PROFESSIONAL DEVELOPMENT IN ELEMENTARY SCIENCE TEACHING USING VIDEO TECHNOLOGY

by

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ABSTRACT

Professional development and inservice training are often used as synonymous terms. However, for the purposes of this study it is useful to stipulate differences. From my experience as science consultant, inservice training has been a short term plan the objective of which is to ask teachers to change their practices after information has been presented to them. Inservice training seems to assume that teachers possess forms of professional knowledge that may lead to changes in their classroom practices. In contrast, professional development may be defined as a long term support for teachers who seek additional knowledge to guide their classroom practices. If teachers do not possess knowledge that will assist them in classroom practices, and they wish to do so, then the opportunity to acquire this knowledge should be provided.

Providing professional development opportunities to teachers in remote schools is a challenge. There are few people offering professional development opportunities and remote schools suffer when in competition with their urban counterparts. Even if experienced personnel were available, the cost of getting teachers to a central site or the presenter to remote schools is more costly than most school divisions can afford. This study explored video technology as a tool to overcome professional development problems of distance, cost and

shortage of presenters involved in professional development.

Central to understanding how video technology may be used to overcome professional development problems is describing how teachers respond to video technology. Video technology has the capability of presenting actual classroom practices demonstrated in vignettes. The vignettes used in this study demonstrated how teachers engage students in manipulating materials to discover scientific principles. A qualitative design was used to collect data on how teachers responded to these vignettes.

The data were collected from four teachers in three phases. These phases were initial interview, classroom observation and follow up interview. During the initial interview each teacher viewed the vignettes and was interviewed. Data were also collected during a classroom visit and follow up interview. Once the data were collected and transcribed they were placed on cards and categorized by topic. The data from one teacher were cross referenced by juxtapositioning the data with other data collected from that teacher. Data collected from each teacher were then cross referenced with the other teachers' data using triangulation. The data were then reported using a case study format which allowed this researcher to include his interpretations.

Three teachers reported that the vignettes were idealistic,

and none of the teachers discussed the main message of the vignettes. Instead the teachers used knowledge suggestive of knowledge categories constructed by Shulman (1987) to interpret the videotaped vignettes. Further, teachers framed problems with their classroom practice after viewing the vignettes. Three teachers framed problems with grouping their students for science and explored aspects of their framed problem. The notion that teachers frame problems and explore different aspects of their problem suggests that teachers engage in a complex mental process called reflection-on-action by Schon (1983, 1987). Since vignettes prompt teachers to critically examine their practices and provide information that is useful to them in solving problems with their practice, vignettes may be used as a professional development tool in remote schools.

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CHAPTER ONE

THE PROBLEM

1.0 Introduction

Professional development and inservice training are often used as synonymous terms. However, for the purposes of the present study it is useful to stipulate differences. Within the context of my experience as a science consultant, inservice training is defined as a short-term plan that tends to focus on specific issues or problems and is aimed at promoting changes in the teaching practice of participating teachers. Through inservice training it is assumed that teachers will gain professional knowledge needed to make hoped for changes in the classroom. In contrast, professional development is defined as a long-term plan of continuing education for teachers who are interested in continuing growth and enrichment that guides them in both theory and practice. In this researchers opinion, opportunities for professional development should be available for teachers.

1.1.Background to the Problem

Schools in remote areas are often small, with long

distances separating them from other schools and teachers. In these remote schools teachers may be alone in teaching a single or multigrade class, have few peers within the school, and have limited access to professional development opportunities.

Providing professional development opportunities for teachers in remote schools is a challenge. The few people providing such opportunities are in demand, consequently remote schools suffer when they compete with their urban counterparts. Elton, Oliver, and Ray (1986) note that not only is it extremely difficult for academics to be released for a few days to teach appropriate courses, but there is a severe shortage of available trainers. Even when experienced personnel are available, it is often too costly to transport teachers to a central site or move presenters to a remote site.

This study explored video technology as a tool to overcome the difficulties associated with the delivery of professional development opportunities for elementary teachers in remote areas: availability of presenters, distance, and cost. Professional development, using video technology, is a form of distance education in which information is made available to participants at a distance (Holmberg, 1979). This study will focus on how teachers in remote schools respond to videotaped

demonstrations of science teaching as one possible approach to providing professional development opportunities.

1.1.1 Using Video Technology in Professional Development. Advantages and versatility of videotape technology include (1) equipment needed to play videotapes is relatively inexpensive, simple to operate, and available in all school divisions and most schools; (2) once produced, videotapes are inexpensive and can be transported easily and at low cost; (3) they can be shown at the convenience of participants in terms of schedules and location; (4) participants can replay all or segments of videotapes for review and discussion; and (5) videotapes can include documentary material from classrooms to demonstrate teaching activities.

One disadvantage of video technology is that participants are unable to interact with the presenters. On the other hand, videotapes can be stopped and started at any time encouraging discussion of content among participants and interaction among colleagues. Fullan (1982) supports the notion of collaboration among teachers, stating that they should interact with one another, as teachers within the same school can better appreciate the context of teaching problems than someone not

involved with the school. Further to this position is the notion that teachers are the primary change agents in schools (Fullan, 1982, Stake, 1987 p.56).

1.1.2 Teachers' Professional Knowledge.

To change classroom practices teachers will benefit from understanding of problems associated with bringing about change (Fullan, 1982, Gunstone & Northfield, 1988). Central to changing teaching practices is the reality that the teacher must solve the problems that inhibit changing practices. Teachers' then must know not only the "what" or substance of change, but the "how" or process of bringing about the change. Teachers' actions in the classroom are what denote teachers as professionals. Therefore, it is of interest to this study to establish what knowledge teachers have and use to interpret videotaped presentations and frame problems with their practice. Teaching practice not only involves a complex form of thinking (Schon, 1983; Kilbourn, 1988), it entails the construction of a knowledge base. Shulman (1987, p. 8) states that teachers possess knowledge about their profession that can be identified and categorized.

If this knowledge is to be increased through professional

development opportunities, then it is important to better understand the process teachers use to acquire professional knowledge. Schon (1983, 1987) states that teachers construct professional knowledge by solving problems evident in their classroom practice. Further, he suggests that teachers then apply this constructed professional knowledge to new classroom problems using a process called reflection. By applying professional knowledge to a classroom problem and reflecting upon it, teachers are in a position to solve problems with their classroom practices.

1.1.3 Reflection

Schon (1983, p. 277) identifies a type of reflection germane to the development of professional knowledge as "reflection-on-action." He argues that when reflecting-on-action, practitioners use their own prior examples, practices, and images of teaching to frame a problem in their classroom practice. To solve the problem, the teacher initiates an action in the classroom. To initiate this action, the teacher draws upon information derived from prior classroom experiences. The teacher then reflects on the action to evaluate the consequences of the particular action. If the action does not provide a desired solution to the problem, the teacher may try again to

reframe the problem so it can be solved. By engaging in this type of problem solving, teachers gradually construct professional knowledge.

1.1.4 Research Method

This study involving video technology will determine if teachers reflect-on-action after viewing four videotaped vignettes. "Vignette" is defined as a pictorial representation such as a brief scene in a movie (Websters New College Dictionary, p.1315, 1983). The vignettes used in this study (see Appendix A) show teachers using materials in a science class. The main point of the vignettes is to show how students learn science processes such as observation, prediction, making inferences as they manipulate materials. Science processes are central to the science curriculum in Manitoba, where this study was done.

1.1.5 Videotaped Vignettes and Teacher Reflection

Kilbourn (1988) claims that vignettes, cases, and stories assist teachers in reflecting on their teaching practices. Videotaped vignettes of science classrooms may stimulate teachers to reflect-on-actions or practices pertinent to their science teaching. If vignettes help teachers reflect on their

actions, then videotaped demonstrations or vignettes of teachers teaching science should promote the phenomenon that Schon refers to as reflection-on-action.

Prior to reflecting on action, teachers may frame problems with their teaching practice and generate ideas for solving these problems. Dewey (1933) states that ideas are suggestions for action. After viewing the vignettes, teachers are likely to express ideas indicative of the professional knowledge that teachers use to interpret the vignettes, and it is these ideas that teachers express after viewing vignettes that are of interest to this researcher.

1.2 Specific Statement of Problem

This study examines the ways in which science teachers respond to videotaped vignettes. The following three questions are addressed.

1. What kinds of ideas did teachers articulate after viewing videotaped vignettes of elementary science instruction?
2. What kinds of professional knowledge did the teachers use to interpret the vignettes of elementary science instruction?
3. To what extent did teachers engage in reflection-on-action after viewing videotaped vignettes of elementary science instruction?

1.3 Implications of the Study

1. By collecting data on the ideas that teachers express after viewing vignettes, some insight into the constructed knowledge that teachers use to interpret vignettes may be gained.

2. The concept of reflection-on-action assumes that teachers become actively involved in the examination of their teaching practices. If teachers reflect on their actions, this study will provide useful information to understand better the problems teachers have in teaching science.

3. By using videotaped vignettes, this study will add to the understanding of how teachers respond to information provided by vignettes and determine the viability of vignettes as a professional development tool.

4. This study will contribute information to distance education. Minnis (1985) states that distance education is an emerging discipline and will grow only to the extent that its research base incorporates divergent methods of research. This study will use qualitative methods to determine the potential value of offering professional development over distances using videotaped vignettes. If videotaped vignettes can be used as a professional development tool, perhaps teachers in distant areas can be afforded more and more effective professional development opportunities.

1.4 Overview of the Study

This dissertation consists of five chapters, organized as follows:

Chapter One presents the context of the problem, the problem to be studied, and the three questions to be answered. This chapter also presents an overview of the theoretical framework and general approach to be used.

Chapter Two is a review of selected literature providing a rationale for professional development, a historical review of video technology used with teachers, and theoretical framework to guide the study.

Chapter Three describes the design and methods used to collect, classify, and interpret the data.

Chapter Four is a report of four teachers' responses to videotaped vignettes.

Chapter Five presents the answers to the three questions used to guide the study, as well as the major findings, implications of the study, and recommendations for further research and study.

CHAPTER TWO

LITERATURE REVIEW AND THEROETICAL FRAMEWORK

2.0 Introduction

This chapter reviews the literature, presents the need for professional development, establishes an historical context, and discusses the theoretical framework of this study. The first section demonstrates the need for professional development using teacher responses to surveys. The second section establishes an historical overview of television and video technology used in professional development. The third section of this chapter discusses the theoretical framework used to analyze the data collected in this study.

2.1 Professional Development and Science Teachers

If students are to be prepared for a changing world, teachers must be given opportunities to become informed of changes in the field of science education. Therefore, teachers must be given professional development opportunities.

Recommendations of the Science Council of Canada

In 1984, the Science Council of Canada reviewed the state of science education in Canada and made several recommendations regarding the professional development of science teachers. The report recommended that "science teachers should develop annually, in consultation with their school principals, a three-

year professional development plan setting out personal goals and development needs (in relation to the school science program) and strategies for meeting these goals" (p. 2). A second recommendation stated that "science teachers should use a minimum of 15 days annually for professional activities, five of which may be during the regular school year (i.e. at the school board's expense)" (p. 2).

While the Science Council's report identified the general need for more professional development, it did not address the particular problems related to meeting teacher or regional needs in regard to remote schools such as those found in northern Canada. To identify specific needs within these schools, the following studies were examined.

Manitoba Professional Development Needs

The Science Council of Canada's report (1984) was followed by a survey of science teachers in Manitoba. One hundred and fifty Manitoba science teachers of grades 7-9 responded to the survey conducted by the Manitoba Department of Education (1985), voicing their concerns about teaching science. Results indicated that 75% of the teachers never used the "hands-on method" in their science class. This was contrary to recommendations in the curriculum and to procedures promoted through inservice training sessions that since 1979 advocated a "hands-on methodology" for science classes.

Following the Science Council of Canada's report (1984) and The Manitoba Survey of grades 7-9 carried out in 1985, the Manitoba Department of Education conducted a second survey that focused on grades 1-6 science. This 1986 survey identified teachers' preference for local inservice training where everyone was engaged in the same subject area. Preference for local meetings was also identified by the Science Council of Canada (1984).

It is evident that since the curriculum suggests that teachers use a hands-on approach in science, local professional development opportunities should demonstrate students using materials. Since this is not always possible in a face-to-face or "live" context, this study examines the viability of video technology as one possible approach to offering professional development opportunities to rural science teachers.

2.2 Video Inservice Training: An Historical Review

Since 1969 television and videotapes have been used to inform teachers of changes in the education, and provide inservice training for science teachers. This section examines past use of television and videotapes for this purpose.

2.2.1 Video Technology used to Change Teachers' Practices.

Klabenes and Spenser (1979) videotaped teachers in their classrooms so that these teachers could assess their own

teaching practices. This study showed that teachers assess and change their teaching practices after viewing a videotape of themselves. Perry (1978) also used video technology for assessment purposes and found that when oral feedback was given as teachers viewed these videotapes, they changed their teaching practices. However, these studies did not indicate the specific nature of changes that took place. Further, neither study indicated the ideas the teachers articulated after viewing their videotapes. These studies implied that a single person interacted with the teacher. Having a single person interact with a teacher is time consuming, costly, and isolates the principal and other staff members who may have constructive ideas about solving problems with teaching practice. This study endeavours to use a research method similar to this professional development method while developing a group, school-based model.

2.2.2 Video Technology used in Inservice Training.

One concern educators have had about televised or videotaped presentations is the lack of communication between the presenter and the participants. A study by Neufeld & Birch (1985) presented data that compared a conventional teacher class presentation with a televised presentation to a class. In the study, 96% of the televised course participants rated the visual aids superior to those used in the classroom presentation. With reference to the attention to the message, 85% of the participants reported they were more alert during the televised

programs than in a traditional classroom and eighty-nine percent reported that they were equally or more motivated. Ninety-five percent reported a similar or more positive attitude toward learning than toward information presented in a regular classroom situation. This study clearly indicated that televised presentations were positively received by participants. However, Neufeld and Birch did not investigate specific ideas the participants expressed after viewing the televised presentation. It is those ideas that would indicate what the participants focused on and what knowledge they used to interpret the videotaped presentation.

Other researchers such as El-Meligi (1985) in Egypt report similar findings to those of Neufeld and Birch. El-Meligi reported that when teachers viewed videotapes providing information pertinent to their teaching, they developed a more positive attitude toward teaching. However, while providing teachers with pertinent information that may improve their attitude toward teaching, it may not improve their teaching practices. That is, a change in attitude does not guarantee that implementation of ideas results in classroom practice.

