems are very important for at least eight, nine, and ten to know about because they might not get that later on.

SC: Do you see any difference at the other grade levels, in terms of your emphasis?

7: In grade 10 there's a definite difference. I haven't taught grade 8 for a long time so . . . But grade 10 I tend to emphasize the physics a little bit more.

SC: Did you emphasize the same sort of things on the old curriculum as you do now?

7: In grade 10, yes. In grade 9, no. I think the grade 9 has changed a fair bit in the biology section.

SC: How would you characterize the kind of classroom situation in which you teach?

7: What do you mean by classroom situation?

SC: Your teaching approach, the sort of classroom that you have, what sort of methods you might use, what sort of materials you might use.
7: I usually tend to introduce a subject with just a small talk about what it's about and then we do a few notes. Then bring up problems in the way of labs as a way of determining what is going on. Using question, answer type things after that and look at the lab a little bit more or whatever.

SC: Do you make use of other kinds of apparatus, overhead projector, . . .?

7: I use overheads, some slides. I don't use filmstrips very much. I don't use videotapes very much. I think that unless the videotape is very good or the film is very good, I think they're sort of an overflow or an overload in terms of that.

SC: How about the use of computers?

7: I would if we had enough.

SC: Use of the overhead, do you tend to switch back and forth between the blackboard and the overhead or do you tend to favour one over the other?

7: Well, I use the overhead for notes and some problems and I do put my problems on the board because there's more room to show the whole thing.

SC: How would you characterize your teaching style? Would you say it's traditional or . . .?

7: It's not a traditional lecture method or anything like that. It's more of a, I try to do more one-on-one with the students, if I can.

SC: Have your teaching methods changed since the new junior science courses were implemented?

7: No, not really. They've changed slightly.
SC: In what way?

7: I probably don't tend to give quite as many notes as I used to because the old science curriculum didn't give you any back-up at all in terms of textbook information so I tend to not give quite as much information as I used.

SC: What do you feel are the important things for students to learn from taking science?

7: I think there's some knowledge that they should learn but also that science is a part of life, that's the approach.

SC: How important do you feel that the history of science, the classical experiments and so on, are to modern day science, science instruction as well?

7: I think bringing up a few of them and the fact that they're interested, some of them. They show how some real science is done.

SC: Do you think it should be a part of the curriculum?

7: It would be nice to have at least part of it in there, yes.

SC: Some people have said that teaching is a calling. Others have said that you have to be born with the ability to teach. Can you comment on these notions?

7: You have to be born with the ability to run too, so . . . I mean, some people feel better with children than other people do. I think that in order to run a classroom properly you have to be able to keep control and some people aren't able to do that or get their ideas across very well. I mean, you have to have some skills, anyway, to be a teacher.

SC: I'm just thinking of the notion of, not quite as bad as just taking someone from the street and placing them in front of a class, but when you have a person come out of university and they take a one year teacher training program, why is it that those people are successful as teachers when many people would not be successful? What is it that makes a teacher successful?
7: Well, most of those people, first of all, want to teach. If you want to do something then eventually, if you try hard enough you usually find the way to do it, if you really want to do it. If you don't, if you find you don't like it, then you usually get out.

SC: Do you find that, are there any characteristics of a good teacher, quote good teacher, that you could tell me about?

7: Show an interest in the kids. You usually get involved fairly well with the students. If you looked at what they call "master teachers," some of those have quite a flair to them. They have a very interesting personality which makes them above average or whatever.

SC: What sort of pressures do you find now, in terms of your teaching, at junior and senior level?

7: The senior level is all these government exams, so there's always pressure there.

SC: Is there a pressure to cover the course?

7: Of course. There's a big pressure to cover the course.

SC: Do you have a pressure to spend more time on any one particular section than another, or any particular topic, say at the Junior level?

7: In terms of government exams, there is a little bit of pressure once you get to, say grade 10. Because in physics, if you want to cover the material in grade 12 quickly, then what they should have done is had a very good background in electricity. That lets you cover a section very, very quickly in grade 12 and so you can spend more time on the juniors.

SC: What other ideas or methods can be used in teaching, that you think would be appropriate to teach in science? In this I'm thinking of for instance, "word playing," any of those sorts of things.

7: I've actually used those in the Science and Tech. course. For some things they work quite well.

SC: So you've used "word playing?"

7: Yes.
SC: Any other kinds of different approaches?

7: Debates, but I haven’t used any of those in the so-called traditional courses like physics.

SC: Partly because of the time or mostly because of the time?

7: Yes.

SC: How about the junior science level?

7: Actually, I haven’t done that this year, although I have before.

SC: Any reason or just . . .?

7: I don’t know. I just didn’t do it this year. I actually didn’t think of that.

