

TEACHERS AS CURRICULUM PLANNERS IN SCIENCE

A CASE STUDY OF A PRIMARY TEACHING TEAM

by

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Abstract

Efforts to improve the quality of schools and to create rich and productive learning environments for all children have historically been a continuous ebb and flow of planned change, innovations and reforms. The purpose of this study was to examine how a team of three teachers worked collaboratively to plan, develop and present a science unit of study to their "family grouped" students. The inferred intent of the Year 2000 initiatives seems to recognize the power and the potential in the experience of the classroom teacher. It recognizes not only the teacher's ability to work collaboratively in a team but also to be the curriculum planner and facilitator of learning experiences. This study examines three phases of curriculum development: the pre-instructional planning and creation of Science Discovery Boxes for primary children; the instructional phase of actual classroom activities; and the evaluation and reflections by the teaching team on their curriculum planning and translation experience. The findings of the study emphasize the importance these teachers place on collaborative team work as they outline numerous personal qualities that are essential for collaborative work. The findings also indicate that the teachers were involved in a change process prior to the Provincial implementation initiatives indicating the need for a shift in educational paradigms. The study suggests that greater in-service in science education be provided for teachers with the same vigor as given to other subject areas such as Language Arts, and that greater recognition be given to the role that everyone's life experiences play in personal and professional growth and change processes that are a complex and valuable component in the lives of teachers.

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Cooperation occurs when two organizations reach a mutual agreement and work together but still keep their own programs. Collaboration, on the other hand, involves joining initiatives not only in planning and implementation but also in evaluation. It is much more of a partnership and shared responsibility.

A Synthesis of Research, Organizational Planning

By S. Hord

in

Educational Leadership

1988

INTRODUCTION

Efforts to improve the quality of schools and to create productive learning environments for all children have historically been a continuous ebb and flow of planned change, innovations and reforms. The Year 2000 Vision for British Columbian schools is an exception to this process of change in terms of its magnitude and is being referred to as a metacurriculum by some educators. In addition to this, during the next decade teachers will not only be implementers of a new curriculum but will to some degree become curriculum developers and planners.

The Sullivan Royal Commission on Education (1988) was the impetus for the Year 2000 Vision and the development of the new Policy Directions (1989) containing the Mission Statement for British Columbia's school system. Included in the framework of the proposed changes to the entire educational system are the changes in governance, curriculum and instruction. These changes are complex and require that teachers develop a new understanding of children as learners, and develop new models of teaching and learning.

In the Ministry's proposals, knowledge is viewed as being individually constructed. It is constructed in the sense that new student knowledge is built on prior knowledge in order to be meaningful and relevant, and it also recognizes that each individual has a particular or unique approach to learning.

Within these proposals the teacher is seen as a facilitator assisting the learner, and the purpose of learning is to acquire both declarative and procedural knowledge. The proposal implies that knowledge is gained by the learner as the teacher provides the setting which allows for experiences which combine skills, subject content and their application. Teaching is also seen as diverse, giving full support to learners academically, psychologically and socially as well as providing custodial care where and when required.

As part of the Year 2000 Vision the Provincial Primary Program outlines the curriculum components for the first four years of schooling. The proposed Primary Program fosters the continuing growth of children's knowledge and understanding of themselves and their world. The Program recognizes that the child's acquisition and use of language facilitates thinking and learning and accommodates the broad spectrum of children's learning rates and styles, prior knowledge, experiences and interests. Instructional models, strategies, resources and facilities support this diversity. Instruction integrates content and process, concepts and attitudes while acknowledging that children learn through active involvement and play. Assessment and evaluation are integral components of the teaching learning process and should facilitate instructional decision making.

Although the above is a simplified and condensed description of the intent of the Year 2000 Vision it provides the reader with a backdrop and sets

the stage for curriculum content and defines roles for the teacher and students. The curriculum content is divided into four major subject strands: Fine Arts, Humanities, Practical Arts and Science. In reference to the Science strand the Ministry Foundation Document states that "young childrens' keen interest in their surroundings, their desire to handle things, to take them apart; their fascination with the change observed in plant life, animals, seasons and science phenomena in general contribute a built in, easy made science curriculum for the alert teacher." (E.L. Widmer, 1990, p. 313).

The primary curriculum provides a balance among the learning dimensions¹ and disciplines of science and teaching approaches to science education. Science is to be an integral part of the "whole" Primary Program, and in order to accomplish this a thematic unit of study approach is recommended. However, a major concern with a thematic unit of study approach is, how much of it is really science? In the past, even with the best of intentions the science is often omitted from the theme.

Given the new Primary Program Document, with its emphasis on changes in teaching methodologies and the way we view the learner, there is much for the teacher to "make sense" out of and present in the every day classroom

¹ In the Primary Foundation Document learning dimensions are defined as attitudes, skills and knowledge.

setting. The emphasis of the curriculum is no longer on the content but on developing a child's attitude, skill and knowledge in a cooperative partnership, allowing for and celebrating each individual's differences not only in learning styles, but also in the moral and cultural background. The teacher or collaborative teaching team, along with the children, are to be the curriculum developers of appropriate science experiences.

This study explores how teachers interpret the new Primary Program and make their interpretations come to life as they create and present a science unit to their students. This is a case study of three teachers working collaboratively in the planning and development of a science unit which they in turn implement in their class settings, within the much larger confines of implementation of the new Provincial curriculum. It is not a case study of teacher effectiveness nor program effectiveness, or effectiveness of program implementation. Olson (1982) indicates that in order to effect a curriculum change there must be some compatibility between teachers' belief systems and the curriculum innovation. This study seeks to explore that notion and to further legitimize teachers' personal classroom knowledge and the role it plays in curriculum planning.

A case study design as a research strategy was chosen to probe the complex dynamics of teachers as curriculum planners as its description provides a useful form of vicarious experience for other teachers engaged in change. Case

studies also permit the identification of internal and external factors that have direct influence on the event and so provide a more complete picture. The study illuminates how a teaching team developed and delivered a science unit of study and records their reflections about their own work.

The data was collected over a six month period during the 1990-1991 school year. Data for the study is drawn from interviews, student work samples and autobiographies written by the three teachers.

The researcher is neither participant-observer nor an outsider observer. The researcher is well known by one of the participants as we worked together in a school setting for one year, and also for the Ministry of Education on a Science project related to the Year 2000 initiative. The second participant also worked at the same school four years ago for several weeks and was then transferred. Since that time the only encounters with this individual were at workshops and at informal teacher "get-togethers". The third participant was introduced to the researcher for the first time at the beginning of this project. The researcher is actively involved in the School District in the promotion of hands-on-science. It was through these experiences, and many hours of informal discussion on the new Primary Program and science, that the team volunteered to participate in this research project. The researcher therefore is a colleague-observer.

Throughout the case study the real identities of each participant, names, places and schools have been assigned pseudonyms to provide anonymity for the participants and their school.

Chapter Outline

The case study is organized into four chapters which are briefly outlined below. Chapter one provides the reader with background to the study of teachers as curriculum planners. It provides a brief introduction to the new Provincial Primary Document and places it in a historical context. This chapter also outlines the problem statement and introduces the concept that the teachers' curriculum, as opposed to a provincial curriculum, is closely tied with their views as people who are teachers. The research questions are presented and the methodology used is described.

Chapter two focuses on the planning and creation of a science curriculum for three multi-aged primary classrooms. It also describes how the teachers translated their planning into a real classroom science experience.

Chapter three discusses the teachers' reflections on their work and examines their backgrounds to uncover what it is that enables them to develop their own science curriculum.

Chapter four makes concluding statements on each of the three purposes of the specific research questions. Through discussion it emphasizes how in this case study, the concept of collaboration emerged as a theme that empowered the teachers to carry out their work. The results of this study provide insights into the work of teachers as they collaboratively developed their science curriculum. From these insights eight recommendations were generated and presented in this chapter.

CHAPTER I

1.1 Background to the Study

Implementation of the Year 2000 proposals will not occur unless teachers assume a leadership role in both personal classroom curriculum planning and shared curriculum development. There is evidence in the new Provincial Primary Program Document that this is what is needed and in turn will be supported if teachers wish to take the opportunity.

This document is only a beginning framework to be shaped by the teachers who use it, together with the children who experience it. Moreover, the PRIMARY PROGRAM is not the real program: it is only the words and the concepts that describe it. The real Primary Program is to be found within each one of us, together with our children, we realize it in our classrooms, playgrounds, homes and communities. (Primary Program: Foundation Document, 1990, p. 3)

This statement indicates that the curriculum experiences for the students are to be determined by the teachers pre-instructional, and instructional decisions made in the course of interacting with the children. As Leithwood (1982) has indicated, there is evidence of curriculum planning being viewed as examples of practical reasoning necessarily done under conditions of incomplete information, and aimed at actions whose effects cannot be fully anticipated. In the case of Provincial implementation of an education proposal not presently practiced nor fully understood, practical reasoning could well play the dominant role as teachers take part in its implementation. Although changes in education

are often agreed to in principle and stated in government policy, they fail to become established in practice (Science Council of Canada, Report #36).

Past school reform according to Connely and Claudinin (1988), indicate that there has been continuing tension between the demands of education authorities with its prescriptions for what should be taught and the 'primacy of teachers and students' who experience the "real" curriculum. Today, for British Columbian teachers the Primary Program Document is non-prescriptive in nature, and relies heavily on teachers' intuitive, creative and expert professional knowledge. In this sense it begins to legitimize each teacher's personal knowledge of classrooms. It is thought that the Primary Program Document statements recognize the power and the potential of the classroom teacher's experience. The value of teachers' experience is shown in Connely, Clandinin (1988) and Schon's (1983) study on the experiences of teachers. They show that teachers' reflections on their practice empower and transform their practice into a more powerful curriculum.

In the past, there has been a tendency to separate both the theory and practice from questions of value, aims and commitments (Pollard and Tann 1989). However, in order to implement the Provincial Primary Program "reflection" on practice and "reflective" teaching are required for understanding the intent and mechanisms by which it can be implemented. Teacher reflection

is also needed to support a genuine partnership between teacher and learners. As Pollard and Tann (1987) say, a reflective teacher is one who constantly questions his or her own aims and actions, monitors practice and outcomes, and considers the effects upon each child.

1.2 The Problem Statement

Curriculum and theory as used by teachers becomes and is very personal as evidenced by Walker and Soltis (1986). Curriculum is very closely connected with teachers' views of what is true and important about themselves and their world and it reaches far down into the personal, social and cultural psyche. Past curriculum implementation research has omitted this aspect, while more recent studies examining teachers' work, indicate that the teacher's personal knowledge plays an important role in classroom decision making. The issue of importance in this study is the role of teachers' personal knowledge in curriculum change. The study seeks to detail how teachers "make sense" of the shift from a prescriptive, to a more open ended and personalized curriculum. The proposed changes also anticipate teachers and students working in new ways, with teachers collaborating in planning and teaching, and students working cooperatively.

A team of three primary teachers was studied as they planned and taught a team developed science unit in their respective classrooms. Teachers' "sense making" is not done in isolation by individual teachers. Teachers come to

understand and work out not only their own personal theories and experiences, but also those which may be mandated by the Province as they present a particular curriculum to their classrooms by taking part in both formal and informal, "in the hall" discussions with their colleagues. Shipman (1972) found that curriculum change occurs through the interaction of groups with different and changing perceptions of the same situations. Later research by Olson (1982) indicates that in order to effect a curriculum change there must be some compatibility between teachers' belief systems and the curriculum innovations.

1.3 Purpose of the Study

The purpose of this study is to describe how a team of three teachers work collaboratively as they plan, develop and present a science unit to their "family grouped" students. This study endeavours to augment the understanding of the roles that "personal theories", experiences and "sense making" play in the process of implementation.

The study examines how a team of teachers work together in planning and translating their science curriculum while taking part in the implementation process of the new Provincial Primary Program. To gain insight and understanding of this phenomena nine specific research questions were used.

1.4 Specific Research Questions

1.4.1 Purpose: to document how three elementary teachers plan a science unit collaboratively prior to instruction.

- (i.) What strategies do the teachers use to select the science content for their classes prior to instruction?
- (ii.) What resource materials were used for planning?
- (iii.) What kinds of interaction occurs among the team of teachers during the planning process?

1.4.2 Purpose: to document how the teachers translate their pre- instructional planning into the classroom setting.

- (iv.) What unit of science study was selected and developed into a teachable unit of study?
- (v.) How did the teachers choose a methodology of instruction for that particular science unit?
- (vi.) Which strategies did the teachers use to teach the chosen unit of study?

1.4.3 Purpose: to document teachers' perceptions and reflections on planning and teaching the science unit.

- (vii.) What are the teachers' perceptions of their instructional methodology?
- (viii.) What facilitating or constraining factors did the teachers experience in curriculum planning and teaching?
- (ix.) What part of the "Science" in the Provincial Primary document do the teachers perceive to match the activities?

1.5 Location and Methodology of the Study

1.5.1 The setting

The study was carried out in a large urban Lower Mainland School District in British Columbia. The School District was involved in the implementation of the Year 2000 initiatives since 1988. This study is limited to one elementary school, three teacher participants and their classes. In this study all names of key participants and schools have been assigned fictitious names. The school will hereafter be called Westview school. Three primary teachers, two female and one male each with no less than ten years of teaching experience comprise the collaborative team. Each teacher has an average of twenty-two students plus several "special needs" children integrated into their classes. Each teacher respectively enrolls a grade one, grade two and a grade three class. For 60% of the school time this "class" by grade organization is still used. For the remaining 40% of the instructional time the three classes are reorganized into "family group" or multi-age activities. It is during the "family group" time that science is presented to the children.