This study reinforces the notion that video technology can be a useful tool in providing teachers with professional information and will report classroom activities that take place following viewing of video material.

Video technology has been used to teach specific techniques. For example, studies by Aijuya-Dosemu and Talabi (1985), and Maugh (1985) examined the potential of technology to train people to maintain equipment. The first study produced videotapes on the maintenance of audiovisual equipment, and the second study used video technology to train teachers in the maintenance of aquaria. These studies showed that videotapes could be used successfully in teaching equipment maintenance techniques and verified that simple techniques may be implemented after viewing a demonstration of these techniques on videotape. However, teaching is a practice that is more complex than implementation of equipment maintenance.

The notion that video technology may be used to present ideas relevant to teaching practices has been tested. Jones (1973) showed science teachers videotapes of science activities being performed. He reports that 45% of the teachers, after viewing a videotape of these activities, stated that the videotapes improved their teaching of science. Again, this study did not examine the ideas or knowledge the teachers used to interpret the videotapes.

In another study, Sheldon and Halverston (1981) report that videotaped inservice training promoted positive attitudes toward science teaching. This research was disputed by Koballa (1982) who claims that Sheldon and Halverston (1981) did not delay the

post test long enough to test an attitude change. Furthermore, Koballa (1982) questions whether it was prior inservice training that affected the attitudes of teachers toward science teaching or whether it was the videotaped presentation.

Most of the research on attitudes use a process-product framework with various scales and instruments that have produced mixed results (Baird, 1988, p. 60). One reason the results may be mixed is that this is an inservice training model and teachers are expected to reproduce what is on the videotape even though they may not have the skills to do so. There may be an attitude change, but there may not be any change in practice in the classroom. An interesting point raised by Koballa is that past experiences may contribute to a teacher's attitude toward inservice training. Further to this observation by Koballa, there is evidence that teachers have experiences that provide them with knowledge that they bring to a situation (Koballa, 1982; Gunstone & Northfield, 1988). This previous knowledge may affect attitudes as well as the ways teachers interpret videotaped presentations. Another factor that may affect the findings of such studies is teachers' lack of science knowledge or knowledge related to teaching science.

To overcome a lack of science knowledge among teachers, Welliver (1969) and Shrigley, Johnson, and Wolfinger (1979) produced televised science lessons. They reported that these

televised science lessons used by teachers to teach science were successful in changing teachers' practices. Welliver stated that the teachers who used televised science lessons performed three times as many science activities as teachers who did not use televised science lessons. Shrigley et. al. (1979) also used television and produced science lessons containing pauses in them so that students and teachers could discuss the lesson. This approach was used for several years to guide the science program for a large area in Pennsylvania. Although videotaped science lessons changed teachers' practices, this method raises the question of teacher dependency on videotaped lessons. The question of dependency on the televised lessons was not dealt with by Welliver or Shrigley et. al.

This study differs from the studies cited above as it collected data on teachers' interpretation of videotaped vignettes. To interpret the vignettes the teachers must have used their professional knowledge. By analysing teachers' interpretation this researcher was able to determine knowledge teachers used to interpret vignettes. Further, this study collected data on teacher reflection-on-action. This data may be useful to determine if vignettes promote the development of professional knowledge. It is this researcher's opinion that by reflecting-on-action teachers may develop professional knowledge, promoted by, but independent of the vignettes. If teachers use professional knowledge to interpret vignettes and

engage in reflection-on-action then perhaps vignettes can assist teachers in developing professional knowledge that may lead them to improve their classroom practices.

An important study by Piper and Butts (1974) presented science inservice training using video technology. These videotaped science sessions were designed to motivate teachers to change their teaching practices. In this study, the same programs were transmitted to twenty-six teachers via videotape and to fifty teachers via colour/cable T.V. The videotaped presentations preferred to the colour/cable television programs. The reasons were teachers could view tapes at their leisure and replay them if they wished. In addition to preference, Piper and Butts found that the factors of experience and prior exposure to science inservice training did not affect the attitudes of the teachers toward the televised or videotaped presentations.

Piper and Butts claim that the teachers reported a change in the way they taught science but were not specific about changes that took place. The notion that teachers change their teaching practices after viewing a videotaped program is problematic. To change their practices, teachers must restructure the thinking that guides their practices (Schon, 1983; Kilbourn, 1988). The process used to change teacher thinking is reflection (Dewey, 1933) and more specifically

reflection-on-action (Schon, 1983, 1987; Kilbourn, 1988; Grimmet, 1988). Reflection, a mental process whereby teachers use past knowledge to frame problems and then apply knowledge about teaching to solve those problems, is discussed later.

2.2.3 Recent Developments

Wildman and Niles (1987) and Wildman, Niles, Magliaro, and Maclaughlin (1990) used videotapes to encourage reflection among student teachers. These videotaped vignettes of student teachers were used in conjunction with the supervisors' comments and questions. They suggest that student teachers were critical of their own teaching and a great deal of time was used to teach student teachers to reflect upon their teaching. When student teachers reflected upon their teaching, their teaching improved.

Mackinnon and Erickson (1988) and Noordhoff and Kleinfeld (1990) videotaped student teachers in classrooms. These studies encouraged student teachers to reflect specifically upon their classroom practices. As well, Mackinnon and Erickson (1988) used what they called "exemplars" of teaching to encourage reflection among student teachers. They state that video technology is a useful tool that can provide information upon which student teachers can reflect. Further, they claim that reflection is a process by which student teachers can improve their practices. This study differs from the work done by Mackinnon and Erickson (1988) and Noordhoff and Kleinfeld (1990)

in so far as data were collected on experienced teachers rather than on student teachers.

2.2.4 Summary

From the above studies, it is evident that video technology may have some potential for informing teachers. Neufeld and Birch (1985) state that televised presentations are preferred over classroom presentations. Piper and Butts (1974) have determined that video presentations are preferred over televised presentations. Koballa (1982) questions whether past experiences affected the attitude with which teachers view videotaped presentations. Piper and Butts suggest that past experiences did not affect the way teachers interpret videotaped presentations while Gunstone and Northfield (1988) reported that past experiences are important when teachers interpret presentations.

Klabenes and Spenser (1970) and Perry (1978) believe that videotapes alone prompt teachers to change their practices. Wildman and Niles (1987) and Wildman, Niles, Magliaro, and Maclaughlin (1990) hold that videotapes can be used to promote reflection, a process they claim is central to a change of practice. Mackinnon and Erickson (1988) and Noordhoff and Kleinfeld (1990) state that videotapes of student teachers promote student teachers to reflect on practices and change them. This reflection-on-action can be promoted among student

teachers by what Mackinnon and Erickson (1988) call exemplars. What is missing in the literature is data indicating that experienced teachers may also reflect-on-action when viewing vignettes of other teachers teaching science. The notion that vignettes of science classes should assist experienced teachers to reflect on their practice is the focus of this study.

2.3 Professional Development: A Theoretical Framework

Professional development for teachers assumes teachers are professionals and that they have knowledge germane to teaching practices. It further assumes that this knowledge can be identified and developed. It is the development of professional knowledge that should be the focus of professional development.

Professional development, related to changing classroom practice of teachers, has been called personal practical knowledge by Elbaz (1981) and Clandnin (1986). Erickson (1987) states that professional knowledge, which is unique to teachers, involves pedagogical principles and practices. Specifically, pedagogical principles and practices relate to methods, materials, and content, as well as classroom management (Court, 1988, p. 96). These pedagogical principles and practices are the shared property of the teaching profession (Crocker, 1983, 1984; Crocker and Banfield, 1986; Crocker, Dodd and Marfo, 1988). According to Darling-Hammond (1990, p. 32) how knowledge of teaching is fashioned and used in the classroom are what

constitute professionalism among teachers. If professional knowledge is specific to teachers and constitutes professionalism among teachers, then this knowledge should be the focus of professional development.

Shulman (1987) states that teachers' professional knowledge may be divided into eight categories. Four categories that pertain directly to this study are described below.

1. General Pedagogical Knowledge, is the knowledge category that refers to those broad principles and strategies of classroom management and organization that appear to transcend subject matter.

When Shulman states that teachers have general pedagogical knowledge, he suggests that teachers have knowledge of how to manage classrooms that need not be subject specific nor associated with an understanding of students.

2. Knowledge of Learners and their Characteristics suggests that teachers have knowledge of how students learn and develop physically and morally at different ages.

3. Knowledge of Educational Contexts pertains to the structure of learning activities that motivate students to learn, and how to establish and manage groupings within the classroom.

4. Pedagogical Content Knowledge is that special amalgam of content and pedagogy that is uniquely the province of teachers, and their own special form of understanding (1987, p. 8).

This category, according to Shulman, suggests that teachers must make connections among the first three categories.

Shulman's categories of professional knowledge are important and relevant to this study in so far as they establish a framework that can be used to organize the ideas expressed by teachers as they interpret the vignettes. Schon (1983, 1987) states that teachers possess professional knowledge as a repertoire of images, understandings, and actions that they use in their teaching. He also provides a framework that shows how teachers use their repertoire to think about their practices.

2.3.1 Schon's Notion of Professional Development.

Schon (1983, 1987) argues that professional or practical knowledge resides in practice. That is, Schon's notion of professional knowledge allows teachers to make sense of, and to function in, situations of uncertainty and changing contexts.

> A fundamental plank in Schon's argument is that professional or practical knowledge is undervalued in society whose academic institutions have traditionally prized knowledge produced by the sciences and humanities. There is, he argues, a special form of knowledge that professionals have and use, and this knowledge resides in practice, is constituted differently and held differently also. It is contextually dependent, arising out of particular puzzles and uncertainties that professionals are required to manage (Munby and Russel, 1989).

According to Schon, knowledge about teaching that appears in textbooks cannot be readily passed to teachers in a lecture theatre. His notion is that professionals [teachers] create

their own knowledge by solving puzzles or problems within classrooms. This solving of puzzles or problems is done through a specialized form of thinking called reflection (Dewey, 1933; Schon, 1983, 1987; Grimmett, 1988; Floden and Buchmann, 1990).

2.3.2 Reflection.

Court (1988) discusses reflection as capturing the essence of teacher thinking, because reflection on practice is teachers' thinking about teaching. It seems then that for a teacher to change his or her practice, reflection is necessary.

Dewey (1933) states that reflection follows the scientific model, which starts with a problem. That is, a problem gives focus and purpose to thought (Dewey, 1933; Schon, 1983). Further, this sort of problem solving in a work setting is a form of scholarship (Floden and Buchmann, 1990). An example of this kind of thinking, as it applies to teaching, is described below.

A teacher detects a problem with his or her teaching practices. This problem, which arises from the classroom situation, prompts inquiry. The problem is framed, and a solution is hypothesized by applying professional knowledge to the problem in context. This hypothesis provides possible actions which may be enacted to address the problem. In addressing the problem, the teacher derives possible solutions

that may be tested mentally, as in a thought experiment.

Thought experiments can be conducted in what Schon (1983) refers to as a "virtual world." He suggests that because professionals have developed a feel for the media and language of their practice, they can construct virtual worlds. In these virtual words, a professional can carry out imaginative experiments in preparation for action. That is, professionals may apply their knowledge to problems, hypothesize solutions, and test these solutions mentally (Schon, 1983, p. 166). These thought experiments can control the variables and juxtapose events at a rate convenient to the professional. Low risk is another advantage of conducting thought experiments in a virtual world. The professional in a thought experiment can test hypotheses without disrupting practice and through this experimentation may plan future actions by recalling and examining past actions.

To plan future actions, past actions must be analyzed and judged. Before past actions can be analyzed, however they must be brought forward and examined by a process called reflection. Reflection is a two-way process that looks back at past experiences and forward to future actions through planning (Grundy, 1986, p. 87; Grimmett, 1988).

Shulman (1987) states that reflection is what a teacher

does when he or she looks back at the teaching and learning that has occurred and reconstructs, reenacts, and/or recaptures the events, emotions, and accomplishments. It is that process through which a professional learns from experience (p. 19). What Shulman suggests here is that reflection is a "looking back" in one's mind and recalling events and the emotions attached to these events. Further, he suggests that there is a judgment involved in reflection as he mentions that the teacher "sees" his or her accomplishments in the classroom. The point that Shulman makes is that reflection is not only looking back as in recalling the events, but judging those events.

Judging events involves criticism, which is an element of thinking about experiences and assessing their worth. Schon (1983) states that it is through reflection that a practitioner brings forward and criticizes the tacit understandings that have grown around a repetitive experience of a specialized practice. By criticizing past experiences, new sense is made of unique situations that the professional has allowed himself or herself to experience (p. 61). Judging past experiences has implications for teachers who are constantly trying to apply professional knowledge and plan for an ever changing situation.

Besides judging past experiences to determine a plan, reflection may also help a teacher make inferences. To make inferences about teaching practices, a teacher must have

professional knowledge. This professional knowledge is applied to the problem that comes from the situation (Schon, 1983) such as a classroom. Making inferences, according to Dewey is a thinking process of arriving at what may be absent on the basis of what is at hand (p. 4). Therefore, inferences may provide the teacher with a possible solution to a problem. This possible solution is then incorporated into a plan for teacher action in the classroom.

Reflection then, can be helpful in planning future actions. Reflection may also occur in the midst of action and after the action has occurred. Schon (1983) calls reflection in the midst of action, "reflection-in-action" and reflection after the action, "reflection-on-action". Each of these types of reflection is discussed below.

2.3.3 Reflection-in-action.

Reflection-in-action, according to Schon (1983), refers to a reflection that a professional engages in while performing an action. This type of reflection may help the professional change his or her action while performing the action. "Schon has not distinguished the general features of reflection-in-action that pertain to how practitioners solve problems in action settings from the context bound expression of these features within a specific professional domain such as education" (Grimmett, 1989).

Court (1989), in her dissertation, discusses at length whether the teacher reflects while the action is taking place as in Schon's term reflection-in-action. She suggests that reflection-in-action is not applicable to the field of education. Central to her argument is that the classroom is such a hectic environment requiring the full attention of the teacher that little reflection takes place during the course of the day (Wildman & Niles, 1987; Court, 1988; Kilbourn, 1988).

The issue here is time. Given the classroom milieu, it is more likely that most reflection done by teachers is done after the action and, therefore, reflection-on-action is probably more applicable to education than reflection-in-action (Court, 1988). It seems then that reflection-on-action is most germane to the teaching profession, and to this study.