SC: Do you like students to work individually or in groups?

7: I like group work or small group work.

SC: Why?

7: Because I think the slower student can pick up a lot more from the faster student that way.

SC: Do you ever use the, do you ever refer to current events that are happening with reference to science?

7: Yes, quite often.

SC: How do you bring that into the class?

7: I encourage students to bring things in or I just mention it sometime during the class. Especially when it’s about a topic that we’re doing.

SC: How important do you think that is? Is that more important than sticking to the curriculum or do you think it’s appropriate?

7: I think they, I mean, science involves the world, so I think that any way we can show that it involves the world and that it’s very important to what happens to them is more important than what’s happening in the curriculum.
SC: Do you think, in general, that science is interesting to most students or are more students disinterested in science?

7: I think a lot of students have some interest in science, whether it be just looking at their blood or, unfortunately we can't do that any more but, ... 

SC: Yes, all the AIDS problems. Should all students take science or do you think science should really be for those who are capable of learning science?

7: No, everybody should take science. Certainly get something, anyhow, everybody gets something out of it, whether they pass or not.

SC: How would you describe the teaching styles of your colleagues as a whole, not individually, but as a whole? Are they diverse or similar, within the science department?

7: I think they're fairly diverse actually. I mean, everybody teaches the same sorts of things but I think that a lot of them emphasize one style more than the other.

SC: Can you explain a bit more on that?

7: I know there's some that emphasize the lecture type approach in their class, that are almost wholly lecture oriented and they do very, very few labs. Whereas there are some of us who do a lot of labs.

SC: Yourself, being one that does more labs perhaps ...?

7: I think in, especially grade 11 where you have more labs, I do, for the first part of the course I probably do, almost a lab a day, which is a lot.

SC: Do you find that there are certain school-based influences on how you teach?

7: Well, there's pressures within the school on how you teach, what you teach.

SC: Such as?

7: Pressures for final exams.

SC: Any other pressures that you might find?
7: There's all this equipment constraints.

SC: You said that you liked to do labs. Do you find that you're short of supplies occasionally or do you have the resource material that you need or the assistance that you would need?

7: For the physics it's pretty good, most of the time. I mean, there's a few things that we don't have but it's generally good.

SC: Coming back to when we first started, I asked you about your academic training. How about the science education year, the training year, the teacher training year, how was that an influence on your teaching practices?

7: I didn't like it. I mean, in terms of knowledge, it was useless.

SC: In terms of knowledge of teaching or . . . ?

7: Yes. It didn't teach me a thing about teaching. My only thing that taught me about teaching, during that time, was the small practicums we did.

SC: Your UVIC ones, they were twice or three times a year?

7: I think it was three times, I can't remember though. One was just an observation. And then the second one was for two weeks or something and the other one was for six weeks or something.

SC: Did you find your practicum supervisors, have they influenced what you do at all?

7: I don't know. They probably did to some degree but I don't know about particulars.

SC: They weren't a great deal of impact on . . . ?

7: No, I don't think so.

SC: The year as a whole, you said that the theoretical part of it was pretty useless, the practical part, when you were on the practicums, was quite useful. So, in a sense, your ability to teach came right from the practicums?

7: I think so. Well, learning things about teaching came directly from the practicums.
SC: And what sort of things did you learn?

7: I don't know. Little things about class control, how to talk to the class, what to do, learn the order to do it in, stuff like that.

SC: My interest for my thesis lies in exactly that. I believe that there is what's called a "teacher's paradigm", where there are a set of routines, beliefs, and traditions that are common to the body of the profession, whatever the profession, and in this case it's teaching. And I'm interested in what teachers said in that. You're saying that you picked up from the practicum some tricks, some ways of doing things. Do you think that is common to all practica that are out there?

7: Probably, yes. They always tell you certain things that you should do.

SC: You've had a practice teacher before?

7: Yes.

SC: How did you feel that relationship worked out and what sort of things did you provide for that teacher, that new teacher?

7: I guess I sort of did the same thing that one of my practice teachers did. What he did, basically did, was leave me alone for a while and then he came back and listened in on us and then gave me a few hints, went away again, and came back again.

SC: What specifically, did you pick up from your practicums, when you were out on practicum, if you were left alone with the kids?

7: When you're first left alone in a course, you sweat. Depends if you learn or to make sure that the whole class is listening, that people aren't doing something that, you know, is inappropriate or whatever.

SC: Okay, now, if I was to take this idea of commonality between teachers, what influence do you think, or if this was understood as being correct, how might this be of use to a person or a group of people who are planning a curriculum change in any topic area, but in this case I'm talking about science?

7: How this information might be useful?
SC: Yes.