1.5.2 Methodology

General Considerations

The strengths and weaknesses of case studies have been the subject of many controversial debates. Despite these debates the case study as a valuable

research tool continues to be used in many disciplines. Yin (1989) outlines the case study's unique strength as having the ability to deal with a full variety of evidence, artifacts, documents, interviews and observation. Herriott and Gross (1979) emphasize the use of case studies in educational settings dealing with change efforts and outline five assumptions that led to the adoption of this approach as a valuable research strategy. Case studies: (i.) provide a useful form of vicarious experience for anyone preparing to manage educational change; (ii.) provide information needed to ascertain whether the stages of the change process were met, and to determine the impact of decision making; (iii.) permit the identification of internal and external factors that may have a bearing on the outcome of change efforts; (iv.) assume that the findings can be useful for those facing implementation; (v.) provide an excellent mechanism for stressing the importance of how school systems and community context in which a change effort occurs can influence its developments and outcomes (Herriott, Neal 1979).

The present case study focuses on a complex current event and no specific theory is presented on implementation, curriculum planning or teachers' collaborative work as the case study itself is exploratory. According to Yin (1989) the type of research questions asked determine the research strategy to be used and the case study is preferred in examining contemporary events especially when the relevant behaviours cannot be manipulated. Schwartz & Jacobs (1979); Van Maanen, Dabbs & Faulkner (1982) in Yin (1989) note that

case studies should not be confused with qualitative research because essentially qualitative research consists of two conditions, one the use of close-up detailed observations and the attempt to avoid prior commitment to any theoretical model. Yin states that these conditions do not always produce a case study, nor are case studies limited to these conditions. In summary, Yin (1989) suggests that the case study strategy may be used to explore those situations in which the intervention being evaluated has no clear, single set of outcomes. A case study therefore is particularly appropriate for this study.

1.5.3 Methodology

Specific Considerations

The nature of the study is such that it required a three-phase approach. Phase one was devoted to investigating initial planning stages undergone in the preparation of a primary science unit. This was carried out through audio-taped interviews and discussions with the three teachers. Through taped discussions the teachers verified and clarified what they meant and thought should occur. This made interpretation by the investigator more precise and less dependent on inference making. Phase two involved the translation of their curriculum planning into hands-on classroom activities. For this phase a variety of data was gathered and used as documentation - video tape of children doing science, student work samples, student evaluations of the project, photographs and

interviews.

Phase three examines teachers' perceptions and reflections about their own work; teacher past experiences, ideas and beliefs that enabled them to work collaboratively; and the examination of factors which helped or hindered the planning and translation process. Here two types of interviews were conducted. The first interview was with all three teachers present with the researcher. The second interview, or rather audio taping of teachers' narrative excluded the researcher to create an environment of greater freedom of thought and expression. Three teacher autobiographies were also collected to support and verify ideas, beliefs and views identified and expressed during discussions and interviews. Using the collected data the investigator determined what teachers brought with them in terms of personal experiences, ideas and beliefs that enabled them to work collaboratively in the planning of a science curriculum. The study also examined the possible factors that helped or hindered the process of planning a science curriculum.

1.6 Methods of Data Collection and Analysis

Data Collection

The primary source of data collection was the discussion and interview audio tapes. As the interview method is an appropriate means of examining the

nature of teachers' curriculum planning. By working with one of the participants previously a feeling of trust was established and maintained during the interviews. Four interviewing sessions were conducted, one for each of the three phases of the study. The fourth session was a lengthy discussion session on audio-tape attended by the teachers only, guided by a series of presented questions. Subsidiary data collected included student work samples, student project evaluations, short videotape of children in action, description of the Science Discovery Boxes, photographs three autobiographies and the teachers' proposal² for classroom organization.

1.7 Data Analysis

All the interviews were audio-taped and field notes were kept. Each audio-tape was transcribed verbatim and checked for errors by the participants. Samples of the transcripts are in appendix 4. The information gathered was classified and sorted into the three phases described previously. Other materials collected were also sorted into the three phases. All the data was compiled and reported in a descriptive chronological style answering each of the specific research questions as the events occurred in the natural setting of the classroom. This description, or story related how the teachers pre-planned the content of

² The teacher's proposal was an outline prepared by the teaching team and presented to their new Principal describing the type of classroom organization and curriculum content they wished to undertake.

science, chose a particular unit of study, taught the unit of study, and reflected on their teaching.

There is no attempt here to describe teachers, other than the three teachers in the team that I was in direct contact with. To what extent this description and interpretative materials is applicable to teachers elsewhere involved in curriculum planning and implementation is a matter for further study. This is not to suggest that this situation is unique or that the teachers and their relationship is distinctive. Neither the teachers nor the school were selected for representativeness by random sampling techniques, or any other technique. They were in fact volunteers. It is important to note here that the study took place in the lower mainland and the school could be any school, and the teachers could be any teachers willing to work together during implementation.

The completion of the study is due entirely to the sustained cooperation and openness given by the teachers throughout the project.

1.8 Assumptions of the Study

It is assumed that:

- (i.) teachers' planning can be inferred from various sources such as interviews, and discussions with the researcher.
- (ii.) the characteristic of a primary science unit can be

identified in both content and methodology of its presentation to students from children's work, teacher prepared materials and a video of classroom activity.

(iii.) an examination of teachers' personal background in the form of interviews and autobiographies will allow the investigator to elicit personal characteristics that the teachers bring to their project that enhance and make the "whole" collaboration, planning, developing and delivery of a science unit possible.

1.9 Limitations of the Study

1.9.1 Reliability

The problem of reliability in case studies is often that the specific steps in the study are not made operational and would be difficult to repeat. The steps in this study are clearly defined and time sequenced and so therefore could be repeated. Internal reliability was checked by looking for consistencies in the participants' responses. The audio-taped interviews were transcribed verbatim and in the description and analysis direct quotes were used. Many of the questions used were open-ended and thus the chance of bias on the interviewer's part was eliminated.

1.9.2 Validity

The validity of the study was enhanced by systematically checking and confirming the descriptions of what occurred. The use of multiple sources of evidence found in the variety of the data collected help to construct validity. Establishing a chain of evidence while examining the process the teachers underwent in their planning also helped to build validity. Another method of validity checking was to have the case study report reviewed by the main participants. In case studies much hinges on the ability to make accurate inferences. Yin (1981) explains that every time an event can not be directly observed an inference will be made.

"Thus an investigator will infer that a particular event resulted from some earlier occurrence, based on interview and documentary evidence collected as part of the case study." (p.43). The external validity depends on how typical the school is and how representative is the range of the teacher's background, age, and experience.

The overall validity of this study depends on the observational skills and sensitivity of the researcher and the confirmation of the description and analysis by the participants.

1.9.3 Generalizability

One of the major concerns that have been debated over and over again about case studies is that they provide little basis for scientific generalization. Yin (1989) states that "case studies, like experiments are generalizable to theoretical propositions and not to populations or universes. In this sense, the case study, like the experiment, does not represent a 'sample', and the investigator's goal is to expand and generalize theories." (p. 21).

In the context of this study and the nature of the contemporary issues being explored, the results can only be generalized through further investigation. A caution to be considered here is that the researcher was a colleague participant in the investigation, and is involved in the Provincial implementation process.

In considering the nature of case studies, the validity, reliability and generalizability of this study, many of the concerns raised above have been addressed.

1.10 Significance of the study

The impact of research carried out in phases of science curriculum planning and implementation could have profound relevance to the everyday practice of science teaching. The case study may also prove to be revelatory

because thus far no study has documented the procedures that a collaborative team of teachers have taken during the implementation of a primary science curriculum. It is also significant because it is carried out in the context of the Year 2000 Initiative and addresses collaborative teaching.

CHAPTER II

PRE-INSTRUCTIONAL PLANNING AND USE OF SCIENCE BOXES

2.1 Introduction

When the research project began, in the early fall of 1990, the construction of Westview Elementary School was nearing completion and teachers were busily moving in and setting up their classrooms. There was much to be organized. The team of three teachers was among the first to move in and set up. The team transferred to Westview school on the understanding that they would be allowed to work together and enroll "multi-aged" students. Prior to joining the staff of the new school the three teachers were required to draw up a proposal for the principal to justify working as a team. The proposal outlined the grouping of students and goals of their instruction. Students were to begin their day in their homerooms as a multi-year group, and then at 10 a.m. form single-year classes, grade ones into their grade one classrooms, etc. The children would remain in these groups and receive instruction in language arts until lunch time. After lunch they would continue as single year groups in their grade classrooms for mathematics. At 1:30 p.m., and for the remainder of the day they would be in their multi-year groups for Science and other curriculum activities.

In the proposal to their Principal the teachers wrote a total of thirteen "beliefs" that they had held about 'shared reading' and oral language activities,

and under the headings of Science and Social Studies they outlined twelve goals that would be met through a variety of experiences. For the proposed science activities the team selected the groups of children and identified the following goals:

Afternoon multi-year grouping (family grouping) would include large group, and cooperative group activities. The goals of the Science curriculum would be met through a variety of experiences, 'hands-on science, problem solving, observation, recording, classification and experiments which would enhance critical thinking, curiosity, and positive attitudes towards inquiry.

Before the school opened in September 1990 the team's proposal was accepted with one modification. Multi-age grouping was accepted for part of the day only. The team had a strong commitment to work together and develop the "best and most beneficial learning environment for their students."

2.2 Pre-Instructional Planning

The team began the detailed development of the Science Unit as soon as they decided it would be a physical science one. The three teachers thought that there was an urgency to develop and teach something in the Physical Sciences. Dawn stated, "We've put a lot of emphasis on the Biological Sciences up to this point and we felt the need to pursue the physical sciences." The team unanimously agreed that Physical Science would lend itself best to hands-on

classroom experiences. Their first idea was to develop a Machine Unit. Initially, the teachers hoped that the Machine Unit would lead naturally into an Astronomy Unit. This astronomy component was abandoned primarily because they were unable to book the planetarium for a field trip when it was needed. They also felt that an Astronomy Unit would be much more teacher directed and thus would not meet their original goal.

Carly and Dawn: We felt the need to do more child-centered activities which is the direction of the Year 2000. Thus a machine unit was in the making.

Several approaches were tossed around and the team concluded that the Machine Unit theme would be best initiated by using the Discovery Box approach.³ The use of these boxes by the researcher in her classroom and at Science World during the previous year influenced the team's decision to adopt this approach.

The team expressed a strong belief that science in the Primary years should be hands-on and exploratory in nature.

³The discovery Box approach is a hands-on exploratory strategy used by the teachers to introduce children to a variety of science concepts. Materials for the students to manipulate are placed in boxes.

In a brainstorming session one afternoon following school the team began to speculate on the kinds of boxes that they could put together. They discussed some of the simple machine principles that they knew of and looked up others in reference books. They soon realized that some principles of simple machines were too difficult to put into the "Discovery Box" concept.

Brett: We realized that some of the principles of simple machines might be difficult to put together, or that they might become quite boring or ordinary, like the screw box or things like that.

Through this thinking aloud process the idea of extending the theme to "How Things Work" emerged because it had the potential to encompass a greater number of concepts.

Brett: A further study of concepts, and in looking at some centers we had already in our rooms like the water table led us to enlarge the unit of "How Things Work." This we thought might help us to encompass a greater number of concepts in the physical science realm.

Through this process of thinking, re-thinking and discussion the team finally came up with eight different Discovery Boxes. The titles of the Discovery Boxes were: Take-Apart Box, Lever Box, Pulley Box, Magnet Box, Water Box, Roller Box, Wheel Box and Pendulum Box.

Although the Discovery Boxes were referred to as "concepts in a box" they were actually in pails, due to their ready availability. Obtaining the supplies to put into the boxes was a major problem. The school was new and had not been well stocked with science items and of course there was not the collection of "junk" in the cupboards that many older schools have in abundance. The team found that collecting the materials and the boxes together was time consuming.

Two Discovery Boxes are described to illustrate their contents and the kinds of activities in which the children would engage. One was without a specific scientific principle, The Take-Apart Box, and the other, the Roller Box involves the principle of the inclined plane.

The Take Apart Box had a collection of old clocks, calculators, radios, toasters and cameras. Tools such as pliers, screwdrivers and wrenches were included for the children to use to take items apart and tinker. This box was used for three sessions in the centers for free exploration and then the "challenge" sheet was added to the Box. The challenge sheet asked one question - "What did you discover?" At the bottom of the sheet there was a blank space for drawing or writing under the heading - WHAT WE DID.



Figure I. Take Apart Discovery Box

The Roller Box contained boards, wooden cylinders, blocks, bottles of various sizes in cylinder shapes and a spring scale. This box was also used in centers for free exploration and then the challenge sheet was added. On the challenge sheet this Box was called the Inclined Plane Box with the following problem statement. The spring scale measures effort. How can you place the block in the box using the least amount of effort? At the bottom of the page a blank space was provided for drawing or writing under the heading - WHAT WE DID.

2.3 Discovery Boxes in the classroom

The instructional phase was divided into three segments, the introduction of the Discovery Boxes to the children, the more directed use of the Discovery Boxes and teacher and student evaluation of the Discovery Boxes.

2.3.1 Introduction of the Discovery Boxes

For the introduction of the Discovery Boxes the students were regrouped into family groups for part of one afternoon. Each of the three classrooms had an equal mix of grade one, grade two, and grade three. There was no change in the total number of children in each classroom during this time. Each classroom introduced six different Discovery Boxes but two additional boxes were added later. The Discovery Boxes were introduced as a Center that children could go to as one of their play or free exploration activities.

Carly: They had several sessions of free exploration before we...and we didn't put anything in the boxes at all (meaning no directions), there weren't any challenges, just ahh...they could play with anything in the boxes.