2.3.4 Reflection-on-action.

The notion of reflection-on-action is most relevant to this study, as it endeavours to determine if teachers reflect on their practices after viewing vignettes. Reflection-on-action has the same characteristics as reflection with the focus on a specific action. The main points of reflection-on-action are discussed below.

As in Dewey's description of reflection, Schon's reflection-on-action starts with framing a problem. By framing

problems, teachers choose the "things" they wish to contend with and establish the boundaries of the problem, as well as how the problem will be handled (Schon, 1983, p. 40). This, according to Schon (1983) and Noordhoff and Kleinfeld (1990), is a kind of "conversation with the situation." This conversation with the situation frames the problem and may promote a thought experiment. In a thought experiment, teachers not only define the problem to be solved, but also search for possible solutions to the problem using their professional knowledge base. The way a problem is framed presents possible solutions to the problem (Noordhoff and Kleinfeld, 1990, p. 173) by determining what strategies teachers will use to solve the problem (Schon, 1987, p. 66; Grimmett, 1989, p. 9; Mackinnon, 1989). What skilled and experienced teachers actually do in attempting to change present situations into more desirable future ones is to impose a "design" on a problematic situation. They then work out the implications of this design, judge what they want to accomplish, and, if necessary, change their design (Noordhoff & Kleinfeld, 1990, p. 12; Mackinnon, 1989, p. 29). In this thought experiment, teachers recall the action in the classroom and explore possible results. These thought experiments help teachers focus on some aspects of the problem or infer other aspects pertinent to the problem. This ability to focus on other aspects of the problem is what Schon (1983) calls reframing the problem.

2.3.5 Reflection-on-action and Reframing Problems.

Reframing a problem, as a result of reflection, means seeing the situation differently by taking into account new information (Mackinnon, 1989). That is, once the problem is framed and some inquiry is initiated, then, new information from the vignettes or from professional knowledge may cause the teacher to reframe the problem. By reframing the problem, the inquirer frames new questions with new ends in view (Schon, 1983, p. 269). This requires the teacher to rethink the factors in the situation, propose strategies to solve the problem, and explore the consequences of the chosen strategies (Schon, 1983; Grimmett, 1988, p. 9; Noordhoff & Kleinfeld, 1990, p. 174). Again, by the process of reflection-on-action, the teacher mentally tests the chosen strategies, hypothesizes, and speculates about the implications of these strategies for his or her classroom.

It is this problem-solving approach by the teacher that should be the focus of professional development. The first step in this approach is to have the teacher frame his or her own problem and then, if necessary, reframe these problems so that they can be solved. Central to framing and reframing problems is reflection-on-action.

2.3.6 Videotaped Vignettes and Reflection-on-action.

Erickson (1987) states that to change practices, teachers

may have to be exposed to principles and practices, not in propositional form, but in regular classroom settings. One approach to teacher change according to Stake (1987) entails the generation of case studies that provide rich descriptions of practice. These descriptions can serve as vicarious experiences for teachers, which, in turn, may stimulate reflection and insights, leading to changes in practices (p. 60). If case studies can stimulate reflection perhaps video vignettes will also cause teachers to reflect on their practices.

Kilbourn (1989) borrows from Schon's notion of reflection-on-action and suggests that vignettes, stories, episodes, cases, and narratives when well written or told, should provide experienced teachers with opportunities to reflect on action. Videotaped vignettes may be appropriate for promoting reflection-on-action, as they allow the observer to view another science teacher in action.

If videotaped vignettes cause a teacher to reflect-on-action, which means that the teacher frames problems and hypothesizes solutions to these problems, then perhaps video technology can be used as a professional development tool. If this proves to be the case, then professional development of science teachers may be enhanced through the use of video technology.

2.4 Summary

In this chapter, three interrelated bodies of literature were reviewed and analyzed in terms of their respective contributions to this study. The review established the need for professional development in science education, discussed studies that use video technology as a training tool, and examined the literature that provides the theoretical framework for the study.

The first series of surveys indicate that science teachers need professional development in conducting science classes where the students manipulate materials. These surveys confirm that professional development sessions should be subject specific and take place locally, preferably in the school setting.

The second section reviewed studies that use video technology in inservice training sessions. These studies indicate that after viewing a videotaped presentation, teachers report change in both their teaching practices and attitudes. However, all these studies used self report data and lack description of teachers' focus and thought after viewing these presentations.

The final section established the theoretical framework for the study. This framework suggests that teachers have

professional knowledge that they use to understand problems with their teaching practices. Problems are examined and proposed solutions are generated by the process of reflection. A distinct type of reflection, reflection-on-action, is suggested as being germane to teaching because it allows the teachers to frame and solve problems with their practices. Further, it was suggested that vignettes promote reflection-on-action. If it can be determined that vignettes promote reflection-on-action, then vignettes may be useful professional development tools.

CHAPTER THREE

DESIGN OF THE STUDY AND METHOD

3.0 Introduction

In this chapter, the rationale for selecting the qualitative method is presented. Accompanying the rationale are all the procedures involved in collecting observations and interview data. The instruments used for collecting the data were audiotape, videotape, log book, and data sheets. In addition, the considerations used to select the teachers, and the interpretation and presentation of the data are outlined.

3.1 Context of the Study

The study involved four teachers who worked in two remote schools. These teachers taught grades four to six in their respective schools. Each teacher's situation was similar: all taught aboriginal students, had the same texts, had similar working conditions, taught their own science and had similar access to science equipment, and had similar teacher education.

3.2 Selecting the Study Method

The theoretical framework for the study suggests that teachers use their professional knowledge to interpret teaching situations and construct problems with their classroom practice. Therefore, a research method conducive to collecting and interpreting teacher ideas was selected. Quantitative research

methods were rejected as these methods tend to de-emphasize individual judgments in favour of established procedures to construct arguments (Firestone, 1987).

Qualitative methodology was selected over quantitative procedure for three reasons. First qualitative research methods are most appropriate for collecting and interpreting the ideas of research subjects, in this case, teachers. Second, a qualitative research design serves to close the gap between subject and researcher and allows the subject to express and explain ideas (Wood, 1988). Third, qualitative research is most appropriate for examining teacher reflection (Ross, 1990, p. 100).

3.3 The Researcher

Prior to becoming involved with this study, I taught grades 4-7 for twelve years. For three of those twelve years, I was a teaching principal of a small elementary school in an urban area. After leaving the elementary school system, I lived in an isolated community for two years. Here I was employed as coordinator of a project designed to train preservice teachers. These preservice teachers were of Cree ancestry and were being trained to teach in Cree schools in northern Manitoba. After leaving this position, I continued educating aboriginal teachers or teachers of native ancestry in a more southerly location for another year. I then joined a school division as a

mathematics/science consultant. As a consultant, I was responsible for professional development, testing and providing program support for remote schools. Over the next 10 years, I developed an interest in providing professional development opportunities for teachers in remote schools. In this capacity, I was confronted with problems of distance, cost, staff turnover, and lack of professional opportunities.

At the time the data were collected, I was employed as a consultant in the same school division as the teachers involved in this study. My interest in this study was heightened because changes in teacher behaviour were often lacking in spite of changes that were called for by inservice sessions. In this particular school division the relationship of consultant-researcher was collegial; that is, as a consultant I had no authority to insist on change. A collegial relationship was adopted to encourage teachers to openly share classroom problems with consultants. Evidence of this collegial relationship between the teachers who participated in this study and me can be found in the sample interview protocols in Appendix B. Principals who acted as facilitators, assisted in the collection of data.

3.3.1 Facilitators

In this paper a facilitator is defined as a person who is aware of the study and although not included as a subject in the

study, lends support to ensure that the study maintains its schedule. The principals, as facilitators, were useful to this study to verify and provide data not normally attained (Hammersley and Atkinson, 1983; Lincoln and Guba, 1985, p. 252). The principals further supported the study by helping with selection of teachers who participated in the study and providing substitute teachers while participants were engaged in the study.

3.4 Teacher Selection

The teachers in the study were volunteer subjects from two, small remote schools (i.e., enrolments of approximately 100 - 300 students). Like most remote schools, participating schools had only one class of each grade from kindergarten through either grades 9 or 12. In the two schools involved in the study, all teachers who taught science at the grades 4 to 6 levels were asked to participate in this study. Since each school had one class of each grade, six teachers were asked to volunteer. The study proceeded with four teachers when two teachers declined the invitation to participate. Therefore, four teachers were involved in the study. One teacher taught grade 4; two taught grade 5; and one teacher taught grade 6. These teachers were assured that at no time would their involvement in the study be used to evaluate their teaching performance. The frames of reference for this study were completely supported by the principals (see Appendix C).

Of the four teachers who participated, the researcher had previously worked with one teacher, who had eight years experience. The other three teachers were in their second year of teaching and not previously known to the researcher. Two teachers had been educated in small rural towns in the southern part of the province, the third in a remote community, and the fourth in a large urban centre.

All teachers who were invited to participate in this study were informed of the intent of the study. To ensure that a collegial atmosphere was maintained, and in keeping with qualitative methodology, each of the teachers was asked to give his or her impression of the process. When asked this question, all said they were pleased with the data collection method and felt they had benefitted from their involvement in the study.

3.5 Data Collection

The data were collected in three phases: (1) initial interviews, (2) classroom observations, and (3) follow-up interviews. The observations and interviews were scheduled at a time convenient to each teacher involved in the study. By allowing a year for the study and being cognizant of the teachers' busy schedules and other demands placed upon them, this researcher hoped to minimize stress and inconvenience to the subjects.

3.5.1 Interview Procedures

The unstructured interview (Lincoln & Guba, 1985, p. 268) or open interview (Rist, 1982, p. 443) method is described as highly flexible, allowing the researcher to obtain information by letting the subjects speak freely while constantly checking for revealing comments. This open-ended questioning technique allowed this researcher to probe for teachers ideas while checking for their interpretation of the vignettes and reflection-on-action.

Each interview was directed to the teacher involved. Interviews did not follow a predetermined format and were not limited to a set time frame. This allowed teachers to freely express ideas that were of interest to them. One of the teachers was brief and precise regarding the problems she felt she would have implementing practices demonstrated in the videotaped vignettes. Another teacher was quite verbal, and it took longer to explore this teacher's views. As the interviews proceeded, certain teacher statements and behaviours emerged that this researcher chose to follow more closely. The content of certain teacher statements, pauses, emotional outbursts, and intonations in the voices of the teachers were used by the researcher as clues to gather and authenticate data as it was collected. This data signified levels of participant comfort and nervousness about expressing ideas. Every attempt was made to ensure that the teachers were comfortable sharing their

comments regarding the vignettes.

Another strategy used to collect data, without directing the teacher, was the use of probes. Probes provided an opportunity to intervene and obtain further information or clarification. An example of an intervention/probe would be "Do I understand you to say?" or "Could you tell me more?" Lincoln and Guba's (1985, p. 271) suggestion that probes be used within the unstructured interview format permitted this researcher to make decisions about what was already known and expand that knowledge to gain insight into the research questions.

3.5.2 Interview Questions

To provide focus for the teacher interviews, open-ended questions were developed by this researcher (see Appendix D). Questions used in the interviews were framed to ensure that the teachers had ample opportunity to respond to the vignettes and express their ideas. Following are sample questions designed to determine the teachers' views of teaching science:

1. What do you hope to impart to your students through the teaching of science?
2. To what extent do you have students manipulate materials in your classes?
3. If you were a cooperating teacher with the teachers you saw on the videotape, what would be your assessment of their teaching techniques?

4. What ideas, if any, did you pick up from the vignettes?

3.5.3 Initial Interviews

The initial interviews were designed to collect data concerning the teachers' ideas of teaching science. After sharing their ideas of teaching science, the teachers viewed the videotapes and shared their ideas about the vignettes. All the ideas voiced during the interviews were audiotaped. Once the data from the initial interview were interpreted, a classroom observation was scheduled.

3.5.4 Classroom Observations

The classroom observations were used to cross reference interview data. To provide a focus to the classroom observations and facilitate note taking for later analysis, a classroom observation sheet was used (Lantz, 1984) to collect and organize data about the structure and organization of the classrooms where the observed lessons were taught (See Appendix E). These sheets included information on the physical environment of the classroom such as notes, windows, chalkboards, tack boards, equipment, posters, and clippings. Grimmett (1988, p. 7) points out that physical environment has a direct impact on reflection-on-action. The data about the physical environments were included in the presentation of the cases to give the reader some context for these cases.

When observing in the classroom, this researcher was cognizant that participating teachers were applying their professional knowledge to the teaching of science. Therefore, every attempt was made to ensure that the classroom observation was a non-threatening situation for the teacher.

The teachers were also asked to express their opinion and concerns about having their classes videotaped. These videotapes were used to store data for later interpretation. However, the ownership of the videotape remained with the teacher and each teacher controlled who could view the videotape of his or her class. In one case, the teacher wished the videotape to be kept confidential. The other three teachers, to the surprise of this researcher, were willing to share the videotapes of their classrooms with other teachers.

3.5.5 Follow-up Interviews

Once the data from the videotapes were interpreted, follow-up interviews were scheduled. The purpose of these interviews was to collect further ideas teachers may have had regarding the vignettes.

3.5.6 Log book

The researcher also maintained a log book, to record information that was not part of the scheduled interviews. This information included teacher comments, researcher and teacher

impressions, principals' comments, and the study schedule. The following excerpt from the log book illustrates this point: "I wonder if the teacher and I are focusing on the vignettes at this point in the interview" (Log book, November 17, 1988). The log book also allowed this researcher to record the teachers' ideas in chronological order.

Table 1 gives the schedule of the interviews and observations that were done over an eight month period from September, 1988 to May, 1989. The schools' names have been changed in the interest of interviewee anonymity.

Table 1: Time Line of Data Collection

<u>1988</u>	
September 15	Initial contact with Dog Bay School
September 29	Follow-up meeting with Dog Bay School
October 11	Two initial interviews at Dog Bay
October 13	Third initial interview at Dog Bay
October 19	Videotaping was arranged for November
November 10	Videotaped all 3 classes at Dog Bay
November 17	Follow-up interviews at Dog Bay
<u>1989</u>	
January 16	Initial contact with Milner teachers
January 18	Interviewed the teacher at Milner
January 24	Videotaping session arranged at Milner
January 30	Videotaped teacher at Milner
February 8	Visited Dog Bay
February 20	Visited Dog Bay
March 9	Visited Milner
March 14	Follow-up interview at Milner
April 11	Returned studies to Dog Bay teachers
April 24	Follow-up visit to Dog Bay
April 25	Follow-up interview at Milner
May 16	Returned draft of study to Milner
May 30	Follow-up visit to Milner

3.6 Data Verification

The data were verified through two processes: "juxtaposition" (West, 1977; Yin, 1984; Lincoln and Guba, 1985) and "triangulation" (Glaser and Strauss, 1967; Hammersley and Atkinson, 1983; Goetz and Lecompte 1984, Lincoln and Guba, 1985).