7: You'd probably come up with some things that you couldn't do or you couldn't do right off the bat. I think there always has to be that. A teacher is always looking for some sort of structure, at least at the very beginning, unless the students have been doing something in the last lesson that carries over, which you don't need very much then. But you always have to have some sort of structure at the start of a lesson. So if you're designing something, it always has to have something. I'm not saying there has to be a set, but there has to be something that gets everybody going.

SC: Who should change curriculum? Should it be the school level, district, provincial?

7: I think a lot of the curriculum is too separate now, myself. It's too rigid. There's not enough room to move. Like in a lot of things, you know, there's just no room to move anywhere and in fact, there's too much to be done.

SC: So, do you believe then that the Curriculum Committee should be a little more flexible in terms of the...

7: I think they should give a fairly wide range of ideas and things that could be looked at. Especially in the junior sciences, I don't think that it's necessary to, I can't think of an example, or something like vitamins. I don't think they should have to, everybody should have to know what vitamin B twelve does or something like that.

SC: It's not crucial to the ...

7: I think they should know something about nutrition, but I don't think it's necessary to tell the teacher that he has to do vitamin B twelve or I mean, it doesn't get quite that specific but it gets very close.

SC: Okay, well I think we've sort of come to the end of my general questions and I don't see any others that I'd want to ask at this point. Do you have any comments to make about teaching in general, in terms of what I've been asking?

7: Not really.

SC: Thank you very much. END OF INTERVIEW 7.
APPENDIX D

Sample Letter of Consent -- Principal

MEMO TO: PRINCIPAL.
FROM: STEVE CARDWELL.
RE: SCIENCE RESEARCH PROJECT

---, as you know, I am currently working on the final part of my graduate degree at UBC. This memo is a procedure that I must follow in order to comply with the UBC rules regarding research involving human subjects (in this case fellow teachers). Before I can interview teachers at Mountainview Secondary, I must have their permission and the permission of the principal of the school. Therefore, would you please consider this as a request for permission to proceed with the next phase of my thesis work. I will provide you with sample questions that I will be asking my colleagues -- and if you wish, you can read my research proposal.

Thank you for your assistance in this matter.

Steve Cardwell.
CONSENT FORM

PERMISSION GRANTED FOR RESEARCH PROJECT: YES___; NO___

SIGNATURE OF PRINCIPAL:________________________________________

DATE:____________________

Attachment: sample questions.
APPENDIX E

Sample Letter of Consent -- Teacher Participants

CONFIDENTIAL

MEMO TO: SCIENCE DEPARTMENT.

FROM: STEVE CARDWELL.


RE: SCIENCE RESEARCH PROJECT

Dear ______________:

As you may be aware, I am currently working on the final part of my graduate degree at UBC. I hope to be able to complete my thesis by the end of Summer. However, in order to do this, I need your participation! This memo is a procedure that I must follow in order to comply with the UBC rules regarding research involving human subjects (in this case fellow teachers). Before I can interview teachers at Mountainview Secondary, I must have their consent and the permission of the principal of the school.

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The following preamble will give you an indication of what I am studying:

Science teachers in British Columbia have experienced a number of curriculum changes over the last few years. These include revisions to the Senior Biology and Chemistry courses, Junior Science and the addition of a new course called Science and Technology 11. Some researchers suggest that in order to effect a curriculum change, there must be some compatibility between teachers' belief systems and the nature of the curriculum innovation.

One aspect of this study will be to investigate how teachers deal with new curricula, and in particular, why teachers deal with new curricula in certain ways -- What are the influences which may have shaped an individual's belief systems such that they govern how a curriculum change is implemented? Of particular interest, is the degree of commonality that may exist among teachers in terms of their belief systems, routines, patterns and problems in the context of a curriculum innovation. In other words, what interpretations and meanings do individual teachers attach to a new situation -- in this case, a curriculum change? And to what extent are these thoughts, judgements and decisions common to a group of teachers?

One possible outcome of the study may be to suggest to curriculum developers some alternate approaches to designing new curricula for the worker in the classroom! Another result could be to propose significant changes to the teacher training programmes that currently exist in B.C.

I would like to approach you sometime in March or April and interview you, at your convenience, about your own educational background, and your perceptions of teaching and curriculum change. The interviews will be
audiotaped and some notes will be taken if necessary. The interview should not take more than one to one and a half hours. Of course, you have the right to withdraw from this interview at any time or to refuse to answer any particular questions.

The interview data will be kept strictly confidential -- in fact, names will not be attached to the data, school or district. You may listen to your own interviews. The completed thesis will be available should you wish to read it.

Thank you for your assistance. Steve.

CONSENT FORM

YES, I WILL PARTICIPATE IN THIS STUDY.

SIGNATURE:_____________________________

NAME:_______________________________

DATE:________________________