This 'free exploration' continued for a total of three one hour sessions. It was a choice activity and there was no limit to the number of children who could work with any one box, and the children were not required to choose a

box during this time.

Carly: We didn't limit it as long as it was working.

During the free exploration time the team found that certain boxes were more popular than others. The Roller Box was popular in two classrooms.

Carly: And in my class the Roller Box...They liked to put ramps up and roll things down and see how far they would go, and make barriers at the other end, roll it, and see if they could hit the barriers down, and that sort of thing.

Brett: One group wanted to create a barrier to see if the rolling things would flip up and carry on down or just sort of stop at that point...and not sort of flip itself up over the hump.

In Dawn's classroom the Magnet Box was the most popular.

Dawn: I'd say the Magnet Box in my room was more popular than the Roller Box. Especially during the free exploration stage.

The Take-Apart Box gained popularity in all three classrooms and the teachers could predict who would go to it and there was a definite mix in the ages of the children who went to that Box.

Carly: Yes. They (the children) are academic thinking. Hmm...That's right because if you were to sit down with them you'd find out they knew a lot of things, academic things. Kids that went to the Take-Apart Box. You know, I could predict which ones would go there, and they would be there all the time. And that little Billy,

who I know outside of school, he enjoys stuff like Constructs and Lego.

Dawn: In the Take-Apart Box in my room it was multi-aged, very definitely.

Carly: Tended to be more on the male side, more the boys, and it more or less depended, I mean you could almost tell which one would love it so much. You could tell by the personality of the children. Very predictable and those ones would go to that box all the time. I don't think they ever left it."

The remaining Boxes were less popular and problematic during the "exploration stage". The Pulley Box for example -

Dawn: Nobody did much of anything with that one. I don't think any one ever figures out what to do with the pulleys.

2.3.2 Directed use of Discovery Boxes

After three sessions of free exploration of the Discovery Boxes the teachers developed what they termed challenges. These challenges were produced on an activity sheet and each Discovery Box had one challenge sheet.

The teachers allowed a period of four weeks for this component.

Dawn: We've got eight boxes so if the kids rotate we are looking at eight days, which is four weeks.

Brett: So what we did was...we looked at the various books, How Things Work, The Way Things Work and some of the other books and umm...tried to look at some of the concepts that are in each of those simple machines and come up with some problems that ah...would try to solve those...We also used a little unit from Susan

Argast (teacher/author) in the Prime Areas Magazine on simple machines. Now to start with, and after that we will add to it as we go along. So like, sort of next week, or the next time we need to revitalize in a sense. Maybe we will put in a whole new set of problems.

The classroom organization at this stage was also multi-age grouping. However, during the free choice centers time children chose a Discovery Box and worked in a cooperative group on the specific tasks. The children were expected to 'solve' the challenges by manipulation and playing with the materials in each Discovery Box. Once solved they were asked to transfer their findings to the challenge sheet in the form of written statements or drawings. Any member of the family group could be the recorder. It could neither be the youngest, the oldest, or one in between.

The teachers in their morning instructional time would frequently introduce specific vocabulary related to the science activities. They also made displays of books and additional material related to the theme hoping that it would serve as a motivational and inquiry booster.

Dawn: I know what I did at that stage too. That's when I brought in those huge Tonka Toys and I set them right on the middle of each table around the room and I had thought...Wow! they'd be so impressed, you know. The adults that walked into the room...(thought) that the kids would really enjoy these. Nothing! The kids hardly, you know they sort of gave them a little roll, and that was it! No connections were made to the "machines" (the scientific principles found in the Boxes. I had put the vocabulary in the pocket chart and I had some books, you know the Rockwell

Books, a couple of really...simple machine books near these trucks, then I moved them from the table and put them near the books, near cards.

Brett: No exploration!

Dawn: No interest, nothing!

However, with the challenge problems in the Boxes there was a renewed interest in the Discovery Boxes.

Carly: But that's not to say that they didn't enjoy it because I know that certainly for at least the first three sessions where we actually had the "challenges" you knew they were curious about what Box they would get, and they really, they really did do it quite well. And then they'd be sort of be watching to see what other groups were doing. And when they got to that Box sometimes they went right to it without even going through it.

There were many surprises for the teachers as they observed the children at work.

Brett: Often in the Discovery...or the exploration stage they (the students) would do things with the things that really had nothing to do the concepts at all that you might be thinking that they would do with it. They would do something completely different.

The teachers found that the children didn't measure accurately while working at the Pendulum and Water Box.

Carly: I don't think they really measured very well... But I think that's our fault. I don't (think) we demonstrated...look this is what a

(teaspoon) looks like, and this is what you're gonna count.

The teachers also found that the children's interest was not sustained for the originally planned time, eight weeks.

Carly: We thought we were able to sustain it (the interest) so each group would get to each box, but after five we realized their interest was waning, and so we didn't...(continue). We then demonstrated a couple of the Boxes.

Brett: Our plan was to have to go to all eight, ahh,...the excitement, you could tell it was wearing thin,

Dawn: We even asked, we asked the kids if they wanted to continue.

Because only one or two children wanted to continue the Discovery Box sessions were discontinued and demonstrations took the place of the hands-on activities for the next few sessions. The demonstrations will be discussed in the following section under sharing.

2.3.3 Teacher and Students' Evaluation of the Discovery Boxes

At this time the teachers came close to abandoning the project. however, rather than abandon the whole process the teaching team felt that they wanted to pick up on things that the kids may have missed in their own discovery approach. The team decided to present demonstrations.

Carly: I knew the Lever was demonstrated and they all brought their rulers and they went around, and using their rulers and made...and...any-thing they could find around the room, you know,

moving the fulcrum point, and ah...balancing objects from the classroom, chalkbrush and this sort of...and they enjoyed that. That was really fun!

The teaching team certainly was in agreement with the success and enjoyment that the children derived from this demonstration. Based on this success the team decided to continue with the demonstrations.

Carly: We did pendulums. Definitely...and that was actually really exciting. We spent about forty-five minutes just demonstrating and just trying different things, shortening the string, different weights, lots of explanation of why...

Dawn: And averaging, it was wonderful. A lot of Math.

Carly: "We actually talked about...it took at least forty-five minutes. They didn't go and do it on their own. They actually sat there for forty-five minutes. They really enjoyed that.

The third demonstration was the inclined plane. There also were mini-lessons with demonstrations of things like inertia, force, energy, and surface tension during the morning sharing time. For one of the teachers this led directly into the class's study on space. Dawn also did some cooperative group sharing.

Dawn: We did do oral sharing at the end of our discovery sessions where we had in my room anyways. I had somebody from each group come up, share what they had learned and I would choose a different grade level each time we did it. So one time it was the ones. So that was one of my instructions before they went to

work, was to make sure everybody in the group can explain it to the whole group because you know I didn't know what grade I'll call on to explain today. So there was that sort of sharing.

Now that eight sessions had been completed including demonstrations, the students were asked to evaluate the Discovery Boxes. The students were asked to evaluate the Discovery Boxes. The students were asked three questions: "What did you like about the Discovery Boxes?; What didn't you like about the Discovery Boxes?; If we are going to do this again next year how could we improve?"

The researcher read each of the sixty-seven student evaluations. Not all the students expressed themselves clearly and a few did not answer the questions asked. Some did not answer all the questions. The question most frequently not addressed was "If we are going to do this again next year, how could we improve?"

The students responded to the question "What did you like about the Discovery Boxes?" by stating that the most liked box(es) was/were the Take Apart Box and the Pulley Box. Table one identifies the most liked Discovery Box.

Table I Most Liked Discovery Box

<u>Discovery Box</u>	<u>Number of children</u>
Take Apart Box	16
Pulley Box	8
Water Box	6
Magnet Box	5
Pendulum Box	3
Roller Box	3
Lever Box	2
Wheel Box	1

They liked the Take Apart Box because they "liked taking things apart" and "discovering how they worked". The Pulley Box was liked because "it was fun".

The students responded to the second question, "What didn't you like about the Discovery Boxes?" by identifying the least liked box.

Table two identifies the least liked Discovery Box.

Table 2. Least Liked Discovery Box

<u>Discovery Box</u>	<u>Number of children</u>
Pulley Box	8
Lever Box	5
Roller Box	4
Water Box	2
Magnet Box	2
Pendulum Box	1
Take Apart Box	1
Wheel Box	0

The reason most frequently given for disliking the boxes was that they

were boring. The Take Apart Box was disliked because the student got hurt taking things apart. Fourteen students stated that they liked everything and only two said they didn't like the Discovery Boxes. Reasons given for liking the Boxes were that they were fun, interesting and you could learn things. One little boy wrote "That I could do them right and they were easy." Two children didn't like the boxes and said they were a waste of time. Six children focused on their feelings about working in a cooperative group. Two didn't like working in a group, one gave no reason and the other said their partners were too disruptive. Lisa said, "I like the challenge of the Discovery Boxes and (I) like the way they teach the child how to work with others." Eight children said they didn't like the writing part of the challenge sheets. About an equal number of children said that the challenge sheet took too long to complete, or that they didn't have long enough to work on them.

Not all the children were able to make recommendations for improvement. A total of forty recommendations were made, sixteen in the form of wishes. These wishes predominantly took the form of wanting to try new Boxes that they didn't have the opportunity to explore. Three children indicated their displeasure with the approach by writing, "No Discovery Boxes!" The most frequent recommendation was that the Boxes should be made better (no explanation) and that more stuff should be put in them. In examining these

responses the student's age (six to nine years) should be kept in mind in relation to their skills of language expression when faced with such questions. However, there was no difficulty in determining the children's likes and dislikes.

2.4 Summary Analysis

In summary the pre-instructional, and evaluation phase took a total of eight weeks. Six weeks were used for the classroom hands-on presentation of the Discovery Boxes. The six weeks were not sequential as there were many disruptions due to special events in which the classes took part. Because of these interruptions science was put on hold until another week. Following the exploratory stage with the Boxes the teachers conducted mini-lessons in the mornings to develop vocabulary and clarify the science principles involved. Following this was the more directed stage with specific tasks of problem solving which included reading and writing or drawing of student findings. The directed investigations with the challenge sheets proved to be problematic. Reading and completion of the tasks proved difficult for some students. The team was not pleased with the students' recording of their findings on the challenge sheet. After completing several of the directed Discovery Boxes "whole" class demonstrations by the teachers were carried out and the team reflected and discussed the implications of these findings. The teachers perceptions and reflections of their planning and teaching of the science theme will be discussed

in Chapter Three.

In this chapter, by analysis of the entire transcriptions, (not only those highlighted in this chapter) the first six research questions have been addressed.

In the collaboratively planned science unit, namely the Discovery Boxes, the teachers choose the specific science content by a process of elimination. They had already taught some Biological Science and had future plans for an Earth/Space theme. This then left Physical Science. There didn't appear to be many choices within the Physical Sciences suitable for primary grades so a Machine Unit was initially chosen and then modified to a "How Things Work" theme. In the interviews with the team no physical science options were uncovered. Part of the teachers' decision making process was directly tied to the methodology of presentation. They decided it had to be a hands-on, child directed approach.

Books were the prime resource for selection of scientific principles to be put into the Boxes. The lack of resource material was a limiting factor.

During the planning process there were three specific sessions dealing directly with the planning and development of the science unit. The first was the discussion on what the team could create, the resource materials, books in particular, that they could find to aid them in the development of the theme. In

the second session the team collected suitable material and assembled three boxes. The search for material was extensive and often occurred outside the classroom at Thrift stores and garage sales. A letter was also sent to parents asking for materials. The third session dealt with developing problems that the children could solve by using the materials in the boxes. The team came up with eight problems and called them challenges.

With regard to the use of the Science Discovery Boxes in the classroom the science theme chosen was "How Things Work" and the methodology was directly connected to the choice of topics and the teachers' desire to teach more physics. The Discovery Boxes served as the organizer for the content, and these boxes were modelled on those in Science World and one other classroom. The teachers had initially planned for "free explorations" leading into a directed problem solving strategy. The challenges were problematic and in general the teachers were dissatisfied with the results. In the course of implementation of the theme the teachers had to modify their strategies to include scientific vocabulary development, mini-science lessons and whole class science demonstrations.

CHAPTER III

TEACHERS' BACKGROUND AND REFLECTIONS

3.1 Introduction

Please allow me to introduce you to the teaching team. Each participant has been assigned a fictitious name: Brett, Carly and Dawn. All their teaching careers have been in the Lower Mainland of British Columbia, each with no less than ten years of teaching experience in elementary grades. They are married and have children of the same age and have taught one another's children in their classrooms. Although Brett, Carly and Dawn have worked together in the same schools during different years of their careers prior to moving to the new school, they had not actually team taught together before as a threesome.

Their approach to education is similar and all three have expressed an enthusiastic love for teaching and cannot see themselves in any other career. They are actively involved in a never-ending quest for more knowledge on teaching and how to best meet the needs of their students. Dawn has a favorite phrase from a poem by Andrea del Sarto that she thinks sums up the team's aspirations. "Your reach must exceed your grasp, or what's a heaven for." And in her own words "strive for excellence...do the best you can...hold onto your dreams." (Autobiography 1991).

3.1.1 Teacher Training Background

Dawn began her university education at the age of seventeen at Simon Fraser University in Liberal Arts with no specific goal in mind. The following year she transferred to the University of British Columbia and took courses in psychology and sociology. In 1969 she graduated with a B.A. in Psychology. She worked for a year as a clerk and was "very dissatisfied with the regimentation...one way of doing everything." (Autobiography 1991).