3.6.1 Juxtaposition

Juxtaposition provides a check on the data from one teacher by comparing what was said with other comments of that same teacher. As the study unfolded and particular pieces of information came to light, steps were taken to cross-reference one piece of information with at least one other interaction; for example, the second interview and/or the classroom observation.

3.6.2 Triangulation

Besides cross-referencing the data using the process of juxtaposition, the data were also cross-referenced with other data collected during the study. This process of cross-referencing data with another data source is called triangulation.

It is a process of cross-referencing one datum collected from one source with data collected from other sources (Glaser & Strauss, 1967; Hammersley & Atkinson, 1983; Goetz & Lecompte, 1984, Lincoln & Guba, 1985). According to Glaser and Strauss,

triangulation enhances the scope and clarity of the study. Hammersley and Atkinson (1983) state that it is through the process of triangulation that distinction between topical and generic levels of analysis is made. Topical data pertain to an individual teacher whereas generic data pertain to data that recurred in all the data collected.

Goetz and LeCompte (1984, p. 11) state that triangulation assists in correcting bias that may occur when the researcher is the only observer of the phenomenon being investigated. Clearly, triangulation is crucial to verification of reflection-on-action and to linking teacher ideas to the vignettes. The processes of juxtaposition and triangulation were used to check the data as the data were being categorized.

3.6.3 Data Categorization

Depending on the focus of the research, there are many ways to reconstruct the teacher's reality. Rist (1982) lists seven frameworks available to organize and present qualitative data (p. 446). However, predescribed categories were rejected for this study because they would have structured the data in ways other than those intended by the teachers. The researcher therefore, decided to use the teacher's own framework to categorize the data. The notion of using the teacher's own framework to classify data is supported by Leithwood (1982) and takes further advantage of involving subjects in all aspects of

the study. After data were categorized, each teacher's comments were juxtaposed and triangulated until themes began to appear in the data categories.

Categorization of the data to determine themes occurred in three stages. These three stages were (1) writing interview transcripts and carding the data, (2) placing the cards in categories to find commonalities inherent in the data, and (3) interpreting the data.

Stage One: Recording and Carding the Data

Data from the audiotape interviews were typed to form transcripts. (See Appendix B for a sample of the interview transcripts.) Once the interview transcripts were prepared, the data were placed on 7.5 cm by 13 cm cards. This made it easier to compare and categorize the data. Once the cards had been prepared, the process of placing the cards into categories commenced.

Stage Two: Placing the Cards into Categories

To place a card into a category, the first card was read and placed on the desk. When the second card was selected, it was compared with the first and if it had similarities in word or meaning to the first card, it was placed in that category. However, if the card had different wording or meaning, it was used to start another category. This process went on until all

the cards had been placed in a category. This method of organizing data is recommended by several researchers (Rist, 1982; Lantz, 1984; Lincoln and Guba, 1985).

An example of the type of statement that determined the category on questioning practices is: "I think you have to have the right questioning techniques in order to have good hands-on science" (Velma, initial interview, p. 16). A second reference to questioning practices was given by Velma later in the interview. She stated, "I thought she [teacher in the vignette] did a really good job of questioning. She used good questions to check up on the learning of the students" (Velma, initial interview, p. 45).

Primary interpretation of the data was done as each card was placed in a category. Once all the cards had been categorized, the second stage of data interpretation commenced. The second stage of data interpretation consisted of rearranging the cards to determine emerging themes. During this stage, three themes emerged that indicated what the teachers had focused on while viewing the vignettes: teaching practices involving questioning, classroom management, and grouping of students.

Stage Three: Interpretation of the Data

Once the data were categorized, this researcher interpreted

the data to reconstruct what the teachers were reporting about the vignettes. This task was done by interpreting the data in four stages: (1) checking the frequency and distribution of the data, (2) organizing the data, (3) checking the findings with the subjects/teachers and (4) reporting the findings. The frequency was checked to determine the predominant themes within the data from one teacher compared to other data collected. While checking the frequency, the order in which the data were collected from interviews, classroom observations, and follow-up interviews was not altered. In keeping with qualitative methodology and to ensure that the data had been interpreted correctly, a copy of the draft presentation was given to each teacher for his or her comments. This process of confirming the researcher's interpretation is known as "member checking" (Lincoln and Guba, 1985, p 316). These stages of interpretation led to a description of the ideas teachers expressed after viewing videotaped vignettes.

This process of data interpretation is similar to techniques used by archaeologists who through inference reconstruct the physical culture from physical artifacts. Physical artifacts of archaeology are constructions produced within a culture. This is done by placing the artifacts on a table and grouping them according to similarities of the artifact's features. To do this, the archaeologist must compare the features of each artifact to the features of all the other

artifacts. The number of groups account for the distribution of the artifacts. The number of artifacts in each category account for the frequency of the artifacts. By noting the frequency and distribution of the artifacts, the archaeologist determines the significance of the artifacts to the culture being studied and attempts to reconstruct the culture represented by the artifacts.

3.7 Generalizabilty

Teachers construct their own meanings depending on their professional knowledge and the environment in which they apply this knowledge. This study reports how four teachers responded to videotaped vignettes. Lincoln and Guba (1985, p. 297) suggest that readers seek similarities in studies to their own situations and likewise, this researcher hopes that readers of this study will find applications to their circumstances. To aid the reader in noting similarities, the method used and the circumstances surrounding this study are reported. The goal is not to produce a standardized set of results that other researchers studying the same issue would have produced, but to produce ideas for further research (Eisner and Peshkin, 1990, p. 203).

3.8 Data Presentation

The intent of the presentation is to provide the reader with description reinforced with data. In this description, the

researcher attempts to give the reader a clear understanding of teacher ideas that were generated after viewing videotapes, professional knowledge they used in their reactions to the video materials, and the degree and kind of reflection-on-action that they engaged in after that experience.

In the presentation, consistency of the data was maintained. Consistency is defined as descriptions that are constructed of several kinds of data related to one another. Lincoln and Guba (1985) state that consistency is established when "each new item of information provided another point of leverage from which to test interpretations" (p. 359). These interpretations are reported in such a way as to help the reader judge this study. Along with the description of the data, this researcher includes personal inferences to help the reader judge this study and make comparisons to his or her situation.

As indicative of this type of study, this researcher has respected the confidentiality and anonymity of the teachers (Ellen, 1984, p. 112; Lincoln and Guba, 1985, p. 254). To preserve their anonymity, the locations and names of the schools and teachers have been changed.

All of the teachers were interested in what had been written about them. Each commented on small factual errors in the presentation and in the descriptions of the classroom and

school and this researcher made changes in keeping with their corrections. All of the teachers confirmed that their ideas had been appropriately represented in the presentation.

The format of this presentation is similar to a case study and was chosen because it helps preserve the consistency of the data and gives the reader a clear indication of each teacher's comments regarding the vignettes.

3.9 Summary

This chapter stated that a qualitative method is the most appropriate method for collecting data on teacher responses to vignettes. Criteria for selecting the teachers and conducting the study were also provided. These criteria were reinforced with examples of interview questions. Once the method for collecting the empirical data was stated, the method of placing the data into categories and verifying and interpreting the data were provided. Further, information was provided concerning the format and criteria used to present data in the following chapter.

CHAPTER FOUR

DATA PRESENTATION AND INTERPRETATION

4.0 Introduction

In this chapter the data obtained from the four teachers involved in this study are reported. These data were collected during an initial interview, classroom observation, and a follow-up interview. To assist the reader in interpreting the data, teacher background, setting, and the environment in which the teachers worked will be presented. Further, this chapter presents the researcher's comments to assist the reader in judging the study.

4.1 Kathy

Kathy earned her professional teaching certificate from one of the universities in the southern part of the province. In her first year of teaching she had ten students, including several children with special needs. At the time of this study, Kathy was in her early twenties, and into her third year of teaching 18 fourth grade students at Dog Bay School. She seemed settled in the school environment and had a good working relationship with her students.

Kathy grew up on a farm near Dog Bay and had attended Dog Bay School from grades 1 to 8. Consequently, she knew the

families of many of her students. Kathy's situation was unusual as she was non-native, attended school in a native community, and returned to teach in that community.

Kathy taught all grade four subjects and was with her class most of the day. She instructed all the subjects in her classroom. When her students went for a lesson in Saulteaux (an aboriginal language), physical education, or library, Kathy was allotted preparation time. She used this time productively: correcting papers, collecting materials, or preparing student assignments.

4.1.1 Setting

Kathy had a regulation-sized classroom that she had arranged to suit her teaching style. The entrance, bulletin boards, and bookcase were along the back wall. Her desk was opposite the door near the window in the corner of the room. The second wall was covered with bulletin boards displaying student writings. At the front of the room in the corner was a small desk where science materials for lessons were organized. The rest of the front wall was covered with chalkboard. In the corner opposite to the science desk was a cupboard for storing supplies. Between the cupboard and the entrance door was a low shelf where Kathy stored her science materials. Kathy's class arrangement facilitated her teaching of science. She had definite ideas about teaching science, which she shared in the

initial interview. Other than class arrangement none of the other aspects of the environment such as political or social context appeared in the interview transcript.

4.1.2 Initial Interview

The initial interview took place in the Resource Teacher's room in the afternoon while classes were in session. When asked about teaching science, Kathy responded:

> Why teach science? So students can acquire knowledge of not only learning what is around them but learn how to find out on their own what is around them. Hands-on science cannot just be giving students assignments with little directions.

Kathy went on to explain her pedagogy as it applied to teaching science.

> You cannot go ahead and say you should understand this. They [students] have to work it through themselves. Having students solve problems helps them gain confidence.

According to Kathy, the purpose of science is to teach students about their environment. She seemed committed to using the hands-on method that, according to her, is best facilitated by giving students clear directions. In Kathy's opinion, science then, is an active process in which students gain knowledge and in the process learn how to gain further knowledge. Knowledge and confidence, according to Kathy, are gained by solving problems. Since Kathy feels that science consists of learning about the environment, she believes

students should be engaged in problem solving related to their surroundings and using a hands-on approach that implies manipulation of materials.

> Murray: How often do you have students manipulate materials in class?
>
> Kathy: As much as possible without groups.
>
> Murray: How do you coordinate the activity with the number of students you have in the class.
>
> Kathy: That's what I still don't know because of the different activities. It depends on the kids and it depends on the activity. Some things you can give them [students] a lot of freedom with some activities...if they have the knowledge, depending on the activity.

In most schools, as in Dog Bay, there is limited equipment so teachers must group their students for science. In her first year of teaching, Kathy had ten students. With ten students she had one group who could engage in activities together. Now that she has eighteen students a single group is not an option. By stating "I still don't know" how to coordinate groups Kathy has framed a problem with her teaching practices related to science. Without further discussion Kathy viewed the videotaped vignettes.

After viewing the vignettes the following discussion took place:

> Kathy: I think the students knew exactly what [activities on the vignettes] was to be done. I think it [vignette] was staged.
>
> Murray: Could you elaborate on that?

> Kathy: If this was not staged and she [the vignette teacher] can do that and those kids are listening to her, she has obviously planned a lot and the students know what they are supposed to do.
>
> Murray: What makes you say that the videotaped teacher was well planned?
>
> Kathy: That teacher is incredible. The control [classroom management] she has means the lesson must have been well planned.

Kathy's first impression of the vignettes was that the students knew ahead of time what they were supposed to do and concluded the vignettes were staged. This is an important point: if teachers feel that videotaped material is staged or idealistic, they may respond negatively arguing that replication of the process demonstrated is not attainable in real life. Kathy's comment that the vignettes were staged was reconsidered after she had an opportunity to view a videotape of her own lesson. Based on her own lack of confidence with grouping students for science, she concluded that the vignettes may be realistic after all and she decided to use the vignettes as a working model of a possible classroom situation. In the end, however, Kathy did not reject the vignettes and became involved in assessing them.

In the initial interview she inferred that the students in the vignettes were on task and listening to the teacher. She attributed the students' behaviour to the teachers' ability to manage the class. Kathy observed classroom management practices in the vignettes and made inferences about the extent of the

preparation required by the teacher to organize a class in this manner. Once she had made the inference about planning and its role in conducting a science class, this researcher probed to find out how Kathy viewed her own situation.

> Murray: What sort of things do you see having to happen in your class to get the kids to work in groups?
>
> Kathy: Last year we worked as one group and I had my recorder and all of the students knew what was going on. To teach the science lesson I have just seen I would have to have more than one group in my class. That's going to be scary for me because I may have two totally different answers to the problem in the lesson.
>
> Murray: How would you solve this problem?
>
> Kathy: I don't see how you can go into a science lesson and say, "Okay, we are going to do this" and whatever happens, happens. Because you may get a number of things happening that may not lead to the correct scientific answer.

Prior to viewing the vignettes Kathy had partially framed a problem around grouping. An earlier reference to the problem was Kathy's statement, "I still don't know [about grouping] because of the different activities." What prompted this problem seemed to be the change in the number of students in Kathy's class from ten the previous year to eighteen the year of the study. This increase in class size was a major concern to Kathy as she mentioned it often in conversation. "Last year I used to have one table and we gathered around it and did the experiment" (Log entry 13/10/88). This year Kathy has done few activities as she realized that this practice would not work in

her larger class. Unable to group her students for science she conducted large class discussions and wrote notes on the chalkboard.

Further, Kathy realized that if she grouped her students for science each group could arrive at a different answer. The realization that different groups could arrive at different answers to the same activity is in Kathy's words "scary." This scary situation was avoided in class by conducting large class discussions. By conducting large class discussions Kathy had control of the discussion and was assured that the students were getting "accurate" information and were coming to a common conclusion. To think that students in different groups would arrive at different answers to the same activity was a problem in Kathy's mind.

Having identified a problem she is having with grouping students Kathy constructed a thought experiment. This thought experiment permitted her to postulate an outcome, which led to a second problem: how to handle different answers to the same activity. Although she solved the first problem of grouping her students she seemed unable to solve the second problem. One reason was that she wanted her students to arrive at what she considers a correct "scientific" answer. Having students learn the correct scientific answer was important to Kathy. This concern was also stated by Kathy in informal discussions. "My

background in science is weak so I depend on the textbook for scientific explanations" (Log entry 17/11/88). Kathy was troubled by the possibility that students in different groupings might arrive at answers that departed from the textbook explanation on which she relied. A question related to this research is: can problems of distance education as described in this paper help Kathy identify and deal with the issues raised above?

When this researcher probed to determine how Kathy would resolve the problem of students arriving at different answers to the same science activity, she gave no verbal responses. The vignettes seemed to have helped Kathy frame a problem and provided information that helped her examine that problem. In a distance education setting Kathy may have discussed this with a colleague. However, such openness requires taking professional risk and collaboration of this kind was lacking at this school. When asked if she had discussed the vignettes with other teachers, she said that she had not, although she enjoyed having this researcher in her class and the vignettes had given her ideas (Log entry 10/11/88).

Clearly, by viewing the videotapes and discussing them with the researcher, Kathy has identified some important issues. The question that remains is: how will Kathy handle this unresolved problem of different groups coming up with different situations?

4.1.3 Classroom Observation

Following the viewing of the videotape, a classroom lesson conducted by Kathy was observed and videotaped. This lesson occurred seven days after the initial interview. For this lesson Kathy grouped her students into three groups of four students and one group of three students (three students were absent). Four desks were placed in a group. Each group having both boys and girls, and academically capable as well as academically weak students. This allowed the more academically able students to play leadership roles in the groups. One member from each group was selected to collect the materials from the shelf at the side of the room. By grouping the students and desks in this manner, the room appeared more spacious and gave the students more access to the shelving and science equipment.

For the lesson Kathy had chosen an activity requiring a hard-boiled egg. The objective of the lesson was to have each group of students compare a hard-boiled egg to a cell. This activity was accompanied by a written question sheet that focused the lesson and kept the students on task. She introduced the lesson with clear and complete instructions. All of the students seemed well aware of what they were to do.

It appeared that Kathy was well prepared for the lesson and the students moved easily from group work to written assignment.

Kathy interacted with each group to ensure that everyone contributed to the group activity. At all times she seemed to be involved with the class and individuals within it, referring to many students by name when answering questions. The only distraction during the lesson was caused by one student who did not wish to cooperate with the other students in the group. Kathy approached the group and quietly explained her expectations. That solved the problem. "One group had to be organized which Kathy did without disturbing the other groups" (Log entry 10/11/88). At the end of the lesson, each group was asked to compare the hard-boiled egg to a cell.

After the class she commented that the session did not go well as too many problems arose. In the opinion of this researcher, and contrary to Kathy's assessment, the class was well conducted. She clearly demonstrated ability to organize and direct groups.

It is worth noting here that Kathy groups her students for language arts and social studies and in these subjects she encourages students to elaborate and extend topics discussed without limiting them to preconceived answers. It is apparent that Kathy treats science differently. She contends that students should have concluded the lesson with the current "scientific" answer and she is concerned that discussion in small groups may deter students from arriving at this answer.

Unfortunately, the science lesson on hard-boiled eggs failed to address problem solving since the hard-boiled egg activity was not a problem with a range of outcomes. Consequently, in this lesson, Kathy avoided the issue of different outcomes.

4.1.4 Follow-up Interview

After the data from the initial interview and the classroom observation had been interpreted, a follow-up interview was arranged. The purpose of this second interview was to collect further data on Kathy's impressions of the vignettes.

Of special interest to this researcher is the role the vignettes may have had in prompting Kathy to deal with her framed problem of grouping students for science in her classroom. In the next excerpt Kathy comments that the vignettes prompted her to consider grouping her students for science.

> ...seeing that it [students working in groups on the vignettes] can work...that's when I decided to do it [group her students] ...and I thought that I liked the way the room on that film [vignettes] looked with the different groups working and I decided to give it a try.

Later she compared her students to the students she viewed on the vignettes. This comparison is interesting as Kathy had an opportunity to reflect on her lesson and to compare the videotape of her class and the vignettes she originally viewed.

> Kathy: They [her students] were a bit too noisy; they looked nothing like those kids on film, yet when I watched them [her own class] on the videotape [videotape of her class] it wasn't that bad. They were working.
>
> Murray: Have your students mentioned anything to you about the change you have made in your class?
>
> Kathy: They [her students] liked the way the room looked and they think that they are not in school any more, it's fun because they are sitting together and they like that. That's good if they like it. They will do the work.
>
> Murray: In the first interview you stated that you felt the videotape presentation you viewed was staged.
>
> Kathy: After seeing my videotape, I don't think it [vignettes] was staged. It ran smoothly because the teacher was prepared for the class. My students had not done the activity with the egg before. They [Kathy's students] were just well prepared. They knew what was expected of them and I think that's the way it was with the kids counting the bugs on the videotape [vignettes]. It was proper preparation on the part of the teacher.

At this point it is clear that Kathy is making use of the video material in reflective fashion. For example, she identified with the setting and demonstrated empathy with the teachers in the vignettes. One result of this comparison is that Kathy was left with the impression that her class is noisy, but after viewing the videotape of her own class, she seemed satisfied that her class functioned well. This comparison convinced Kathy to change her opinion about the vignettes and how her own class functioned.

Kathy commented on two criteria she used to assess how her class functioned. First, she stated that the students were on

task. Second, the students made comments to her that they liked the new classroom arrangement. The reason she gave for the success of her class was that her students were well prepared. This idea of preparing her students became more apparent to Kathy only after she had viewed the vignettes. Kathy credited the vignettes with assisting her in grouping her students. Further Kathy was surprised at the outcome of her experiment "I was surprised that the groups worked so well in science" (Log entry 17/11/88). This comment seems to indicate that Kathy felt confident her initial problem was solved and was satisfied with this solution.

Kathy also commented again on her opinion that the vignettes were staged, something she believes until she viewed the videotape of her own classroom. After viewing her own videotape, she felt that her classroom was well managed. It seems that Kathy was so busy solving a multitude of classroom problems that while she was teaching she did not have time to reflect on how well she was managing her own class. This supports Court's contention that the classroom is such a hectic environment that little reflection takes place during the course of the day (Court, 1989). Further, Kathy's comments suggests the vignettes helped her assess various aspects of her classroom milieu. For example, she reported that "One day I had two groups with a similar problem and I gathered them at the back of the room and discussed the problem quietly" (Log entry

17/11/88). It seems the vignettes provided Kathy with information she was able to put into practice, and prompted her to assess her classroom practices.

4.2 Kent

Kent, like Kathy, was a second year teacher at Dog Bay School. This was his second year teaching grade 5. Kent graduated from one of the provincial universities with a degree in science. His ability in science was respected among the staff and because of his background he was considered the science expert at the school. Kent prefers to teach science in the science laboratory and because of the small number of students in his class that is where he often teaches.

Kent's class consists of ten students, including several with special needs. One student has both physical and mental handicaps and a full-time teacher assistant works with this student. Although many of Kent's students have special needs, Kent has high expectations for himself and his class.

4.2.1 Setting

The science laboratory had counters around three walls. One wall had bulletin boards, which displayed student work. The back wall of the room had shelves that held microscopes and other science equipment. The third wall was windowed and faced a lake. Student desks were placed in the centre of the room. These desks were movable and could be arranged into groups. Along the front of the room was a long teacher's desk with sink and gas outlets. To the side of the teacher's desk was a smaller desk that the teacher sat at when correcting student

assignments. The wall behind these two desks was a chalkboard that spanned the length of the room except for a door. The door opened into a small storage cupboard where chemicals and other science equipment were stored.

4.2.2 Initial Interview

The initial interview took place in the Resource Teacher's room in the afternoon. At the outset of the interview, Kent explained his objectives for teaching science.

> Science is like the scientific method. It's used in everything and its logical thought goes through all kinds of patterning, observation skill, and uses fine motor skills. It [science] uses almost anything you want in the Elementary class.

Kent is confident his science background provides him with clear principles for teaching. In his opinion the scientific method is very important and he uses it to guide his science classes. He made references to his belief that "Students must learn the scientific method and use problem solving to understand science" (Log entry, 13/10/88). According to Kent, the scientific method helps students acquire logical thinking patterns that can be applied to every subject taught in elementary school. Further, he stated that in science students learn fine motor skills, which implies that he has students manipulating equipment in his classes. Kent's ideas about science education are consistent with concepts presented in the vignettes and are reflected by Kent's comments after viewing the

vignettes.

> Murray: What comments would you make regarding the videotaped presentation you have just viewed?
>
> Kent: If I wanted to right now, I could rewind it [the videotape] and if I thought the experiment was good, I could write it down and use the experiment in my class.
>
> Murray: What comments can you make about the activities shown on the videotaped presentation?
>
> Kent: Some of them [activities] are not viable for a single teacher in a class to do. One of these activities is where the students are testing the pollution caused by car exhaust. ...The idea of teaching kids about the pollution using the exhaust from cars was good. My concern is kids inhaling exhaust. ...The car thing bugs me. You got 10 kids out behind the car. Where is the rest of the class?

What Kent found most interesting in the vignettes were suggestions of experiments he could use in his class. His constant use of the word experiment was of interest to this researcher. He seemed to apply the term to activities whether or not they demonstrated the science process he described in his opening comments. Further he questions the activity involving pollution caused by exhaust fumes from cars. He is concerned about kids inhaling exhaust and seeing only four students with one teacher behind the car. He wonders where the others are and how a single teacher, such as himself, could manage this particular activity. It is important to note that Kent is trying to transpose activities in the vignettes into his own classroom. Kent must be aware that such activities are not readily transposed from one classroom to another due to the

number of differences in teaching practices and classroom milieu. At this point, however, Kent has not indicated that he is aware of these differences. Apart from the above concerns, Kent contends that the vignettes contain useful information, and he is open to ideas he can use in his classroom.

> Murray: If you were a cooperating teacher with the teachers on the videotape, what comments would you make to them?
>
> Kent: For the most part they [teachers] were very good. Their classes were well controlled and organized. I would have suggested to one teacher that when adding drops to a solution that you stir the solution after each drop. I felt that she was guiding the students rather than letting them find out for themselves....Another of my concerns was the observation of burning things over a flame. She made an observation that I thought was pretty narrow and it wasn't very clear. It almost went against what she was trying to do.
>
> Later Kent made the following comments.
>
> Kent: One thing that bothered me though was the part on evaluation using anecdotal observations.
>
> Murray: What bothers you about anecdotal reporting?
>
> Kent: It's fine when you have four kids in front of you to do anecdotal observations. But when you have 10 or 11 all doing separate things, it is harder. Then what does she do with the evaluations, or does she just put it on a piece of paper and ignore it, or what? What value is an anecdotal comment?

Kent complimented the teachers in the vignettes on their control and organization of their classes. He seemed, however, to have concerns about information he interpreted from the vignettes. He was critical of some teacher actions he viewed in the vignettes. Kent's comments suggest that the teacher should

follow more precise laboratory procedures. What is important is Kent observed the teaching practices of the teachers in the vignettes. Further, he judged those practices and indicated he would not follow their example. "Some of the teachers on the videotape were not very good science teachers" (Log entry 13/10/88). These judgmental comments may indicate that Kent saw more on the vignettes than he could use. He observed teacher practices and questioned their intentions.

One of these teaching practices was evaluation. It seems from his comments that Kent wanted to learn more about evaluating students using anecdotal reporting. He commented on the applicability of using this method of evaluation in a large class. "Evaluation is a real problem in science if you do not want to just use paper and pencil tests" (Log entry 10/10/88). This comment seems to indicate that the vignettes did not give him enough information about what the teacher was writing and therefore he would not be able to use this information to assess ten or eleven students all doing separate and supposedly different activities. One reason Kent may be concerned with anecdotal reporting is the number of special needs students in his class. This researcher has had some experience with evaluating special needs students and readily agrees that this is a problem as special needs students may not do well on written tests. These students are usually evaluated on what they do in class, therefore, anecdotal reporting is important.

Clearly, either the vignettes do not provide enough information about anecdotal reporting or Kent is unable to interpret the vignettes for the information he is seeking.

What is important here is Kent is observing and assessing evaluation practices, and he seems to be wondering how he can apply these practices to his own teaching. Kent did not comment further on teaching practices before teaching a lesson observed by this researcher.

4.2.3 Classroom Observation

The observed science lesson was conducted in the science room. The objective of the lesson was to have students practice controlling variables. Two groups of five students were given five balls each and asked to measure the height of the bounce of each ball. The variable that the students were to control was the height from which the ball was dropped. The students were asked to record the height of the bounce of five kinds and sizes of balls.

The number of students in the room led to an informal presentation. Kent sat on the teacher's desk with the ten students standing around him, listening to his instructions. His instructions were brief and were followed by a short discussion during which there were few student asked for clarification. The students were told to ensure the balls were

dropped from the same height, but were not provided with clear directions or a means of collecting data.

Students in the group were not assigned specific tasks to perform during the activity. The introduction to the lesson, grouping students, and collecting data varied significantly from the vignettes, however, his students seemed to be interested in the activity. The size of each group and the lack of specific instructions led to confusion within several groups. Many students observed the activity as they had no task to perform. "It seemed Kent's expectations and activity was beyond the comprehension of the students. He seemed unaware that the students were not on task or did not comprehend the intention of the lesson" (Log entry 10/10/88). Once he noticed the students were not on task, Kent asked several open-ended questions.

Kent used open-ended questions, which helped the students to focus on their assigned task. The asking of open-ended questions was observed by Kent in the vignettes. Along with this observation, he mentioned, "The teachers on the videotape interact more with their kids than I do" (Log entry 13/10/88). Perhaps this is a practice that Kent has become more aware of since viewing the vignettes.

Once the task had been completed to Kent's satisfaction he brought closure to the lesson. He gathered the students

together and discussed several errors that had been made during the activity. Several students lost interest in the discussion, perhaps due to its length and negative tone. It is this researcher's opinion that Kent's lesson was less than successful. He seemed so committed to the scientific process that he overlooked the students level of competency, understanding, and needs.

4.2.4 Follow-up interview

The follow-up interview took place in the Home Economics room seven days after the classroom observation. A substitute teacher was hired to take Kent's class in the afternoon to allow time for the interview. The interview lasted almost two hours. After a general discussion of Kent's lesson, the interview focused on Kent's responses to the vignettes.