She then completed the Diploma in Early Childhood Education at U.B.C.. This led her directly into teaching kindergarten for five years before she went on leave to have her own family. While on leave she continued with her own teacher training by taking courses such as "Math Their Way" and attending district workshops. In her own words, "I took every course on Whole Language that I could."

Carly was educated at the University of British Columbia. Initially, she enrolled in the Sciences and wanted to become a nurse. Numbers in the enrollment for nursing were cut so Carly decided to join the Faculty of Education for a year with the intention of returning to Nursing. Once in the Faculty of Education she stayed. Primary Education was her professional major with Psychology as her academic major. Carly completed a three week practicum in England. She returned to U.B.C. the following year to complete her fourth

year and added Developmental Drama to her course load. Carly's teaching career began with a grade two-three split, and later she taught Kindergarten and each of the other primary grades at different times during her career. She also took time away from her teaching to have a family.

Brett began his education at Columbia Junior College in Vancouver in 1969. During this first year he felt somewhat out of place. His decision to become a teacher was made early in his post secondary education year. "At some point I must have decided that teaching was what I wanted to do but I can't really remember when." (Autobiography, 1991). The following year Brett enrolled in the Faculty of Education at the University of British Columbia. His professional major was in Art Education with Canadian History as the academic major. In 1972 his teaching career had barely begun when it was abruptly interrupted by a serious motor vehicle accident. Brett returned to teaching a year later and taught a grade six class. Brett taught both upper and lower elementary grades with no further breaks in his career. He currently teaches the grade threes (Year Four) of the multi-age group at Westview school.

3.1.2 Science Background

Carly is the only team member with an academic science background. She took biology, chemistry, physics, mathematics/calculus in her first year at U.B.C.. Dawn and Brett were only exposed to the required science methods

courses. Brett found his lack of a science background very frustrating.

Brett: I haven't got a lot of knowledge in science, I mean it wasn't in my background. I didn't do well in science in school so it was something I generally steered away from.

Dawn makes no reference to an educational background in science.

3.1.3 Early Influences

Each team member in their taped interviews and autobiographies mentioned numerous people and, or books that influenced their thinking and work as teachers. This information is given here because each teacher made a shift or change in their teaching style and methods somewhere along the way. In the section under teacher reflection the notions or events that sparked the changes will be discussed. It must be noted that this is not to suggest that those authors, events, mentors or inspirational people do not continue to influence them as teachers.

Carly stated that while attending University, *Piaget* was a strong influence as was completing a practicum in an Infant School in Britain with its emphasis on the "whole child." An important author for her at that time was *Sylvia Warner Ashton*. Carly mentions four influential professors, *Marion Ralston*, Children's literature, *Roland Gray*, Math methods, *Kate Hawkhead*, Primary Education and *Gaalen Erickson*, early childhood education.

In particular I learned about creating a positive learning environment for children, creating a setting where children can experience challenges at their own rate (Autobiography, 1991).

After several years of teaching Carly became intrigued by "Math Their Way." This was not by choice, a course in "Math Their Way" was a requirement of employment at her particular school at that time. Also having to transfer from school to school was a major influence on Carly. After a forced transfer Carly stated: "I was now a kindergarten teacher and here I felt truly effective and fulfilled. This was the kind of teaching I had longed for. I vowed to never leave kindergarten, learning centers, child centered, "whole" child, it all felt so right!" (Autobiography, 1991).

Dawn comes from a family of educators - "mother and grandmother were teachers...people always assumed I would become a teacher." Significant authors for Dawn were Steinbeck and I "read all of Ayn Rand and began to fantasize about the creative energy within myself and to value my own ideas." (Autobiography, 1991). With psychology and sociology courses as her background Dawn worked with troubled teens and was influenced by Joyce Mason's work with children. "She taught me the importance of just being yourself when working with kids...let them know that you care by really listening. Work at the Child Study Center promoted the feeling of "yes I can make a difference. Mary Thomson was one of our seminar leaders that year and she

taught a course on Parent Teacher Communication that I feel was very important...she talked about the partnership that exists between parents and the school." Dawn is an avid reader and identified literature that has been influential in her life. "Over the years there has been a core of books that I have read and re-read that have kept my idealism alive. The most important ones are *The School in Rose Valley* by Grace Rotzel, *Teacher* by Sylvia Ashton Warner, and *The Open Classroom* by Herbert Kohl." (Autobiography, 1991).

For Brett, working with colleagues in an "open-area" school in his early teaching career was the most inspirational. He describes this environment as

...a school staffed with an idealistic energetic group who developed a close bond to each other as this school had the reputation of being one of the toughest in the district to teach in because of its high transience, single parent apartment catchment. This was my first exposure and probably laid the ground work for the way I am teaching now (Autobiography, 1991).

Brett did not read educational literature until later in his teaching career when he embarks on an assessment of his teaching career. Up to that point work demanded much energy in just keeping the "lid on" in the classroom.

These early experiences and influences, in part, made the teachers who they were and helped the researcher understand what it is that enabled them to do more than cope with implementation and become their own science

curriculum planners. For each of these teachers something occurred along the way that set them on the path of change.

3.1.4 Reflections on Change

Dawn felt that her 'change' occurred just a few years ago. The following excerpt from Dawn's autobiography illustrates her readiness to change.

Four years ago I felt that I was ready to make a change...I observed in many classrooms...I saw classrooms where children were no longer filling in worksheets...they were doing things...I received a lot of encouragement from Lori Williams (District Staff)...I felt confident that I could take that next step and teach six year olds to read...I sensed a movement afoot that was child centered as opposed to curriculum driven...at last I was confident that the kindergarten notion of meeting children where they are and taking them as far as they can go was moving up through the primary grades - I welcomed the Year 2000 draft. I have continued to network with many colleagues...this has been a vital part of my growth as an educator...often times clarifying my thoughts as I shared ideas (Autobiography, 1991).

Dawn felt that she had been very product oriented and had preconceived notions of how she wanted the children to respond.

In the course and timing of change, Carly is less clear. She thinks that transfers from one school to the next, and fellow teachers who took her 'under their wing' were major influences. New programs such as the Writing Process and Individualized Reading were also influential in forming her teaching strategies.

Brett, on the other hand, is very precise about when the change began for him. It grew out of dissatisfaction with seeing students fail to make progress through the instruction of the day, three reading groups and lots of comprehension exercises. Along with this Brett states, "I was becoming bored and dissatisfied with my teaching and really without realizing it was seeking to change." Brett was not able to make the change while working at Polar School. He had to move where new ideas were better supported.

The following year he was hired at Hill Elementary School to implement a three year Fine Arts Program. At a workshop on Language Arts, "I saw for the first time a new way for me to teach reading and writing which was very different from what I was doing." Prior to this Brett describes himself as an extremely shy person "up till now I had hardly spoken a word in a staff meeting, still shy, passive, quiet, reluctant to voice my opinions. But when I got hired at Hill something inside me said this your chance to become more assertive and change." Moreover, Hill School provided an encouraging supportive environment.

Encouragement was also there in the form of a mentor from District staff and the Principal at Hill "who expected and gently prodded, and my wife who had faith in me that I could do it. These forces happening at once as well as the Whole Language program coming into existence as a valid way to teach I think

were the motivations that changed my philosophy, outlook, approach, style and thinking about teaching." (Autobiography, 1991).

During the years in which Brett changed his teaching style the following books influenced his thinking: Jon Stott, *The Family of Stories*; Terry Johnson, *Literacy through Literature* and *Bringing It all Together*; Faye Brownlee, Susan Close & Wingren, *Reaching for Higher Thought and Tomorrow's Classroom Today*.

3.1.5 Current Influences

This section attempts to list books, programs, processes and people which are currently influential factors in the teaching lives of the team. Here current means since 1988 and to the present day.

Brett specifically identifies the following books and authors as current influences: Charlotte Huck, *Children's Literature in the Elementary School*; Kieran Egan, *Teaching as Storytelling*; Johnson and Johnson, *Cooperative Learning*; Cochraine, *Reading, Writing and Caring*; Vgotsky and numerous journal articles. The Draft document of California's new science curriculum and Selma Wasserman's *Are you Afraid of Spiders?* are the only science print material Brett referred to as being influential.

Carly identified five books which have an influence on her teaching. She

mentioned Terry Johnson's books, *Literacy Through Literature*, *Bringing It all Together*, *Reaching for Higher Thought* and *Tomorrow's Classroom Today*. Dawn also mentions the same books as Carly and Brett.

All three teachers attended many workshops in the past three years that were directly related to the Year 2000 and the New Primary Program. Carly mentions four workshops that spurred her on, presented by Susan Close, Julie Corday, Jon Stott and Margaret Reinhart. Brett's opportunity to work with fourteen science teachers on the evaluation of science material for the Publication Branch of the Ministry of Education was an influential event in terms of science teaching.

I think that my job and the stimulation of interacting not only with fourteen other interested science teachers but being immersed in science materials good and bad helped me to realize the key role science and its concepts could play in helping children learn and discover, (I had previously almost ignored science or relied on a text). Having reviewed a few excellent materials I came back home all pumped about wanting to do lots of hands-on discovery science. My two partners could hardly contain my enthusiasm as I was going on and on about how science and structures, patterns, etc. Once I got it all out they brought me down to earth and agreed science too was what they wanted to see in their program as well. (Autobiography, 1991).

All three members of the team stressed how much they influenced each other as they worked collaboratively in their new setting at Westview School during the research project.

3.2 Coming Together As A Team

The description of how the three teachers came together to form a team is included here as it provides background information which helps the reader understand the difficulties and problems associated with initiating voluntary, collaborative teaching.

In 1989, Brett joined the teaching staff at Carly and Dawn's school because there were some exciting things happening in its Primary Department. He found himself as one of five grade 3 teachers there. He was located in a portable hut so team teaching was out of the question. Brett soon became the Primary Contact person and initiated discussion on the new Primary Program. Through these discussions and "hallway talk", Brett, Carly and Dawn began to consider working together as a team. Other teachers were interested in looking at multi-age teaching so a mini project was initiated and following its success the three teachers decided to teach in this way the following year. In the meantime due to falling enrollment Dawn became a forced transfer. This could easily have been the end of their project and their wish to team teach. Rather than give up, the three teachers proposed a collaborative teaching project to the Principal of Westview School. This proposal was accepted with some compromises. In Dawn's words the coming together of the team was through "good fortune", whereas Carly suggests, "Brett, Dawn and I came together perhaps through my

relationship with both, and the desire to have the best grade one and grade three teacher team with me."

Team teaching at Westview involves not only team teaching, platooning, integration of subject strands (and integration of students with special needs), multi-age classroom organization, the implementation of the Year 2000 Primary Program, but also the planning and development of curricula. This was an intricate and complex task requiring not only understanding of the curriculum, its diverse methodological practices and how children learn. It also required sensitivity, respect and trust as working partners. Dawn referred to the working relationship as one that "requires idealism, hard work, enthusiasm, love of children, knowledge of human growth and development, curiosity, tough egos, accountability to each other, to the children, to their parents and to the administration."

3.3 Reflections on Planning Science Curriculum Discovery Boxes

In his autobiography Brett recalls the planning stages of the science unit.

We got together several times to plan or sketch out science themes as well as the rest of the programs and other details of team teaching, planning, and multi-aging. Some of the ideas we had for introducing science and creating little scientists were shelved as the year began because the newness of what we were trying to do took our energies elsewhere. We decided to do "hands on" got hold of a couple of books (teacher published) that contained hands on experiments and used that as our program for the first part of the

year. (Sept. to Nov. 1990). Being a team and sharing the responsibilities as well as support helped us to accomplish doing the kind of science we wanted to do. Collecting materials can be sometimes frustrating and at times an awesome task when you are trying to deliver the other parts of your program and I think that's why maybe many teachers opt not to do much science or rely on textbook and end up doing teacher directed and demonstrated experiments. Working together and sharing ideas or information when something doesn't go quite right like directions or class management of experiment equipment (spilling etc.), and the responsibility and accountability you have to your partners to not drop science because something goes wrong (Autobiography, 1991).

In the early planning stages of the Science Discovery Boxes he states:

We knew in our planning that we wanted to put more physics into our program and decided upon Machines as a way to do this but had not discussed the approach or method. Through continual discussion of how to get the responsibility of planning and responsibility of learning into the hands of the children the discovery box idea came about. Using our limited knowledge (high school, university courses in science) as well as our library resources which was next to nil we began to plan out the what and the how of Machines and Discovery Boxes. The sheer gathering of materials, the thinking of how to take the kids to the next step was almost insurmountable and I know we would have given up if we were not working as a team and sharing ideas and jobs (Autobiography, 1991).

Once the Boxes were developed and had been used by the children Brett thought that there were some successes and failures that would guide the team when using the Discovery Box approach again.

We also discovered something that I think helps to shape our

thinking not only in science but also in other parts of the curriculum as well, and that was that process was far more important than product. In reflecting, the children overwhelmingly said that the part they disliked most was the recording of information all the time (Autobiography, 1991).

After having spent so much time and energy to develop the science Discovery Boxes all of the team thought that they would use them again, with some changes.

Dawn: We are working on a three year plan. It's the discovery model we like, um.... we talked about doing a whole unit on wheels, didn't we?

Brett: Yes, and we're...I also thought about ah...making the Discovery Boxes not necessarily focusing on one strand but maybe a...multitude, there might be a Wheel Box, a Rocks Box and a Shell Box...so that there isn't a unity there, in a sense that the Machines (had), a unity more in the sense of processes.

Carly: We talked about it being a Center too, something that would be on going.

Brett: And not necessarily be product orientated; or the children writing down ahh...self evaluate, and making it more of a "process" as they work through it.

The Science Discovery Boxes were done in family groups (multi-age groups) and the teachers reflected on the children's experiences. The teachers were dissatisfied with children's written work.

Dawn: Science means duplicating something over and over again and you

might not get the same results each time you do it. So, maybe, you know, we had to talk about that. You know in another context this week and last week about something else and so maybe they did learn something that way...I think. We were unhappy with the write-ups.

The teachers were more pleased with the children's written work following the structured science demonstrations.

Dawn: With what was written down as their knowledge, you know, with what they had acquired, and they seemed to do better because...after we did our demonstrations. That's when I had them write the answers to the questions and the write-up after the demonstration.

The team observed that in mixed age groupings, the ages and personalities of individual children determined who were leaders and who were followers.

Brett: ...sometimes I've found three (grade threes), the four students (year four) would take over...the reluctance of the younger ones might be, oh you know, they would sit back and do a lot of observing; now that's not in all cases. Sometimes it was the year two's, they were sort of the ones that were the...(initiators). It really depended on the group and the personalities of the group, ...seemed to function the best.

Dawn: Maybe that's okay too because certainly I would never have tried this with a class of year two's all by themselves. It wouldn't have worked.

Carly: We know that their role will change...so they won't be cheated out of being the leaders, the manipulators of the material.

With regard to putting this unit together and presenting it to their students the teachers felt that it was different than any science they had attempted previously.

Brett: It was the three of us because I tried the physical sciences last year and ahh...by myself and it petered out after a while. For one thing it was too much work to try to get all the stuff and keep it going and all that.

Carly: And that's happened, not that you want to chuck the whole thing, and ahh...working in a threesome has helped work in other areas too.

3.4 Summary Analysis

To summarize, the three teachers have a diverse educational background, Brett with an academic major in Canadian History, Carly with one year of sciences and mathematics, and for Dawn a concentration of Psychology and Sociology. Their professional majors were Art Education, Drama and Early Childhood Education. Their in-service training is far less diverse. In their professional training and in-service training there is no mention of science with the exception of attending a limited number of workshops such as "Snails in the Classroom" and "Hands On Experiments for Primary Grades". All three concentrated on "Whole Language" and children's literature and to some degree "Math Their Way."

This study finds contrary to what many teachers believe, that these three teachers with little science background successfully taught science. A science background may be beneficial but it is not necessarily the most important factor in developing and teaching a science curriculum. This is revealed by the examination of the team's work and reflection. All three teachers changed their teaching methodology, sparked by dissatisfaction. Carly's change occurred primarily because of school transfers. She had a vision of what she wanted to do and finally was able to attain this by being transferred to a school that matched her 'philosophy' of teaching and provided the support of the implementation of the "Writing Process" Program. The timing of Year 2000 Draft was perfect because it provided greater freedom in the selection of teaching strategies, classroom grouping, and its view of the "whole child" as a learner.

Dawn also was dissatisfied with the rigid classrooms of the past and that was her main reason for remaining as a kindergarten teacher. She welcomed the Year 2000 initiatives and embraces its approaches.

I am a facilitator. I want children to become lifelong learners. I want children to learn to take risks...I want them to know that whatever they attempt will be accepted and valued...I want them to feel safe and respected and loved. I want them to be aware of the infinite possibilities that the world of books provides. I want them to learn to work and play cooperatively, to appreciate what they each have to offer, to share their wisdom with each other for

the betterment of all...I want them to have fun (Autobiography 1991).

The changes the teachers experienced were encouraged by practices in the Language Arts, such as Whole Language and the proposal included in the Year 2000 Draft Document. For these teachers, professional and personal change and growth are synonymous. Brett used to be very timid, not voicing his opinions for nearly twelve years of his career. His personal changes are dynamic as he took the leadership role and shares his knowledge of Children's Literature with colleagues. His enthusiasm for science teaching was a direct result of working with other science teachers at the Ministry of Education in Victoria. Carly and Dawn's personal changes are less obvious and are related to becoming mothers and developing a greater sensitivity to children and their parents. Dawn used to be product oriented and spent time designing student material with preconceived ideas about how she wanted the children to respond. Dawn states: "I am now more interested in teaching children how to access information rather than presenting a neat and tidy theme." This notion of having to have a product at the end of a learning experience was very evident in their work with the Science Discovery Boxes and was the cause of dissatisfaction with the quality of the student's work. The students also expressed unhappiness with having to do written work to prove what they had done with the Discovery Boxes. This was the single most negative factor encountered during the use of the Science

Discovery Boxes.

While engaged in using the Discovery Boxes the teachers looked for curiosity and positive children's attitudes and not so much the understanding of the scientific principles presented. The principles of "how things work" were not stated in the teachers' planning scheme. One cannot assume that the principles were not discussed and understood by the teachers, however, the researcher did not establish that the teachers understood the science principles involved.

During the presentation of the Discovery Boxes the teachers made constant adjustment and change as they observed the children closely. As a result, the teachers reverted to conducting whole class demonstrations.

For Carly the change in her science teaching was linked to the introduction of a thematic approach to teaching, the Math Their Way approach, and the absence of a prescriptive student science textbook.

Carly: Exploring science, and where they, you know have to read. We want them to, I want them to experience rather than read.

Carly also indicated that you really have to rely on yourself because the text book is not suitable for Primary grades, and even the kits that are available from the District Resource Center are often incomplete and inadequate.

It is the lack of suitable primary materials, and science teaching strategies

that drive teachers to develop suitable, "rich" science experiences for young children. And, as is evident in this case study, collaborative planning, its translation in 'class field testing', reflection and adaptation made it all possible and a dynamic experience. Brett states "Being a team and sharing the responsibilities as well as support helped us to accomplish doing the kind of science we wanted to do." And in a later interview he goes on to say that if it were not for the team he would have abandoned doing physics with his class long ago. He had tried last year to do it on his own and it was not very successful.

In answering the three research questions posed in phase three it is clear that the teachers' perceptions of teaching science are deeply imbedded in their collaborative planning and teaching. Their teaching methodology and strategies were a direct result of using the Discovery Boxes as a way to introduce children to the discovery of the principles of "How Things Work". They reflected on their work and the students' evaluation as a team and saw their first attempt at using Discovery Boxes as a field-test and discussed how they would change it for next year. They felt that this was a worthwhile way to bring some physics into their classrooms and thought that they could expand the Discovery Box approach to include a wider range of science disciplines. Most importantly they decided not to abandon the Boxes upon the completion of this project. The teachers also found and came to terms with the notion that the process the children are

engaged in while using the Boxes is of greater importance than the product.

Facilitating factors can directly be attributed to the Year 2000 Document because it legitimized the use of a multitude of teaching strategies and recognized the professional skill that teachers possess. It also made the teachers' initial proposal for multi-age grouping acceptable at Westview School and this in turn set the stage for the teachers' collaborative creation and teaching of their science curriculum. The teacher felt that there was a direct match between their class science activities and the science component of the Primary Document.

The Discovery Boxes can be viewed as part of the Physical Science Strand in the Primary Program. It was also hands-on and exploratory allowing the child's curiosity to direct his/her activities during the first three sessions. This leads into more structured activities, the challenges, and then culminating in teacher directed demonstrations. By examining *Science Is Happening Here*, (Ontario Ministry of Education, 1988) as presented in the Primary Document (p. 125, 127) and reviewing the transcripts of this study, Discovery Boxes can be seen to support those concepts that make the curriculum integrated, child centered and encouraging of talking, writing and doing.

By using the Science Boxes, there also was a balance between individual activities, small group activities and large group activities in the form of sharing

and demonstrations. The learning dimensions of attitude, skills and knowledge were also addressed and the activities and family-grouping of the children allowed for a wide range of abilities and were not restrictive. There were opportunities for critical and creative thinking in both teacher directed and child initiated activities. Making connections across the curriculum was not evident. The students experienced difficulties in making connections between the science concepts and scientific principles presented and the real world. There was no self or peer assessment of their work. Instead there was student evaluation of the use of the Science Discovery Boxes.

This study set out to examine how teachers create, and translate their own science curriculum into a classroom setting. In order to do this their past experience as well as the actual process was investigated. This study showed that collaboration was a crucial force that made the teams' work successful. The teachers spent more time during the interviews discussing the power of collaboration than in the development of the science unit. In their autobiographies it was the most dominant theme. The teachers not only discussed the positive aspects of collaboration but also identified specific personal qualities they feel are essential to team teaching and collaborative work. At the top of their list was respect and trust. One must, they thought, also be flexible, a risk taker and comfortable with oneself and one's teaching.

Being mature and experienced was also identified as being important, as was being responsible and accountable to each other and having a sense of humour. In short collaborative teaching requires being a true team player.

CHAPTER IV

CONCLUSIONS, DISCUSSION AND RECOMMENDATIONS

4.1 Conclusions

The primary purpose of this study was to explore how a team of three teachers interpreted the new Primary program as they planned and presented a science unit to their students. By using the "exploratory" case study method and collecting not only interview transcripts, samples of student work and also teachers' autobiographies the researcher was able to describe the work of the teaching team as they engaged in science curriculum development.

The conclusions of this study are organized around the three purposes presented in chapter one.

Purpose 1: to document how three elementary teachers plan a science unit collaboratively, prior to instruction.

Under purpose I three questions were posed:

What strategies do the teachers use to select the science content for their classes prior to instruction?

What resource materials were used for planning?

What kinds of interaction occurs among the team of teachers during the planning process?

In the selection of the science content the teachers strove for a balance among the three science strands, the Biological, Earth/Space and Physical/Science strand. Because there was very little available materials for primary teachers on physics the planning and development of such a unit was a welcomed challenge for collaborative work. The teachers used reference books and several 'teacher developed' materials to guide their planning.

During the planning process the teachers held three formal meetings for brainstorming and teasing out the how, why and what should be included in their science unit. They also spent many hours engaged in informal "in the hall" sharing of ideas.

By using the case method it was indeed possible to gain an understanding of the planning process. The collaborative process, in which ideas were presented, accepted, rejected and refined, was the mechanism by which the teachers created the Discovery Boxes, developed the 'challenges' and their changing approaches to inquiry science learning.

Purpose 2: to document how the teachers translate their pre-instructional planning into the classroom setting.

Under Purpose 2 three questions were also posed:

What unit of science study was selected and developed into a teachable unit?

How did the teachers choose a methodology of instruction for the science unit?

Which strategies did the teachers use to teach the chosen unit of study?

The teachers selected the Physical strand of science for this project and decided on the theme "How Things Work". To facilitate student exploration and inquiry the teachers constructed eight Science Discovery Boxes for each of the three classrooms. The development of these Boxes was not completed without stress and frustration. The teachers found it difficult to find scientific principles which could be illustrated through hands-on exploration with minimum directions given to the students. Their decision on teaching methodology stemmed from their belief that science should be hands on, exploration and followed three models of inquiry learning, 'free' exploration, question directed inquiry (the challenge) and discovery demonstrations.

Purpose 3: to document teachers' perceptions and reflections on planning and teaching the science unit.

Under purpose 3, another three questions were posed.

What are teachers' perceptions of the instructional methodology?

What facilitating or constraining factors did the teachers experience in

curriculum planning and teaching?

What part of the 'Science' in the Provincial Primary Document did the teachers perceive to match the science activities?

The children's exploration was judged successful. The teachers were particularly pleased with the children's exploration of the Take-Apart Box. The 'challenge' sheets used to promote understanding of science principles presented in the Discovery Boxes proved to be problematic. The teachers were unhappy with the children's work on these sheets, particularly with their inability to show understanding of the science principles involved. The children's written records were seen as a poor measure of what was learned.

The availability of appropriate materials, and the time required to assemble them were constraining factors. The teachers felt inadequate as they wrote the 'challenge' because they believed that they needed more science content background. In particular they thought that more inservice training and more science books, to guide curriculum development were needed. These resources they thought would help them develop specific questions to facilitate student independent inquiry and discovery.

The researcher found there was a correspondence between the dimensions (attitude, skills, and knowledge) the teachers thought important and included in their goals for the children's work, and those described in the Primary Program:

Foundation Document. The evaluation procedures used by the teachers differed from those recommended by the Primary Program: Foundation Document. In the project there was no student peer evaluation. The students were asked to evaluate the Science Discovery Boxes rather than peer evaluate their own learning.

At the completion of the study the teachers thought that they were still product oriented. They thought that children should learn and be able to show what they had learned by writing or enunciation of the science principles incorporated in the Discovery Boxes. The teachers realized that children at this age have limited vocabulary and language skills to describe and, or explain scientific phenomena. The teachers found that the children could show and tell that they had acquired a vocabulary to clarify their ideas. The teachers greatest discovery was that it was in the doing and talking while using the Discovery Boxes that children learn. The learning was in the action rather than in the formal recording of what they had found out.

Although the teacher grappled with many constraints they completed the project and judged it successful and will repeat it next year.

4.2 Discussion

Three themes emerged from the study which are worthy of additional short discussion. The study touches on each, but each is an area of continuing

interest and concern for teachers and administrators. The themes are collaboration, teacher innovations and its correspondence to the Primary Program: Foundation Document, and 'change' in the lives of teachers and their schools. They are discussed in light of the study but it is acknowledged that each has been, and will continue to be, an area for extensive research.

Collaboration has been a central focus for the teachers participating in this project. Without collaboration the project would not have continued. The teachers see collaboration as support, as a way to pool knowledge and as a means to clarify ideas and beliefs. Indeed collaboration became a way to 'live life in the school', with the team seeing themselves as a unit now and in the future. For these teachers collaboration is more than a means to an end. It is an end in itself involving mind and heart, a process involving intellect and emotions. Their perceptions of collaboration is much more encompassing than that presented and advocated in the Primary Program.