> Murray: Now that you have had time to consider the videotape, have you had any further thoughts about it?
>
> Kent: Yes, I got some ideas on how to do activities. I noticed how she had the materials set out. I changed some of the things she did such as putting the items into little cups instead of having them on a sheet of paper.
>
> Murray: Is there anything else you thought about after our last meeting?
>
> Kent: One thing that I thought a great deal about was the questions.
>
> Murray: Are there any other thoughts you would like to share about the videotape?
>
> Kent: I still wonder what the teacher used her anecdotal comments for. The teacher was writing things down, and I never knew what she was writing down.

> Murray: How would you resolve this question about anecdotal reporting?
>
> Kent: I'm just wondering if the people we should be talking to about anecdotal reporting is our staff. You get a conference together after [the videotaped presentation] and ask other people in the school. Maybe somebody has the solution to that [problem] already in their mind and you could share answers.

Kent seems to have tried to incorporate some of the practices he observed while viewing the vignettes. First, he changed the way he distributed materials. Second, having commented on the questioning practices prior to his lesson and demonstrating open ended questioning practices during his lesson, it seems that Kent is trying to improve his teaching practices. Although minor in nature, it is these practices that can make a science class run more efficiently. What is important is although Kent seemed to lack reflection on his actions, he observed and used practices he observed and interpreted from the vignettes. In the second interview, he confirmed that his observations of open-ended questions by teachers in the vignettes prompted him to think about using more open ended questions in his science class.

One practice that Kent observed in the vignettes and still remained puzzled about was anecdotal reporting. The teachers did not discuss or demonstrate how to use the notes made during the lesson and he still could not understand the function of anecdotal evaluation. Kent, by making this observation, indicated an interest in anecdotal evaluation but wanted more

information about this classroom procedure. "I still don't know how those teachers were using the notes they made during the class" (Log entry 17/11/88).

When asked where he might obtain more information, he stated that he might turn to his colleagues. This is important as it indicates that the vignettes may encourage Kent to seek professional guidance from his colleagues as a result of viewing the vignettes. In a situation where information was being provided to teachers in remote schools via video technology, this is one way that some confusion may be resolved. Moreover, discussion among staff members might assist in developing school plans that would provide consistency within the school, increase professional confidence, and lead to teachers discussing problems with their practices. Such discussions could lead to professional growth.

4.3 Susan

Susan taught at Milner School, the second school involved in this study. In Milner School, only one of the three teachers who taught grade 4-6 volunteered to participate in the study.

Susan was in her early twenties and, like Kathy and Kent, was a second year teacher. In her first year of teaching, she taught in another remote community. This was her first year of teaching at Milner School. She taught a grade 5 class of twenty-four students half-time, including the teaching of science. The other half of her teaching assignment was spent teaching music to students from kindergarten to grade 6.

4.3.1 Setting

Susan taught her science classes in a large room that had been designed to accommodate music classes. At the back of the room was a tiered, carpeted area used for choral practices. A bulletin board and coat rack occupied the other corner at the back of the classroom. The desks occupied a tiled area near the front of the room. The wall along the front of the room was covered with chalkboards. In the corner, at the front of the room, was a small window. Bulletin boards ran along the wall beside this window. The room would have been quite dark it if were not well lit with fluorescent lighting.

4.3.2 Initial Interview

The initial interview took place in a small room adjacent to the library. As in the first school, the principal hired a substitute to allow the interview to take place during school hours. The interview commenced by asking Susan to share her views regarding the teaching of science.

> Susan: I think science helps us understand the world around us. I think when we do experiments and apply the results to our surroundings, we see how our surroundings affect us.
>
> Murray: To what extent do you have students manipulate materials in your class?
>
> Susan: At the beginning of the year not very much. Now, I try to do an experiment every class. They [students] are more comfortable [with the activities] and are more willing to work now. Now that they are able to work with this stuff [equipment], it is a lot easier to get to the point.

Susan's comments indicate that she is committed to the hands-on approach in science. However, to state that the students are more able to work with equipment implies that at one time students had difficulty handling materials. According to her, once students learn to handle materials, it is much easier to "get to the point." This comment suggests that Susan feels students understand the point of the lesson better when they can manipulate materials. Further, according to her, students manipulate materials to conduct experiments to learn about their surroundings. That is, students learn through experiments about their relationship with their surroundings. After presenting her view of science education, Susan viewed the vignettes.

Murray: What did you observe while watching the videotape?

Susan: The main thing that I kept thinking about was the teacher was only working with four kids. The second teacher worked with several groups and this was a little bit more realistic to me. The kids were very organized and either they [students] had done it [activities] throughout the year or they have been doing hands on since grade 1. I don't think that if this was their first experience with hands on materials that they would have been that calm.

Murray: What other observations did you make while viewing the tape?

Susan: I like to listen to the questions the teachers asked - good questions. I like the way they [teachers] got the groups [students] together and compiled the information and came up with the conclusions for the experiment. I like that idea.

Murray: What did you notice about the questions teachers asked on the videotaped presentation?

Susan: Well, they [teachers] were not asking yes/no questions. They asked questions where the kids had to think about the answers, talk about what they were doing, what they were saying and what was happening. They had to think about what they would do to make them think and build upon what they already knew.

Susan commented that showing one teacher with four students was not realistic to her. She also notes how the students approached their assignments. She observed that they were very comfortable, organized, and calm. This observation about calm students prompted her to infer that the students had had previous exposure to hands-on science.

Further, Susan observed teacher practices in the vignettes. Of particular interest to her was the way the teacher gathered the groups together to compare students' results and conclude

the experiment. At the end of the class, one teacher in the vignettes brought all the students together to compile a graph of student information. Once the students were in a group, the teacher asked several questions.

Susan commented that these questions prompted students to think about what they were doing, what was happening, and what they were saying. Susan felt these questions encouraged students to think and, therefore, helped to increase their knowledge by building on what they already knew. To determine if Susan observed other practices that could be beneficial to her, the following question was asked:

> Murray: Did you observe anything on the videotape that you could transfer into your classroom?
>
> Susan: I don't think there was anything I could transfer to my classroom. If anything that could be [transferred] would probably look different in my class as I deal with things differently than the teachers on the videotape. If they had my class, they wouldn't be reacting the way they did on the tape.

This insightful comment by Susan indicates that she would personalize rather than imitate practices she observed on the vignettes. Further, her comment implies that teachers respond to contexts. Just as she would adapt practices she observed from the vignettes to her classroom, so would the teachers in the vignettes adapt their practices to Susan's classroom. This is significant as Susan states that teachers do not just reproduce observed actions but must personalize them. It seems Susan is engaged in professional development. She is saying

that practices demonstrated in vignettes are not to be just reproduced but analyzed and incorporated into one's personal teaching practices. What is important is Susan may have identified the difference between inservice training and professional development opportunities. To cross-reference this comment of personalizing practices, this researcher observed Susan in action.

4.3.3 Classroom Observation

This researcher observed and videotaped Susan's lesson six days after the initial interview. The objective of the lesson was to determine which foods contained starch using iodine. Bread, cheese, crackers, and apples were tested using paper as a control. Prior to the activity, Susan demonstrated the reaction using corn starch solution and iodine. Susan mentioned that iodine was a poison and cautioned students to be aware of safety measures. The students were divided into groups of four and each member of the group was assigned a task. The criterion used to group her students was their ability to work with each other. Question sheets accompanied by a chart were distributed to students to assist them in organizing their data. Five plastic containers, one containing iodine and the other four containing the test items, were arranged on a desk at the side of the room. One student from each group was assigned to retrieve the material for the group. During the class this researcher made this comment: "The directions, assigning groups

and managing the materials went well" (Log entry 24/01/89).

The same student who collected the material performed the activity. Consequently, only two students in each group were involved in the activity. This meant that each group had two members who just observed. Since the activity could have been easily done by two group members, the observers soon lost interest in the activity, which seemed to lead to increased noise level in the classroom. To eliminate some of the noise, Susan moved around the room to ensure that each group was on task and conducted her class with practised proficiency.

The students seemed interested in the colour changes that occurred to the test items. Susan encouraged the students to orally describe to the recorder the colour changes they observed. However, as the activity progressed more students lost interest and the noise level in the room indicated that many students were not doing the task assigned to them.

4.3.4 Follow-up Interview

For various reasons the follow-up interview had to be rescheduled several times. Finally fifty-one days after the classroom observation the follow-up interview took place. This interview was held in the afternoon in the room adjacent to the library. Susan entered the interview still disappointed with results of her lesson but remained calm and candid when

questioned. "Susan is confident of her answers and gives rationale for her responses. She is a good teacher who challenges me to consider many of the missing elements when presenting inservice training sessions" (Log entry 18/01/89). This researcher was most interested in Susan's responses to the vignettes in the follow-up interview.

> Murray: Have you tried anything different in your class after watching the videotape?
>
> Susan: I tried it [grouping students] several times in other classes. It worked well sometimes and then sometimes it doesn't. It depends on the kids ... that's where I'm having problems, with some of the kids. I don't want to go on with large groups when they [students] need individual attention. When I'm in a large group, I feel I'm losing some of them.
>
> Murray: Are there other things you observed on the videotaped presentation?
>
> Susan: I remember watching the way the kids on the videotape neatly passed things and they went and got the material and they brought it to the group and it worked well. It was nice and quiet. The noise level was low.
>
> Murray: What do you suppose made the group function that way?
>
> Susan: It could be something I'm not doing that the teacher on the videotape did. Or it could be the other way around. Something I'm doing that she didn't ...

Susan's comment that sometimes her groups work and other times they do not identifies a problem Susan is having managing groups of students in science class. She tries to rationalize the problem by attributing it to certain students. When her small groups fail to function in her classroom the same way as those displayed in the vignettes, Susan resorts to large group

instruction. Large group instruction is not satisfactory to her as she feels that she "loses" some of her students she restates her earlier assumption that students learn best when doing experiments and manipulating materials. She also states that in large groups she is unable to provide individual instruction for students.

In an attempt to solve her framed problem, Susan observes the teaching practices demonstrated by teachers in the vignettes. She noticed that the classrooms were quiet and well organized. She relates the noise level of these classrooms to the orderly way the students obtained their materials. What is important is that Susan seems to be attempting to solve her framed problem of grouping students by observing teaching practices demonstrated in the vignettes. However, she suspects that the solution to her problem is more complex than material organization.

In an attempt to examine other aspects of her problem, she compares herself to one of the teachers in the vignettes. She also rationalizes that either the teacher in the vignettes is doing something that she is not or she herself may be the cause of her problems. It seems that Susan takes full responsibility for her problem. This is significant as she at first stated that "kids" were the problem. Unable to solve her framed problem, she continued to recall information from the vignettes.

Susan: I remember one time when they [classes in the vignettes] were outside and the teacher was asking something to do with a car. I remember thinking that she's [teacher in the vignette] asking good questions and the kids really had to think what they were going to say ...

If she asked questions to which kids could just answer yes or no, then I don't think that is a good question. A good question should make them [students] think about their answer and what is happening. This helps them to see what is going on.

After discussing the rationale for asking good questions in class, Susan gave examples of good questions.

Susan: Why is this happening? What do you think will happen next? Why does this do this?

Murray: Were there any clues on the videotaped presentation that would suggest to you how the teacher on the videotape got her class to function the way they did?

Susan: The thing I was thinking of while watching it [videotape] was how well they [students] did it [activity]. They were doing exactly what they were supposed to and there were no detours. I've had to clarify a lot of ideas, and I've had to think a lot more about what is happening in my room... I think one of the things she [teacher in the vignette] did was ask kids to respond using specific names. I know I've done that.

Murray: Do you have any further comments about the vignettes?

Susan: To see how she or he did it [conduct a science class] and to see what steps they [teachers] went through, maybe they [vignettes] have some ideas that you could try in your class.

After comparing herself to the teachers in the vignettes, Susan observed the questioning practices of these particular teachers in the vignettes. Susan specifically identified open-

ended questioning practices the teacher with the car was using. According to Susan, open-ended teacher questions promote student thinking. To illustrate her point, she identified the type of question that promoted this type of thinking.

Further to asking open-ended questions, Susan observed that the teacher in the vignette seemed to personalize questions. She said this practice was familiar to her. It seems, then, that Susan observed, rationalized, and empathized with the teacher's practice of asking questions in the science class. Even though she provides information regarding sound questioning practice, she does not specifically relate these practices to her problem of grouping her students.

This researcher then probed to determine if Susan was trying to observe practices that would solve her problem. Although Susan did not specify practices that would solve her problem, she did comment that she found the vignettes beneficial. They provided her with an opportunity to clarify ideas she had about what was happening in her class, showed her steps that the teachers in the vignettes went through, and gave her new ideas that she could try.

Susan left the interview without solving her framed problem of consistently running a successful hands-on science class. It appears that her problem is not with her "kids" as she suspects

or with her ability to manage a science class that is grouped for science. Perhaps this is where her problem becomes most evident; and, therefore, she framed a problem with grouping her students. To this researcher the problem is the way the selected activity was carried out. This activity should have been done in smaller groups so every student could be involved. Perhaps if the lessons Susan planned were more complex, the activity would run more like those demonstrated in the vignettes. If this were a distance education model and there was no intervention except the videotape, Susan would need more assistance from other staff members to help solve her framed problem.

Even though the problem remained for Susan, she had an opportunity to assess her teaching practices, receive new ideas as to what to do in science class, and observe step-by-step how another teacher conducted her science class. These are all opportunities that Susan is not usually afforded during her professional development days.

It seems that Susan, Kent, and Kathy benefitted from the experience of viewing the vignettes. As noted previously, these teachers had been teaching for two years. If teachers who have been teaching for two years can benefit from viewing vignettes, perhaps more experienced teachers could also benefit from viewing them.

4.4 Velma

Velma, like Kathy and Kent taught at Dog Bay School. She graduated from a university in the southern part of the province and at the time of the study she was in her third year at Dog Bay School. However, she was older than her colleagues by about five years and had taught two years in northern schools before transferring to Dog Bay School. Her prior teaching experiences made her the most experienced teacher in the study. In the year of the study, Velma was teaching grade 6 with twenty-four students.

4.4.1 Setting

Velma's classroom had two walls covered with chalkboards. The other two walls were covered with bulletin boards. One of these walls had one small window. Near this window was Velma's desk and a micro-computer the students used when they were assigned to do work on it.

Velma taught most of the subjects to her class and home economics to other grade levels. For part of each day, Velma was in the home economics room at the far end of the school. When she wasn't teaching home economics, she had a teacher assistant help her with her classroom duties. The teacher assistant allowed Velma extra time to work with the special needs students and sometimes relieved her of the extra work these students generated. Velma assigned the teacher assistant

various activities such as collecting materials and assisting students.

4.4.2 Initial Interview

The initial interview took place in the Resource Teacher's room during the afternoon while school was in session. During this discussion Velma shared her views on science education.

> Velma:.. Science, I really enjoy it, but it's not my top area as far as my capabilities are concerned... I spend more time on science because I don't want to go up in front of my class babbling and blundering around. So I work on it.

In the first part of the interview, Velma commented that she found science to be a problem. One problem she commented on was her inability to find words during her science class. To overcome this problem and to ensure her science class was successful, she spent more time preparing her science classes. She then commented on her objectives of teaching science.

> Velma: I think in a sense what science is doing is helping children to learn how to solve problems...If you can teach something that is relevant to the child...I try to follow the curriculum as much as possible, but it has to be relevant [to the child] because otherwise the child hasn't learned anything.

What is important to Velma in the teaching of science is that students learn how to solve problems. Although she tries to follow the curriculum, she also tries to engage students in problems that are relevant to them. Further, she comments that if the problems are not relevant to the student, then little

learning will take place. After commenting on her impressions of her science teaching, she viewed the vignettes.

> Velma: I think if I would have seen this [vignettes] in my first year of teaching, I would have thought that is the way my classroom should go. But now after a few years, I know, that it's not going to happen... the way you see it on the videotape...I am skeptical when I see such idealistic things happening in the classroom. I find that really hard. You almost think: I must really be a terrible teacher, I can't do that. But maybe I could...Classes don't run that smoothly, and I can't always see them [students] coming up with conclusions either.

It seems she would like to believe the vignettes are real classroom situations. However, in her words, experience has shown her that the classroom does not run as smoothly as demonstrated in the vignettes and students do not always arrive at conclusions. The vignettes could have made Velma feel she was a terrible teacher but instead she is challenged by them. She states, "maybe I could" make my class function the same way as the class in the vignettes. Here again the environments in the vignettes differed from the environment that Velma was working in, but she is aware of and recognizes similar class situations. "Kathy and Velma vary in their teaching experience but seem to be responding to the vignettes in a similar manner" (Log entry 08/11/88). Velma also expressed other views of the vignettes.

> Murray: If you were a cooperating teacher with teachers on the videotape, what would you say to them regarding their teaching?
>
> Velma: I think I would really commend them on their

> preparation before the lesson because obviously they [teachers in the vignettes] were well prepared on their questioning of individual groups...I thought she did a really good job of questioning. She used good questions to check up on the learning [of the students].
>
> Murray: What do you mean by good questions?
>
> Velma: The questions are good because there is not as much room for errors and the students have a wide variety of responses and feel free to answer them [questions] based on their observations...I think you have to have the right questioning techniques in order to have good hands-on science.

Following her ideas about questioning practices, Velma frames a problem.

> Velma: Was she [the teacher in the vignette] making it so all the groups were asking the same questions?...It is quite idealistic in the sense that you have three or four different groups of four or five students and I would be working with one group and there would be no questions from them. The other groups would be saying, "Teacher, Teacher excuse me". What do I do next if only one group was getting those questions?

Velma complimented the teachers in the vignettes on their questioning practices. The reason she liked the questions was that these teacher questions solicited a variety of answers from students. Velma seemed to want students to derive their own answers based on their own observations. She also advocated that students feel free to express their answers without fear of making errors.

Later in the interview Velma commented that good questioning practices are an important part of conducting hands-on science classes. It seems good questioning practices are

important to her: she noted the questioning practices of both teachers and students in the vignettes. From her observations of questioning practices Velma considered questions asked by students. Specifically, she framed a problem around how to manage questions from different groups. She observed that the students in the vignettes asked questions and she wondered how the teacher managed questions from different groups of students. Having framed a problem Velma then recalled information provided by the vignettes that may assist her in solving her problem.

> Velma: Also another thing I noticed [on the videotape] within a group is that they [students] can have a discussion and you [teacher] can have these three children talking giving their opinions...They [students] were used to doing things [science activities] very systematically.
>
> ...the teacher really had to prepare the students. Really sat down with them, explained to them what was expected in their groups, prepared them ahead of time so they understood completely what they are looking for.

Velma observed that the student groups discussed questions among themselves. Through these discussions some of their questions were answered and, therefore, they did not direct all their questions to the teacher. Since the students answered some of their own questions, the teacher did not have to manage all the students' questions. She also observed that the students in the vignettes worked systematically at their activities. This observation prompted Velma to infer that the teacher must have prepared the groups of students to know what to look for and how they were to work systematically. Having

observed and made these inferences, Velma later conducted a science lesson in her own classroom.

4.4.3 Classroom Observation

Velma taught her class with practised efficiency. Classroom activities such as reading announcements, handing out notices, and collecting and returning assignments were dispatched quickly and effectively. "If grouping students for science is a problem, it is not evident today" (Log entry 10/11/88). The lesson that this researcher observed and videotaped began with a review of the principles to be applied during the lesson. As the students identified the principles that were taught in previous lessons, Velma wrote them on the chalkboard. She tried to include all of the students' opinions in this exercise. Each student was asked individually to respond, not just the students who raised their hands. The students were attentive and seemed to enjoy the science class. Velma's encouraging questions and light-hearted approach to teaching seemed well received by all the students.

When the principles had been written on the chalkboard, Velma proceeded to group the students. She read the names of the students from lists. These lists had been prepared previously using Velma's insight into compatibility and ability of each student. Each student in a group of four was assigned a task such as recorder, reader, materials manager, or observer.

Once the groups had been assigned, the students were instructed to position four desks into working tables. To organize the class in this manner, desks in proximity to one another were moved into position quickly and quietly. It was evident that Velma was well prepared for her class.

Once the class had settled into groups, the equipment managers were instructed to get the materials necessary to make the electric "fairy" which had been organized on a ledge at the side of the room. When the materials had been arranged on the desks, the readers began to read the directions in an orderly and organized manner to the group. The others in the group listened and began to perform the activity. While this was taking place, the recorders were given the sheet that Velma had prepared previously. During the lesson Velma confidently circulated around the room answering student questions. She brought closure to the lesson when everyone had a working "fairy" and had returned the question sheet. The equipment managers returned the equipment to the ledge at the side of the room.

4.4.4 Follow-up Interview

After the data from the initial interview and classroom observation had been interpreted, this researcher returned for a follow-up interview seven days later. In the following discussion Velma commented on the preparedness of the teachers

in the vignettes.

Velma: I also was very impressed by how the teacher was so prepared and everything [materials] were set out. She [teacher in the vignette] had everything there, but I don't think that [my preparation] was prompted by the video. I think I would do that [be prepared] anyway. It is just that it [vignette] reinforced that for me. Being prepared is a very important aspect of teaching science.

Murray: Was there anything else you observed on the videotape?

Velma: I think the one thing that I remember seeing on the videotape, that I really thought about and I had to do myself, is that the teacher really had to prepare the students. Really sat down with them, explained to them what was expected in their groups. Prepared them ahead of time so they understood completely what they were looking for and it made me really think about how I was going to set up my group situations...

Watching how the students worked together on the video, I thought, like I don't see how you can get kids to do that [work well together] and so when I was putting my groups together, I thought about that [grouping] and I thought about students who could work together. I also thought of not putting all the students that find science easy together, putting my special needs with my better students so that they could work together and hopefully the better students could help those that have more difficulty.

Then the other day in class one of the kids said, "You know what the answer is just tell us." I said, "No, I want you to be able to figure out the answer and I am here to help you figure out the answer not to tell you the answers, because you are not going to learn." That settled them down and they began to think again and they tried to solve the problem we were discussing...Now they are putting up their hands and saying, "Is this the way you do it?" and they are seeing if they understand it correctly, checking whether their procedure is right and whether they understand the question right, especially ones who kept asking the questions all the time. So that is good, now they know that they have to think before they ask and it is just a reassurance thing and

hopefully we can slowly wean them off that too.

What is of interest is that Velma did not think the vignettes helped her prepare for science. She mentioned in the initial interview that she always prepared for science, but she commented that the vignettes did reinforce the idea that teacher preparation was important.

What she attributed to the vignettes was learning how to prepare the students for group work. This preparation, according to Velma, included thinking about students who worked well together, how to give directions to students, and setting expectations. This is important because she credited the vignettes with helping her make the connection between teacher preparation and teacher expectations.

It seems that the vignettes provided information that helped Velma solve two problems with her practice: grouping her students and managing questions from these groups. These two problems, which are interrelated, were addressed as Velma reflected on some of the grouping practices demonstrated on the vignettes. This lead her to reflect on how she would group her own students "I thought about students who would work together".

The second problem was managing student questions. To solve this, Velma chose not to respond directly to student

questions but encouraged them to think about their own questions, in other words to "think again and try to solve the problem."

Further, Velma explained that the way the students now asked questions solved her problem of not knowing what to say in science class. She seemed pleased with the changes in her class. Velma was then asked if the vignettes provided information that brought about these changes. To this question she responded in the following manner:

> The videotape made me curious whether I could actually do it [conduct a successful hands on activity in groups] in my class. I am trying to recall if I picked up something I hadn't thought of before. It is hard to say, really hard because I am not sure whether it is something I knew and had to have that reassurance or that reinforcement to come up with it again.

Velma could not credit the vignettes to any changes that occurred in her class. However, she stated that the vignettes "made her curious." Further, she stated that she may have had the knowledge prior to viewing the vignettes and the vignettes reinforced the idea for her. What is important is that the vignettes prompted her to reflect upon her classroom experiences. This reflection seemed to encourage her to try to overcome problems she had with her teaching practices and develop professionally.

Working with Velma was most educational. She provided

insights into her teaching in a congenial manner. This congenial manner was evident in the following log book entry. "I feel comfortable talking to you about my lesson even though you are the science consultant. I actually set out to prove the situation on the videotape could not work in my class and was surprised to find that it worked" (Log entry 17/11/88).

4.5 Summary

This chapter presents data in a format similar to a case study and in the sequence in which it was collected. Further, the researcher has presented his interpretation of the data along with evidence from the data to support the description of the data. It is hoped the reader has been able to judge the research and has been able to apply the data to situations within his or her experience.

During the initial interview Kathy stated that science should teach students how to learn about their environment by solving problems. Having stated her perspective of teaching science she framed a problem with grouping her students for science. After viewing the vignettes she examined another aspect of her framed problem. This aspect was handling the variety of answers that students working in groups may generate. Possible solutions were derived after Kathy conducted a thought experiment. She then chose an activity and grouped her students to perform her chosen activity. This researcher suspects that

the activity she chose ensured that the anticipated outcome to her problem would not arise. More specifically, Kathy ensured that her groups would work by deliberately avoiding a problematic situation.

The vignettes assisted her in conducting her thought experiment and provided her with information such as how to group students, ask questions, and provide support for her student groups.

Kent did not frame a problem with his teaching of science. However, the vignettes provided him with ideas for his science class, questioning practices, managing materials, and made him consider aspects of anecdotal reporting. Kent could not determine from the vignettes how the teachers in the vignettes used anecdotal reporting. To answer this query Kent suggested he may talk to his colleagues about anecdotal reporting.

Susan framed a problem with grouping her students for science. She then viewed the vignettes for information that would assist her in solving her framed problem. She observed how organized the class was and how they were grouped for science classes. After viewing the vignettes she tried classes that were grouped for science with inconsistent results. She wondered how her management of groups differed from the teachers in the vignettes. This reflection-on-action did not help Susan

solve her framed problem. This researcher suggests that Susan was unable to infer how to engage groups productively from the vignettes.

Velma framed a problem with grouping her students for science. After viewing the vignettes she examined another aspect of her problem, how to answer questions from several groups of science students. Having observed students in the vignettes discussing answers to their own problems she decided to group her students. She then told her students that she would help them solve their problems, not solve their problems. This action changed the types of questions students asked and encouraged them to work more independently. At the conclusion of the study Velma was pleased with her professional growth.

CHAPTER FIVE

MAKING SENSE OF THE CASE STUDIES

5.0 Introduction

In this chapter the method of collecting and analysing the data is reviewed and the research questions are used to draw conclusions from the data.

Professional development opportunities are conceived as valuable for teachers because they may lead to the improvement of instruction. Teachers in remote locations, however, often do not have access to professional development opportunities. One means of offering such professional development opportunities to these teachers is through the use of videotaped vignettes of other teachers engaged in teaching.

This study is an examination of four teachers' responses to videotaped vignettes demonstrating science teaching. Four teachers, from remote schools, were interviewed twice and were visited in their classrooms. The researcher proposed that the four teachers would use their professional knowledge to interpret the videotaped vignettes and possibly apply what they learned in their own practice. By recording and analysing the teachers' responses and interpretations of the

vignettes, the study sought to determine what each considered important to his or her own practice. Further, the study sought to describe to what extent each teacher reflected upon his or her practice after viewing videotaped vignettes.

Specifically, the study collected data on (a) the kinds of ideas the teachers expressed after viewing the vignettes, (b) the professional knowledge that the teachers used to interpret the vignettes, and c) the extent to which each of the four teachers framed problems with their own classroom practices and reflected on these problems.

5.1 Conclusions of the Study

This section answers the stated research questions and outlines the conclusions of the study. These conclusions are derived by comparing and analysing the data collected from the four teachers involved in the study.

5.1.1 What kinds of ideas do teachers articulate after viewing vignettes of elementary science instruction?

Before commenting on ideas specific to the research, it is worth noting that three of the teachers were initially skeptical of the vignettes. Velma stated that she was quite skeptical when she viewed what she considered to be an idealistic situation. Kathy expressed her skepticism by stating that in her opinion the vignettes were staged. Susan mentioned that a

second teacher viewed in the vignettes was a "bit more realistic." These comments indicate that three teachers considered the vignettes either to be rehearsed or the videotape was heavily edited. These initial responses may have been because teachers do not often see videotaped vignettes of colleagues or observe their own classrooms while teaching. Despite their skepticism, however, they accepted the vignettes as plausible situations.

It appears that when these teachers view vignettes they are aware of the classroom context in which science was taught in the vignettes shown to them. After some initial responses, the teachers in the study commented on the implicit educational situation, teacher practices, and student-student interactions demonstrated in the vignettes. Kathy commented that she organized her classroom into groups after viewing the vignettes. By specifically focusing on the appearance of the classroom in the vignettes Kathy seemed to consider the situation in which science was being taught. Kent considered another aspect of the educational situation. In one vignette the students were measuring the amount of pollution given off by car exhaust. After viewing this vignette Kent expressed concern about exposing students to unhealthy car exhaust fumes. Further, he mentioned the car activity showed one teacher with only four students. To Kent this student-teacher ratio was unrealistic. Like Kent, Susan commented on the situation in

which science was being taught. Susan liked viewing an entire class as she considered several groups to be more realistic than one teacher with only four students. Further, Susan commented on classroom contexts as she observed the way teachers in the vignettes gathered groups of students around themselves to compile information at the conclusion of the activity. Velma also commented on classroom contexts as she wondered how she could handle student questions within her class if she grouped her class for science. She viewed the vignettes and observed how students carried on discussions in their groups.