It is interesting that the collaboration process lead to enhanced perceptions of professionalism. Deficiencies and problems could be viewed overtly and need not be hidden. Accountability to each member meant they felt more readily able to justify their teaching methodology to others, including administrators.

While themes are identified for discussion and treated separately it is evident that they are interrelated and nested within each other. However, it is

interesting and challenging to identify the correspondences and dissonance between what the teachers did and what is advocated in the Primary Program. It is recognized that the continuing discussion will reflect aspects of both 'collaboration' and 'change'.

The Primary Program views the school curriculum as being in each teacher, embedded in curriculum content knowledge, knowledge of children and professional skills. These teachers thought that working as a team helped structure and articulate the curriculum. However, it was only at the projects end that they asked the children to evaluate the Discovery Boxes. Clearly these teachers adapted their teaching approaches as the children encountered difficulties but this is not the 'true' learning partnership advocated by the Primary Program: Foundation Document. The teachers did present different learning strategies, 'free' exploration, directed questioning, and demonstrations, and in this there is correspondence with the Primary Program: Foundation Document. It is interesting that the teachers saw their adult cooperation as a model for student behaviour and their use of multi-age grouping as representative of the ethos of the Year 2000 initiatives.

These teachers recognized that they were product oriented and had not changed. One could speculate that without the Provincial Primary Program, they would not have seen where they stood. As evidenced by this study these teachers were aware that they both changed and remained the same and their

actions and reflections are a patchwork of consonance and dissonance of the educational changes now advocated in the province.

Discussion of the theme of change is in many ways the most difficult and problematic. The discussion will be limited to a small number of issues thought to be significant by the researcher.

These teachers changed because they were ready. Each was dissatisfied with what they had been doing and sought out contents in which their change would be encouraged and supported. All three had a long latent period which preceded action reaching back in time measured in years.

It did not surprise the researchers that they wanted to participate in the research project. However, at the beginning of the project they expressed fear of the magnitude of the changes being advocated in the Province indeed, overwhelming was the word used by Brett. While all three teachers said they espoused the Ministry of Education's advocated changes they felt anxious with their translation into action. Beyond translation into action lay the question, how do I know that what they say I should do is what I have done? Reflection on this question continued throughout the project and guided on-going change.

The action in the classroom with the science unit took eight weeks. Participation in the project extended over one academic year. Even with this extended period of time and collaborative support the changes are uneven and spotty when judged against the Ministry of Education's recommendation.

However, for the group, and the individuals involved the changes are significant and meaningful. The support of others, the sense of camaraderie the extended period of time over which the changes were initiated and implemented illustrates what is already known. Human beings change their beliefs and behaviour slowly. However, it is significant that these teachers continue to work together. One can speculate that their further collaboration will sustain change and continue professional development.

4.3 Recommendations

The results of this study provides insights into the work of teachers as they planned their science curriculum. From these insights a number of recommendations have been generated:

- (i.) Pre-service science education training and inservice workshops should be treated with the same vigor as other areas such as Language Arts.
- (ii.) Teachers who engage in science curriculum development should be encouraged to do so and should be provided with funds for materials.
- (iii.) Teachers should be encouraged to network and develop a forum for the communication of their ideas.
- (iv.) Teachers should be encouraged to seek out colleagues with whom they can

work collaboratively.

(v.) Collaborative teaching should be encouraged at school, district and university levels.

(vi.) The three teachers did not enter into curriculum development and its implementation without having experienced some dissatisfaction with their own teaching and dissatisfaction with the limitations and constraints of the existing educational system. There is evidence in this study that change takes place over considerable time and does not necessarily occur because 'innovations' are being legislated by outside sources.

School Boards should encourage teachers to explore dissatisfaction with their teaching strategies and allow time for changes to take place.

(vii.) Educators at all levels should give greater recognition to the role that personal background and life experiences play in professional growth and the change process.

(viii) While collaborative teaching is in vogue and advocated by the Primary Program not every teacher may wish to work in this way. As individuality is recognized in children, it is recommended that it be recognized in adults.

BIBLIOGRAPHY

- Argyris, C., and Schon, D.A. (1974). *Theory in Practice: Increasing Professional Effectiveness*. London: Jossey Boss Publishers.
- Ball, S. J., and Goodson, I. F. (1985). *Understanding Teachers: Concepts and Contexts*. In S.J. Ball and I.F. Goodson (Eds.). *Teachers' Lives and Careers*. Philadelphia: The Falmer Press.
- Becker, H. S., (1952). In Goodson I. F. (1988). *The Making of Curriculum, Collected Essays*. University of Western Ontario, Canada: The Falmer Press.
- Berman, P., and McLaughlin, M. (1976). *Implementation of educational innovation*. *Educational Forum*. 40, 3.
- Clark, C. (1989). *Handbook of Research on Teaching, Third Edition*. Edited by Merlin C. Wittrock, Macmillan Publishing Co.
- Connelly, M. F., and Clandinin, J. D. (1988). *Teachers as Curriculum Planners*. The Ontario Institute for Studies In Education. Toronto: OISE Press.
- Connelly, M. F., and Ben-Peretz M. (1980). *Teachers roles in the using and doing of research and curriculum development*. *Journal of Curriculum Studies*, 12 (2) : 95-107.
- Connelly Michael F. Crocker, R.K., and Kass, H. (1985) *Science Education in Canada. Vol. I. Policies, Practices and Perceptions. Informal Series 60*. The Ontario Institute for Studies in Education. Toronto: OISE Press.
- Crocker, R. K. (1983). *The functional paradigms of teachers*. *Canadian Journal of Education*, 8 (4): 350-361.
- Crocker, R. K., (1984). *Determinants of implementation of an elementary science program*. *Journal of Research in Science Teaching*, 21 (2): 211-220.
- Dalton, T. H. (1988). *The Challenge of Curriculum Innovation: A Study of Ideology and Practice. Educational Policy Perspectives*. Redwood Burn Ltd., Trowbridge, Wiltshire U.K.: The Falmer Press.

- De Bevoise, W. (1986). Collaboration: Some principles of bridgework. *Educational Leadership*, 43 (5): 9-12.
- Denzin, N. (1970) in Goodson I. F. (1988). *The Making of Curriculum, Collected Essays*. University of Western Ontario, Canada: The Falmer Press.
- Dewey, J. (1983) in Connelly M. F., Clandinin, J. D. (1988). *Teachers as Curriculum Planners, Narratives of Experience*. The Ontario Institute for Studies In Education. Teachers College Press, Columbia University, Ontario (p.81).
- Driver, B., and Oldham, V. (1986). A Constructivist approach to curriculum development in science. *Studies in Science Education*, 13: 105-122.
- Fullan, M. (1982). *The Meaning of Education Change*. The Ontario Institute for Studies in Education. Toronto: OISE Press.
- Goodlad, J. I. (1975). *The conventional and the Alternative in Education*. University of California. Berkeley, California: McDutchan Publishing Corporation.
- Goodlad, John I. and Anderson R. H. (1987). *The Non-graded Elementary School*. Columbia University. New York: Teachers College Press.
- Goodson, I. F. (1986). *The Making of Curriculum, Collected Essays*. London: The Falmer Press.
- Hargreaves, A. (1989). *School based decision making: A Case study*. Unpublished paper.
- Herriott, R. E., Gross N. (Eds.). (1979). *The Dynamics of Planned Educational Change, Case Studies and Analysis*. Berkeley, California: McDutchan Publishing Corporation.
- Hord, S. (1986). A synthesis of research organizational collaboration. *Educational Leadership*, 43 (5): 22-25.
- Lieberman, A. (1986). Collaborative work. *Educational Leadership*, 43

95):4-8.

Leithwood, K. A. (Ed.). (1982). *Studies in Curriculum Decision making*. Symposium Series/13, The Ontario Institute for Studies in Education: OISE Press.

Lortie, D. C. (1975). *Schoolteacher: A Sociological Study*. Chicago: The University of Chicago Press.

Ministry of Education. (1989). *Primary Program*, Province of British Columbia. Victoria, B.C.

Ministry of Education. (1990). *Primary Program Foundation Document*, Province of British Columbia. Victoria, B.C.

Ministry of Education. (1981). *Curriculum Implementation, A Resource Booklet*. The Ministry of Education Ontario.

Nespor, J. (1987) The role of beliefs in the practice of teaching. *Journal of Curriculum Studies*, 19 (4): 317-328.

Olson, J. (1980). Teacher constructs and curriculum change. *Journal of Curriculum Studies*, 12(1):1-11.

Olson, J. and Russel, T. (Eds.). (1984). *Science Education in Canadian Schools*. Vol. III. *Case Studies in Science Teaching, Background Analysis*. 52. Science Council of Canada, Ottawa.

Orpwood, G. W. F. and Souque, J. P. (Eds.). (1984). *Science Education in Canadian Schools*. Summary of Background Study 52. Science Council of Canada, Ottawa.

Pollard, A. and Tann, S. (1987). *Reflective Teaching in the Primary School, a handbook for the Classroom*. Cassel Educational Ltd. London.

Pinar, W. F. (1988). "Whole, bright, deep with understanding: Issues in qualitative research and autobiographical method. *Journal of Curriculum Studies*, 13 (3): 173-188.

Science Council of Canada, summary of Report 36, Science for Every Student, Educating Canadians for Tomorrow's World, Canadian Publishing Center, Hull, Quebec.

Schon, D. A. (1983). *The Reflective Practitioner: How Professionals Think in Action* New York: Basic Books Inc. Publishers.

Shipman. (1972) *In the Challenge of Curriculum Innovation, A Study of Ideology and Practice.* Redwood Burn Ltd. Trowbridge, Wiltshire, U.K.: The Falmer Press.

Solway, D. (1989). *Education Lost, Reflections on contemporary Pedagogical Practice,* the Ontario Institute for Studies in Education OISE Press Toronto, Ontario.

Tomkins, Georges S. (1986). *A Common Countenance, Stability and Change in the Canadian Curriculum,* Prentice-Hall Canada Inc. Scarborough, Ontario.

Tye, K., and Tye, B. (1984). Teacher isolation and school reform. *Phi Delta Kappan*, 65 (5): 319-322.

Walker, F. Decker and Soltis, Jones F. (1986). *Curriculum and Aims.* New York: Teachers College Press, Columbia University.

Werner, W. (1987). Training for curriculum implementation. *Pacific Education* 1:40-53

Werner W. (1988). Program implementation and experienced time. *The Alberta Journal of Educational Research* 34: 90-108.

Wideen, M. (1989), in *Research Forum: Collaboration: Working Together For Successful Learning, A Journal Devoted to Educational Practice and Theory* V.5, Research and Evaluation Dept. of School District #36, Surrey, B.C.

Widmer, E. L. (1990) *In primary Program Foundation Document,* Ministry of Education, British Columbia.

Yin, Robert K. (1989). *Case Study Research, Design and Methods,* Applied Social Research Methods Series, Volume 5, Newbury Park, California: Sage Publications Inc..

APPENDIX I

Description of Science Discovery Boxes

THE EIGHT SCIENCE DISCOVERY BOXES

Each Box had a title and the following items were in each Box.

Box 1 Take-Apart Box

Old clocks, radios, calculators, and other household items (depending on supply/availability) e.g. toaster, cameras. Tools to use: screwdriver, wrenches and pliers.

Box 2 Lever Box

Flat sticks (like rulers) 30 cm long, weights, wooden triangular prism blocks (for fulcrum).

Box 3 Pulley Box

Small Pulleys, string, weights, washers, masking tape.

Box 4 Magnet Box

Several types of magnets (bar, horseshoe, etc.) items that were attracted to the magnet, and some that were not attracted.

Box 5 Water Box

The water-table, and or washbasins, eggs, salt (later these items were added) needles, magnets, teaspoons, styrofoam, and paper to construct sails.

Box 6 Roller Box (Inclined Plane Box)

Boards, wooden cylinders, bottles, spring scale.

Box 7 Wheel Box

Small top, chalk boards, cardboard box, wooden cylinders.

Box 8 Pendulum Box

String, pencil, paper clip, steel washers, masking taper, timer.

The boxes were introduced to the students as an extension of their "free play" or centers time. The first few sessions were designed for discovery only. After the initial sessions the science "challenges" were added to each Discovery Box.

APPENDIX 2

Sample of Challenge Sheets

DATE _____

SCIENTISTS _____

DISCOVERY BOX Inclined Plane Box

PROBLEM This spring scale measures effort.
How can you place the block in the box
using the least amount of effort?

WHAT WE DID

DATE _____

SCIENTISTS _____

DISCOVERY BOX Wheel Box

PROBLEM Fill a box with chalkboards.

How many different ways can the box
be moved across the room?

WHAT WE DID

APPENDIX 3

Guiding Discussion Questions

Copy of request given to all three members of the teaching team.

Each teacher was given the following excerpts from Connelly and Clandinin, *Teachers as Curriculum Planners*, and then asked to write their autobiography.

"So much of our personal practical knowledge is tacit, unnamed and because it is embodied in our practice, difficult for us to make explicit. Furthermore, teaching provides little opportunity for reflection." (p. 33).
To get this Connelly and Clandinin suggest..."Another tool we have found useful in reflecting on our personal practical knowledge is biography and autobiography. These two methods need to be differentiated somewhat. Autobiography is the telling of our own history, while biography is someone else reconstructing an individual's past." (p. 33).

By writing a personal narrative we can discover the highlights and emphasis education and teaching has in our life experience.

Because most of us have not tried any biographic retelling of our lives, we feel it is a most helpful starting point to exploring our personal practical knowledge. (p.39)

As suggested by Connelly and Clandinin an autobiography should not be less than five to ten pages, less than that will not capture the details of your life.

The following are suggestions that you may wish to include in your autobiography.

- things that had a strong influence on your teaching.
- things/events that may have fostered growth/expansion of your thoughts on education both theoretical and/or practical.
- support you may have received or not received.
- books that you have used/read.
- particular workshops or parts of one (workshop) may be even just an incident that was inspirational.

In the reflection/account of each other that you offered and suggested you would like to do I would like you to perhaps include:

- strengths of each other and how that enhances or makes neat things happen when working together.
- how is it that your personalities work so well?
- what would you recommend to someone else trying to get a team together and work.

APPENDIX 4

Sample of Interview Transcripts

Transcription of Interview I

Sample of Discussion Session with Team. No Researcher Present.

Transcription: Interview I

(Tape #1, side 1)

BA - subject #1(interviewee)
CB - subject #2(interviewee)
DC - subject #3(interviewee)
RE - researcher

(Introduction by BA)

BA reads from his journal:

What I originally wrote down was that we originally thought we would do a "Machine Unit" to teach some physics and as we (the team) talked more about machines it was felt that it would be best that ahh ... what did ... instead it would be best initiated using the discovery box approach. This we thought would provide opportunities to make the theme more child centered and directed. We then began to pull information from books we had available. I put them in brackets, we are a new school so our resource center is rather meager. So we got the books we had come across in the library and in our own libraries and we began to flip through them, sort of, get warmed up kind of thing. And of Ahh ... we began to look at some of the things we began to think about some of the boxes we could put together. We began to brainstorm on some of the simple machine principles that we knew about and ...

DC: looked up the ones we didn't know.

BA: "That's right!" and we realized that some of the principles of simple machines might be difficult to put together, or that they might become quite boring or ordinary, like the screw box or things like that. and at that point we couldn't really see a lot of interest coming from something like that. A further study of concepts, in looking at some centers we had already in our rooms i.e. like the water table, led us to enlarge the unit to "How Things Work". This we thought might help us to encompass a greater number of concepts

in the physical science realm.

BA: (addressing his group) does that sound accurate ?

CB, DC: mmm ... (all agreed)

BA: We then spent an evening after school to begin putting the boxes together. We wrote down the simple machine concepts: the lever, the screw, etc., as well as pendulum, magnets, electricity sinking and floating. I had received a grade three innovations package, in it was a unit called "Roll It". We decided that the inclined plane concepts were difficult to put in a Discovery Box so we replaced the Inclined Plane Discovery Box with "Roller Rocks". We have been gathering boxes and ice cream pails to use as Discovery Boxes as we have decided to do this unit. We then went to the science cupboard to see what we could use from there. We got weights, rulers and magnets, some compasses, etc.; not a whole lot as we are a new school. We managed to get two boxes together. gathering and finding containers takes a while, as we discovered much longer, because of our busy teaching schedule, and family schedules, and school schedules it wasn't until the following Wednesday that the two of us could stay and work more on the boxes.

CD: One of us had to go to a funeral!

BA: Well, I'm not gathering in to that (laughter by all three) why is the third person not working here ?

We managed to get four more done or partially completed. At this point we could begin the unit. We began January 28th.

RE: How long did you spend on that first evening putting the boxes together ?

CB: We didn't do too long. The first evening took about one hour, we did it about one hour, we started at about four thirty and by five

thirty we were gone. We just put a couple of boxes together. We did all the initial talking about the different simple machines and what might ... would go in it. Then we went to the science cupboard to see if there's enough.

All: (chorused) The second evening took a couple of hours.

BA: Did I forget anything ?

BA: I just sort of paraphrased in a sense the progress up to that point.

RE: Could I go back to the beginning when you thought you might do a unit on space ?

BA: Oh right!

RE: Then you changed your mind.

CB: I think it was because we booked the planetarium and we couldn't use the planetarium at that time. At the time it looked like we would start the theme on the machines in January because we couldn't get the planetarium until the end of February. (The teachers are referring here to a field trip to the planetarium and the problems with booking such a trip.) But as it turns out our machines are taking longer to get into anyway so.

DC: We've put a lot of emphasis on the biological sciences up to this point and we felt their need to pursue the physical sciences.

BA: And we thought maybe with the "Machines Unit" it could lead into the "Astronomy Unit" and then thinking back we thought, well, we'd originally thought of the "Astronomy unit" being the unit we would work as part of the project you are doing, and then looking at the difficulty of the "Astronomy Unit", it tended to be much more, I guess, teachers centered and directed; that maybe the "Machines Unit" might provide us with the opportunities of a

more child centered approach.

CB, DC: (both chime in) ... we felt the need to do more child centered activities which is the direction of the year 2000.

(Break for tea brought in by other colleges)

(End of tape I, Side 1)

(Tape IV, Side 1)

Discussion Session with Team
No Researcher Present

Historical Background

What is it in your past/present that enables you to create a science curriculum, and to work together collaboratively as a team during a time of educational change and implementation ?

(Introduction by DC)

DC: We have discussed the characteristics that we think we share, and now we are going to talk about the whys ... We listed the characteristics as being adaptable, relaxed about our teaching. We like to share ideas, we used the term synergy, we decided that we were risk takers and that we enjoy shop talk and ... we think that, that the why of all those things is probably what you are interested in.

DC Shoot ! Okay !

BA: Ahh ... maybe the best way is almost (to) do a tiny little interview, like for you ...

CB: What ?

BA: Ah ... What has it (is it) in your life that ... ?

CB: In my life ?

BA: ... that makes you, what is it about you, that say ... is willing to try.

CB: BA why don't you start because you have already done your autobiography ? I haven't thought about myself.

BA: Okay. Well ahh ... I'll have to rehash it. Basically to me it was ahh ... somebody making some expectations on me. And also in my own

personal life I had, I was building more confidence and self-esteem about myself. Umm ... I think having children and all of that has a way of ahh ... a way of making you feel ahh ... more comfortable ahh ... with yourself and ahh ... The whole move to Hill School sort of created a situation where I ... Nobody knew me there so I wanted to make a change, or a change was happening. It was logical and ahh ...

CB: Yeah !

BA: And by doing that ...

CB: It was like starting all over.

BA: That's right, yeah it was like that and ah ... and I could get myself out of ahh .. a box that I had created for myself, or had been for six years. But I think a lot of it was too that Marie (principal at Hill School) not only expected, but she trusted that I could do it, I could deliver it.

DC: Ah ha ... and by gently motivating and prodding and that kind of thing brought out those qualities or those things maybe that had been buried way back.

CB: So you had to live up to your expectations.

BA: Yeah, I tried and I don't like not to live up to my expectations because I get embarrassed or whatever, so ...

DC: Yeah !

BA: I didn't want to let anyone down by doing that, so I took on the responsibility. I was given the responsibility which I hadn't been given before in a real way and ... people listened, they appreciated. I had a chance to get into some sharing ahh ... of ideas there that ah ... I got some workshops which really stimulated me about children's literature and I brought back that information to the various members. And was really turned on to the whole

literature, children's literature program and, and other people seemed to be interested and wanting to hear about it, and we sat down and we talked. Through that all those I think (DC completes his sentence)

DC: experiences ...

BA: experiences ahh ... collectively ahh ... just allowed me then to ah have a sense of ah ... willing to try new things. In fact it wasn't a big deal anymore.

DC: It was a big deal !

BA: Whereas before I wouldn't ...

DC: Is maturity part of it that too ? Where we are not ...

BA: So, I think it has to do with maturity.

CB: Yeah !

BA: At twenty-nine there was no way I would sort of ...

DC: You become more comfortable about yourself, with yourself and ... and this is ... And this is what I am.

BA: You are more comfortable with who you are, and this is what you are, and you're okay.

DC: I'm okay, I'm okay !

BA: And I think too ... given the opportunity when ah ... Nina (district resource person) and whoever the Social Studies Helping Teacher was came around, did a project and then I had to get ah ... people and do workshops which was I mean totally beyond ... you know.

CB: Yeah.

BA: ... ah ... it stretched me even further which hadn't happened so far. And ahh ... by doing that I think that stretching process gave you

a sense of "Yeah, I can do this !"

DC: Ah ha ! (pause)

CB, DC: So ?

DC: Does she (the researcher) want to know what it is about us as a person that make us come together ?

BA: That's part of it.

CB: You know, like the fact that you love people or that you've always been a people kind of person.

DC: Yeah that kind of ...

CB: Okay you know growing up lots of ... you know, having lots of friends and I liked other people and was involved in Girl Guides and Rangers and umm ... you know that kind of thing.

DC: Maybe that sort of stuff is the stuff for your autobiography part. I find that interesting because that certainly wasn't the kind of person I was.

CB: No, oh really ... surprised !

DC: I was more of a loner. I would suspect that you were too.

CB: Yeah ?

BA: I was the kid that, I tended to be alone. I only had two very extremely close friends all through school. And that really all ... and very much timid in the sense of ...

DC: Not a risk taker joining in. Like I wouldn't sort of (get) into a group sort of mess about. I still don't do that in party sort of situations. I feel comfortable around people I know and I can let loose um ...

CB: So maybe I've got you guys. I'm just the boss

kind of thing.

DC: Yeah.

BA: Yeah, probably.

CB: I want you guys, since you're gonna do some stuff here ! I'll get you before Shelly does, sort of thing.

(laughter and chatter)

DC: What makes us adaptable ? Do we feel good enough about ourselves that.

CB: Yes, I suppose that must be what it is, that ... we all come from a really solid, loving kind of family.

DC: Yeah.

CB: Don't we ?

BA: Yeah, I do ...

CB: And I think we all have a pretty good self esteem, and that, you know and that ...

BA: And we probably trust people faster than maybe others do.

CB: Yeah umm ... yeah.

BA: And tend maybe to be more open, and expose ourselves.

DC: Yeah, sure !

BA: than other people do.

CB: Yeah, that's probably very true.

DC: I wear my heart on my sleeve.

CB: That's true !

DC: And so if somebody has an idea we are willing to give it a shot and if it's a stupid idea we

tell each other so.

BA: Yeah.

CB: And we are not the kind who only think our ideas are our ideas.

BA: And you don't have that ownership that's ...

CB: Yeah, sure.

BA: (If) your idea doesn't go your way I'm taking my ball and going home.

CB: Sure !

DC: And I think that's something we have.

BA: That's key to the changing thing, of people working together.

CB: Not getting hurt feelings over something.

DC: No.

CB: Yeah, that's right !

BA: And I think some people on our staff do have that.

CB: Yeah, and certainly Dean (another staff member) at the staff ...

DC: Oh yeah !

CB: And maybe that's why we sought each other out too. We knew we could be honest with each other and not worry about hurting each others feelings or how a person would take it or ... yeah, yeah.

DC: I'm finally so relaxed about what we are doing.

BA: I think we're ... even going to, into it for the first year and I think we'll get probably more, even more so this year as the time goes on. Umm ... we had worked out the program and

thought it was good.

DC: Ah ha !

BA: We weren't trying to do too much at once. And ah ... even though it was a big step, I mean some people would see it as a huge monstrous step, what we've done because we've done two or three things here; we are teaming, we're in a sense platooning, multi-aging 'cause that's what trading ... kind of thing is.

CB: That's right, you really, you really build yourself up when all of a sudden you're not just working with twenty children, but working with forty. Because we are consistently working with forty children that we were responsible for, so you ahh ... add. So you add, you're definitely getting extra work there.

DC: We are not afraid of hard work, obviously not.

CB: Or the time, or the time, and we had to be creative sometimes with the time, like where would we get the moment and that sort of thing but ...

BA: And ahh ... I think we are committed to teaching because anybody who comes in two or three weeks before school starts to ... there's not too many out there that are ...

DC: ... to kids too (committed), to the education process. I think you know we genuinely I think the three of us really care about kids, enjoy kids and get a kick out of kids.

CB: Yeah !

DC: Yeah, and something that BA was saying a little earlier when you left the room umm ... we could sit and shoot the breeze like this about, you know, teaching the kids, and engage in shop talk and not tire of it.

CB: Yeah, like we did when we went to Keats Annex with a paid sub, and we went and we had a day

with them. We didn't leave early like the other group did, and we did ...

DC: I think they may have gone to another school, but anyway.

CB: And then we went to trout lake and talked for two more hours and then we went out for dinner and talked for two more hours and then ... Yeah you know we didn't turn around and come back after our time at Keats Annex. And we are friends too, and we enjoy each others company.

DC: Yeah and when you two came together that way, but I mean you know, you already had that prior knowledge but I hardly even know you BA !

CB: No, that's true !

BA: I think you were probably relying upon CB.

CB: You trust me ! That's what it was, wasn't it ?

DC: I hardly even know you, you were in the portable, and who are you ?

CB: See the other thing is, I feel that each one of us had something different to offer, you know. I wanted to learn from BA, I wanted to offer you know. I wanted to work with BA because I wanted to learn more about literature based programs.

DC: Ah huh ...

CB: That's why I felt he would really be a good strong member of the team.

DC: Well I have always enjoyed working with people no matter you know, I can work with most people.

CB: Yet, yes that's something I've always found too. And you probably have, you get along with everybody.

BA: Yeah ... and ahh ... neither of us has ...

like certain people have their hidden agenda.

CB: That's true.

BA: ... they're self centered.

CB: Yeah, that's right !

DC: ... Empire building or whatever ...

BA: Yeah so there's another agenda why they are doing it.

DC: We'd all like to be rich and famous though.
(laughter)

CB: We'll do it together though !

BA: See I think down the road I think there's avenues open to us for ... writing some stuff, yeah !

CB: And the thing is too, I mean it may happen but I'm looking at the future. I don't see ... I see I see us together, I do I can't see us ... I can't see us leaving teaching. (laughter)

BA: No.

DC: Yeah, like Rick and I often talk about ahh ... if we win the lotto, and that kind of stuff. I can't imagine not teaching. I just can't imagine ah ... no, no ... We'll I'm tired now but come the first of August I'm back in the teaching mode again and ready to go.

BA: Yeah, sure !

DC: You know something else too, one of the reasons I'm increasingly more and more relaxed about teaching is because I've always had good views, you know that really honest. Nothing breeds success like success.

BA: Exactly.

DC: So if you have parents ...

BA: That's what I was saying, that, that when Marie (principal) did that she had, people were pleased and, and ... Yeah success breeds success !

CB: Yeah !

DC: And I never had that feeling about myself as I was growing up. But that's very much something since I have begun teaching I felt really ... like my very first report by a principal you know, talked about my confidence and dealing with parents and all of these kinds of things, I really, I never ever even thought I had till I saw it on paper. Then I thought well ...

CB: Probably it happened for me when I had Peggy as a student teacher when initially (I thought) I can't have a student teacher. What have I got to teach anybody, you know, or show her, or model or whatever. And then I had Peggy and she was here as this person from the university who, who had you know, all the new ideas and you know 'Terry Johnson' and all those guys sort of thing and she loved what I was doing, and it felt ... and I thought wonderful ! I've, I thought, well you know maybe I CAN do this or ...

DC: Yeah !

CB: 'Cause we're not people to blow our own horns. That's why it's so difficult to sit here and talk about it.

DC: That's right. We can try, and not look at that. (laughter)

CB: I'm just so pissed off I didn't know this ... (laughter)

(pause)

BA: What do each of us bring to the group that might be an area that ... ?

DC: I just sort of had a brief chat with her (researcher) and ...

CB: With who ?

DC: With RE, and no, at the school, she dropped in and she wants to know what's different about the three of us you know. Why do the three of us work together so well ? Why do other people find it difficult to do this ?

CB: You know I didn't realize we were so different. I kind of thought well if I, maybe other people could work like this. But you know I think she is probably right, that there aren't as many people as I think that could work in a (team) like this.

BA: See I don't see anybody else on staff trying.

CB: Well that's not true.

BA: I can see Lena ...

CB: Lena already, is already talking about it, so is Paul, they're talking about doing ... although what they're talking about doing is more like platooning.

DC: Lena could do what we are doing.

CB: I believe that Lena could.

DC: Yeah.

BA: Yeah, she's got the same ...

CB: And Paul could, maybe if they got ... I don't know.

DC: He's too new at the game.

CB: Yeah that's true !

DC: I think experience has a lot to do with this. We bring a lot of our life experiences to what we are doing.

BA: We are also of similar ages.

DC: Yeah we are similar ages, we've got kids that

we care about.

BA: So we all ... we are empathetic too ...

DC: Empathy ...

BA: Umm ... to the ah ... notion that I can't show up here because I've got something I have to ... family. There's no resentment.

DC: That's right, that's right ! Now for instance if one of us was single ...

CB: Oh yeah !

DC: ... you know that would be very different. It would be hard to get into that other persons shoes.

CB: That's just it you know, that's just it. I've ... You'd think they were so selfish, you know they have no children to look after you know, they have no husband you know and whatever, no wife whatever. Even the ones who don't have children ... (discussion continued for several minutes all talking at once)

CB: But you know then again, lots of people have kids but couldn't necessarily work together the way we do. Umm ...

DC: The risk taking is a key thing. I think it really is a key thing. I think what we are doing is, is fairly unique.

BA: Yeah it is ! It's not just 'multi-aging' it's more than that.

CB: But you know I kind of think we are doing it in such a safe way that it is not a risk.

DC: That is, that's smart. We had to push awfully hard to do this. Yeah and if we weren't confident in our own ability we would have backed down from that man. (referring to the principal)

CB: That's true.

DC: No way it was opposed by a principal. That's right ... to what we were about to do.

CB: And if we really didn't think it was the best for the children we probably wouldn't have (done it). Well we would have thought it's just another thing we could try haphazardly, flippantly.

DC: Yeah.

CB: Well lets try this !

DC: Yeah. Then we would probably have right back, backed up into a corner.

CB: Then we would probably each have ended up each having a single grade and then say, three afternoons a week multi-aging for art and music, and something like that. We would never have done what we have done ! We can't deny ...

BA, DC: That's right !

CB: And next is going to be even ... perfect, not perfect but I mean it's too early. I mean to be here even on the last day of school and it's you know I mean ... (some chatter)

CB: ... we are dedicated. We must be because we came together on our own time a lot.

DC: I think I believe in kids, you know I really believe in ... apart from the program I sort of trust kids. And I think a lot of people get hung up on the program and so the program has to be delivered in a certain way. Be very product oriented.

CB: And thing is too, what ... trying to be risk takers. Anyway (their own kids came in to talk) I know what I was going to say, I was going to say, in what we are doing, setting an example for the kinds of things we want our children to do, which is cooperate you know, cooperative groups, teaming, peer learning, peer ...

- DC: Risk taking, risk taking ...
- CB: I think we are modeling what we think children ...
- DC: What is that saying ? We want them to do as we do. Yeah, yeah. Expectations, expectations that's another word you talked about, Marie, soon and ah ...
- CB: The other thing is too, we have ... I don't think we have people waiting for us to fail. But we are being watched very carefully.
- DC: Yeah by administration and by parents.
- BA: More than probably we know.
- CB: We are being watched probably more than ... other teachers are even (watching).
- DC: Oh for sure. And just on time I shared with you, the ahh ... one of the parents in the class was asking with ... that social evening in the neighborhood. And there were a lot of Primary teachers there and they were really amazed ...
- CB: Oh !
- DC: ... at what we were doing.
- CB: Oh, oh !
- DC: It was ah ... Pat Ortiz.
- CB: Oh, whatever.
- DC: Or whatever at her place there were a lot of teachers there that were very interested in what we were doing and ahh ...
- BA: I think even for ah ... you know like Jackie and Cindy are going to do a similar thing this ... (they've) been at the game for a long time. They adopted it, seen as a ...
- CB: Do you know.

BA: ... a process to go through.

CB: You might be very right, that we could maybe work on some sort of, way of writing up what we are doing because maybe there are people who could do what we are doing. They just haven't even thought about it.

DC: And the way we have done it, so safely !

CB: Yeah I know, I know.

BA: It's safe.

DC: Yeah.

CB: It's safe you know and that's ...

DC: Yeah, you know and that's sort of ... I only have one drink when I go out and that's the kind of person I am. You know I'm a risk taker in some ways but I also know my limitations.

CB: How does ? (laughter)

DC: On the other hand ...

BA: I've ... I still basically have a ... perimeters that I do ...

CB: cross ...

BA: Yeah not cross over. I did even in my younger days. That's right your perimeters were wider then, they were wider but ... didn't get myself into situations ...

DC: Yeah.

BA: that I thought I couldn't get out of.

DC: Yeah that's right.

BA: I never would ... into a place.

DC: ... that you didn't feel safe ...

BA: ... that I didn't feel safe.

APPENDIX 5

Sample of Teacher's Autobiography

CARLY'S AUTOBIOGRAPHY

- born January 31, 1953
- eldest of three children
- strong, nuclear and extended family; grew up knowing all grand-parents, aunts, uncles, cousins, and great-grandmother.
- father was a draftsman, but I grew up hearing from all who knew him that he should have been a teacher; he was a favourite with my cousins and friends; very involved in Boy Scouts; also a talented artist.
- mother was a homemaker (stayed home); very involved, loving mom; Brownie and Guide leader; enjoyed crafts and various hobbies.
- I always enjoyed children; was a popular babysitter with neighbours and friends.
- worked part-time at Safeway from age of 16. This job put me through university and saw me to Europe twice!
- High school and first year UBC were sciences oriented. I took Biology, Chemistry, Physics, Maths (including calculus).
- original plan was to go into nursing. I took a year off after first year UBC to work and travel to Europe. Was to return to Nursing faculty but numbers were cut and I was out, so I joined another faculty "for a Year" with the intention of returning to nursing. That faculty was Education and I never looked back!
- took primary as my professional major and psychology as my academic major.

Piaget was a strong influence

- at the end of 3rd year UBC, I went to Leicester, U.K. for a 3-week practicum at Wolsey House Primary School. This was a British Infant school; very child-oriented, emphasis on the whole child. Individualized reading, hands-on math, daily physical education, cooking program with child-sized working stoves. I had read Sylvia Ashton-Warner and this school embraced her philosophy. I was impressed!

- stayed in Britain to live in London for a year. Worked at a clerical job by day and as an usherette at the National Theatre by night. The theatre has always been in my blood (my grandfather and aunt are professional actors) and this experience solidified it. Ron, my future husband, worked at the N.T as well, and studied at Drama school during the day.

- returned to Vancouver to finish fourth year university. The year was now 1976. Added Developmental Drama (2 courses) to my repertoire.

- three very influential UBC professors - Marian Ralston (Children's Literature), Roland Gray (Math Methods) and Kate Hawkhead (Primary)

- 1977/78 school year - Cultus Lake Elementary, 2/3 split, very transient area, trailer park, Indian reserve, low-rental (an exhausting year; thought I'd never teach again!)

- summer 1978, married Ron, chose to sub '78/79 in West Vancouver, worked at Safeway. Did not feel professionally fulfilled.

- after an incidental meeting with Roland Gray (at one of Ron's plays), I was encouraged to try teaching again and he sent me to see Terry McBurney.
- was hired by the school district for a position at Polar Creek school, on Sept 1, 1979. Grade 2/3 split.
- enjoyed teaching at Polar Creek but felt that something was missing. My program was very curriculum driven, ability grouping for Math and Reading, not much child-child or even teacher-child interaction; effective discipline was more important than effective learning it seemed. Met Brett at Polar Creek. We shared a classroom with two classes for a short period of time. Brett was very structured, very traditional.
- summer of 1980, took an Early Childhood Education course at UBC with Gaalen Erickson, a Danish professor who introduced me to the Danish attitude towards children and their learning. In particular, I learned about creating a positive learning environment for children, creating a setting where children can experience challenges at their own rate. Learning centers.
- Although I returned to Polar Creek with grandiose ideas after the summer course, I was limited by the lack of support within the staff and administration and by my own inexperience and lack of personal supplies (this was my 3rd year of teaching). I was teaching grade 1.
- having a baby in the summer of 1981 greatly influenced my teaching. I realized that each child that I taught was someone's most treasured

possession. It made me strive to do the very best that I could for my pupils! But I still felt there was more; teaching could be even more satisfying yet.

- a big influence was a move from Polar Creek to Valley School (a so-called "values" school that didn't impress me in the least, but one thing did impress me...) Math Their Way was compulsory to teach at this school, so I took a summer 1983 course in MTW. Now we were getting somewhere. This was exciting to teach! (My second son was born during this school year.)

- the next major step was a forced transfer from Valley School to Ming, because I wanted to teach half-time and numbers dictated my move. I was now a kindergarten teacher and here I felt truly effective and fulfilled. This was the kind of teaching I had longed for. I vowed to never leave kindergarten, learning centres, child-centered, "whole" child - it all felt so right! Moved to Casey Park Annex, 1986/87, to share a Kindergarten Day with Jill W. (I was now a mother of 3 - 2 sons and a daughter).

- again "numbers" dictated a short-lived move to Hill and then back to Casey (main school) for a 1/2 split, 1987/88. I was not pleased to be leaving kindergarten but was in fact, pleasantly surprised with the Whole Language approach and the Writing Process that Casey Park had embraced. Here I met Dawn, teaching grade 1 (her first year of grade one) and she was a colleague and also my eldest son's teacher.

- a fellow grade 2 teacher, took me under her wing. Impressions "reading

program (anthologies), the Writing Process, workshops and Professional Development activities with the likes of Susan Close, Julie Corday, Jon Stott spurred me on.

- the Primary Series of workshops 1989/90 were helpful. I went to them all. Not all were as good as I'd hoped, but I learned from each. Margaret Reinhardt was superb! She got me thinking about multi-aged grouping.

- Brett and I had kept in touch over the years and I notified him of an opening at Casey Park for 89/90 school year. He joined us. This was a "new" Brett, very different from Polar Creek days.

- books such as The Learner's Way (Reinhardt), Tomorrow's Classroom Today (Close, Wingren, and Brownlee), Literacy Through Literature and Bringing It All Together (Terry Johnson) have become pseudo-bibles and I never tire of reading and re-reading them. I have applied many (most?) of their strategies to my classroom teaching.

- Brett, Dawn, and I came together (perhaps through my relationship with both and desire to have "the best" grade 1 and grade 3 teacher team with me). We chose to volunteer to move to Westview (the new school) to remain together as a team. My particular specialty - Grade 2, The Writing Process.

- although I know there is room for continued growth and learning, I feel very satisfied and fulfilled with my role as a teacher now. My program is guided by the children's interests and my knowledge of the essential "curriculum."

- Dawn, Brett and I work very well together. We are honing our abilities to "fine

tune" our relationships. We want the best for our children and are united in our love and care for these "treasured possessions". We encourage risk-taking, and problem-solving. We celebrate successes of the children, however small. We model cooperative learning and peer teaching.

- my sister gave me a card, that I then framed. At the moment it sits in my home. In the fall it will sit on my desk. It sums up my goals for myself, as a teacher.

It reads: Enable me to teach with WISDOM

For I help to shape the MIND

Equip me to teach with TRUTH

For I help to shape the CONSCIENCE

Encourage me to teach with VISION

For I help to shape the FUTURE

Empower me to teach with LOVE

For I help to shape the WORLD