Kathy, Velma and Kent commented on how well prepared the teachers in the vignettes seemed to be. This preparation was evident to these teachers in several ways. Kathy and Velma noticed that the students in the vignettes knew what to do. Kathy inferred that if the students knew what to do it meant the teachers had set expectations. To Kent and Velma preparation included having materials set out for easy student access. To Velma, who was concerned with questioning techniques, preparation meant the teacher knew what questions to ask.

Teacher questioning practice was commented on by all the participants in the study. Kathy and Kent stated that teachers in the vignettes were asking good open-ended questions. Susan and Velma indicated that the teachers' questions encouraged student thinking. While Kent did not elaborate on what he meant

by good questioning techniques, Kathy and Susan inferred that by asking questions a teacher could ensure students were on task. Other comments, discussed below, suggest that the vignettes did not fulfill the viewing teachers' expectations.

Susan's comments indicated that she had not determined what the teacher in the vignettes was doing to make her class run smoothly. This researcher suspects Susan did not notice how the teachers matched the activity with the size of the student groups. The vignettes caused Velma to wonder how teachers in the vignettes were "making the students ask the same question." Kent wondered how teachers use anecdotal reporting which implies that given more information he would use this method to evaluate his students. These comments suggest that teachers use vignettes to seek information useful to them in their teaching practices. It appears the teachers in the study were convinced that they were viewing sound teaching practices in the vignettes and asked themselves, "Why?" This indicates that they looked beyond the vignettes and reflected on what they saw. Further, they reflected on their own practices such as lesson preparation practices, set expectations, and material distribution.

Velma questioned how the teacher was preparing groups of students to ask questions. By questioning how the teacher in the vignette prepared students to ask questions, Velma indicated that she was aware of teacher-student interaction in the

vignettes. Velma commented not only on student questions but observed how students in the vignettes discussed questions among themselves. Velma was not the only teacher in the study to comment on student-student interaction. Kathy and Susan commented that they liked the way the groups in the vignettes worked together. Further, Susan inferred that the students must have had practice working together for some time because of the way students quietly got materials and passed them among themselves. She also commented that student-student discussion and thinking assisted students in formulating conclusions to experiments.

In addition to the above responses, Kent commented on the inadequacies of the vignettes. Specifically, he observed a teacher in the vignettes using anecdotal reporting, but stated that the vignettes did not show him how to use anecdotal reporting in his classroom. Unable to find a solution he suggested that he should discuss this problem with his colleagues. If videotaped vignettes encourage teachers to discuss unresolved problems with colleagues, as Kent suggests, then vignettes may promote staff problem solving. This suggestion may assist Susan as she tries to solve a problem with her science class.

More important, there is evidence teachers actively respond to vignettes. They seem to be seeking information from the

vignettes that is useful to them. However, it is interesting, to note what teachers omitted from their comments. For example, none of the teachers mentioned the scientific processes such as observation, prediction, inference, and so on. This is significant because the importance of scientific processes was the focus of commentator comments and captions in the vignettes. It seems that these scientific processes may not have been useful to the teachers and therefore were ignored. The question that now needs to be answered is "what" knowledge seems to be used when teachers interpret vignettes.

5.1.2 What kinds of professional knowledge did teachers use to interpret vignettes of elementary science instruction?

Shulman's (1987) categories of professional knowledge were used to interpret the ideas that the teachers expressed after viewing the vignettes. Four of Shulman's categories germane to understanding the knowledge teachers may use to interpret vignettes are general pedagogical knowledge, knowledge of learners and their characteristics, knowledge of educational contexts, and pedagogical content knowledge. Shulman's categories are now used to categorize the knowledge the teachers used to interpret the vignettes.

Kathy and Velma used their general pedagogical knowledge when they inferred that the teachers in the vignettes were well prepared. Further, Kathy inferred that the teachers in the

vignettes had set expectations for their students. Similarly, Kathy, Susan, and Kent noticed the questioning techniques of the teachers in the vignettes. Kathy and Kent specifically commented on the open-ended questions asked by the teachers in the vignettes. Since questioning techniques transcend subject matter, these teachers appeared to have used their general pedagogical knowledge to interpret these aspects of the vignettes.

After viewing the vignettes Susan and Kent changed the way they organized materials and students. Kent stated that he changed the way he distributed materials in his science class. Susan commented that she grouped her students together to compare their findings after conducting an activity as a result of having viewed this practice in the vignettes. The importance of these somewhat isolated anecdotes is that technical strategies may be identified by teachers in vignettes and implemented into their classrooms. Susan mentioned that she personalized questions as did the teachers in the vignettes. Organizing materials and students and personalizing questions are practices germane to teaching all subject areas. By commenting on these practices teachers seem to be applying general pedagogical knowledge when interpreting vignettes. Further they must have used this knowledge to incorporate actions into their teaching practices.

Another type of knowledge these teachers may have used to interpret the vignettes is knowledge of learners and their characteristics. Velma stated that students in the vignettes were encouraged to use their own observations and were not afraid to make errors and noticed that students went about their tasks systematically. Clearly, Velma interpreted the vignettes with some prior understanding of learners.

Similarly, other teachers in the study noticed the students in the vignettes. Kathy, for example, commented that the students in the vignettes knew what to do. To make this comment Kathy must have had knowledge of what students do when assigned a task. Knowledge of students assisted Kathy in inferring that the teacher in the vignettes must have organized her students and set expectations for them. Susan concurred with Kathy and Velma as she commented on how organized the students in the vignettes performed their tasks. In the following comment Susan seemed quite cognizant of students when organizing her classroom for science:

> "I don't want to go on with a large group when they [students] need individual attention. When I'm in a large group I feel I'm losing some of them."

After viewing the vignettes Kent commented that the interest of the students was "keeping them in line." These interpretations of the vignettes suggest these teachers were using knowledge of learners and their characteristics.

The learners in the vignettes were organized into groups. To interpret how students function within groups, teachers have to have previous knowledge of how groups function or knowledge of educational contexts. These teachers' responses indicate that the educational context in which science is taught was the most problematic issue for them in the study and, therefore, was of prime interest to this researcher.

The criteria that Susan used to judge the educational context demonstrated in the vignettes were noise level and the calmness of the students. Kathy specifically stated that she observed how well the groups worked. Susan commented that she liked the way the teacher grouped her students to compile information collected during the activity. Velma noticed how the groups functioned as she commented on how groups of students get involved in discussions. It is interesting to note Velma made this comment after framing a problem around answering student questions. Each of these comments suggest that teachers use knowledge of educational contexts to interpret vignettes. Besides knowledge of educational contexts other comments suggest that teachers use knowledge categorized by Shulman (1987) as pedagogical content knowledge.

There is little evidence in the study to suggest teachers amalgamate distinct categories of knowledge. Velma states that she considers both content and pedagogy:

"I try to follow the [science] curriculum as much as possible but it has to be relevant [to the child] because otherwise the child hasn't learned anything".

Although concerned about content Velma considers both content and pedagogy important to her students' learning.

Kent focused more on content than did the other teachers in the study.

"Science is like the scientific method its logical thought goes through all kinds of patterning, observation skills, and uses fine motor skills. It [science] uses almost anything you want in the Elementary class."

In this comment Kent suggested that all subjects in the curriculum could be structured around developing student skills. Later in the interview Kent used this assumption to assist him in assessing the benefit of activities. This is evident in his comment that one of the teachers he viewed might be guiding students rather than allowing them to "find out" for themselves. Kent made a second reference to the learning of science in his comment, "Students must learn the scientific method and use problem solving to understand science."

Susan commented that teachers in the vignettes would adapt their teaching to different situations. She stated they would act differently if they were teaching her class. This comment implies that Susan is aware that teachers' practices depend upon students, content, and situation. This comment occurred when

Susan was interpreting the vignettes and seemingly seeking information to solve a problem she was having grouping her students for science class. Although she made this comment she failed to interrelate these components to solve her problem. Kent also referred to the context of the classroom when he wondered how a teacher with a number of students could do some of the activities shown in the vignettes. No other evidence was found that suggested teachers relate content to pedagogy.

This lack of relating content to pedagogy was surprising to this researcher. It was a surprise as it may mean that teachers use discrete knowledge to interpret vignettes and professional development sessions. This evidence concurs with Gunstone and Northfield (1988) who state that teachers use their prior knowledge to interpret professional development sessions. The data in this study indicates that teachers seem to possess and use knowledge similar to the categories suggested by Shulman. That is, Shulman's categories can be useful in understanding how teachers frame problems and solve problems using their pedagogical knowledge.

5.1.3. <u>To what extent do teachers engage in reflection-on-action after viewing videotaped vignettes of elementary science instruction?</u>

After viewing vignettes Kathy and Susan identified similar problems with their science teaching practices. These teachers framed a problem in terms of developing appropriate strategies for grouping students in their science classes. Although each of the teachers framed a problem around grouping their students, they examined different aspects of this common problem.

Kathy's approach was to conduct a thought experiment about student grouping that assisted her in examining concerns she had with teaching a particular science lesson. This thought experiment resulted in an hypothesized outcome for grouping her students in a science lesson, but left her puzzled as to how to deal with the potentially different answers students may derive from the same activity. Further, she hypothesized that these different answers may not be scientifically correct. In order to circumvent this potential problem Kathy chose to engage the students in a simple comparison activity. In so doing she attempted to minimize the range of student responses and the likelihood of obtaining "incorrect" responses. Although Kathy grouped her students, she only partially reached her earlier stated goals of engaging students in meaningful problem-solving activities. That is, the lesson content and her instructional activities still did not provide the sorts of challenges and explorations between students and materials that she had

envisioned earlier. It is also interesting to note that she grouped her students because she liked the appearance of the classroom in the vignettes. It seemed that the vignettes assisted Kathy in that they suggested an approach that she might use to address some of her educational goals.

Susan, like Kathy, was concerned with grouping her students for science. Initially she identified her students as the problem. She then stated that sometimes her groups worked while other times they did not. Having stated this problem she seemed to be viewing the vignettes for clues that would assist her in solving her problem. She reflected on her teaching as she commented that the vignettes made her "think about what goes on in my classroom." Further, she attempted to reflect-on-action when she stated, "It could be something I'm not doing that the teacher on the videotape did, or it could be the other way around, something I'm doing that she didn't." Clearly, the vignettes prompted Susan to examine her teaching practice related to grouping her students in her science class.

Velma framed a problem around grouping her students as well. She then identified an aspect of this problem as answering student questions when students were placed in groups. After viewing the vignettes she commented "I thought about that [grouping] and I thought about students who could work together." Further, while viewing the vignettes she inferred

that students in groups were discussing the questions and, therefore, the teacher in the vignettes did not have to answer all the questions raised by students. This inference encouraged her to group her students and then announce to them that she was there to help them, not simply to answer their questions. This action caused her students to change the questions they asked. This response to her action surprised Velma and may have increased her knowledge of students and their characteristics. It seems the vignettes provided Velma with information that caused her to reflect on her actions, and assisted her in solving a problem answering student questions when students were placed in groups.

Kent commented on evaluating students using anecdotal methods demonstrated in the vignettes. Given that he had several special needs students in his class this method of evaluation would have been helpful to him. However, the information he wanted was lacking in the vignettes so he did not solve this problem to his satisfaction. His interest in this aspect of the vignettes showed that he was reflecting on evaluation practices. Further, the vignettes appeared to have helped him formulate this problem with his teaching practice.

The vignettes appear to have assisted these teachers with framing problems with their practice and provided information to solve these problems. Further, it seems these teachers improved

their practice as a result of reflecting on action after viewing videotaped vignettes. This study concurs with Kilbourne (1988) who suggested that vignettes promote teachers to reflect-on-action.

5.2 Major Findings of the Study

1. TEACHERS APPLY PEDAGOGICAL KNOWLEDGE TO INTERPRET VIGNETTES.

Teachers in the study apparently apply general pedagogical knowledge, knowledge of learners and their characteristics, knowledge of educational contexts, and pedagogical content knowledge to interpret the vignettes. Most of the comments made by teachers involved with the study were about practices that could be used in teaching any subject. These comments include teacher organization of materials and students, setting expectations, questioning practices, material organization, grouping students and personalizing questions.

2. AFTER VIEWING VIGNETTES TEACHERS MAY FRAME PROBLEMS WITH THEIR TEACHING PRACTICES

Three of the four teachers in the study framed problems with their existing classroom practice. A central issue in each of these cases was the grouping of students. However, each teacher articulated this problem differently. Kathy wondered how she would handle the different answers provided by each group to the same activity. Susan searched for the answer as to why her students did not appear to be on task. Velma wondered

how she would handle the questions from different groups. What is important is that teachers framed problems with their teaching practices and identified aspects of these problems after viewing vignettes of elementary science teaching.

3. TEACHERS MAY REFLECT-ON-ACTION AFTER VIEWING VIGNETTES OF ELEMENTARY SCIENCE INSTRUCTION BUT MAY NOT SOLVE THEIR FRAMED PROBLEMS.

Kathy framed a problem with grouping her students for the purposes of engaging them in problem-solving activities. However, she only partially solved her problem because once the students were grouped she engaged them in an activity that did not require them to solve a problem. She was prompted to solve the problem of grouping her students as she "liked the way the class looked in the vignettes." To overcome the problem of grouping her students she must have reflected and initiated action.

Susan provided insight into reflection on practice when she stated that she has had to "clarify a lot of ideas and think a lot more about what was happening in my room." She clarified her ideas on grouping her students and commented "It worked well sometimes and then sometimes it doesn't." According to her, the reason groups worked or did not work depended on the "kids." Later she reflected on her actions as she stated, "It could be something I'm doing that the teacher on the videotape did or it

could be the other way around." It appears that Susan reflected on her classroom actions/practices as a result of viewing the vignettes.

Like Susan, Velma also framed a problem that concerned grouping her students. Velma's problem was how she would deal with a variety of student questions and grouping her students for science class. By reflecting on her problem she commented "I thought about that [grouping] and I thought about students who could work together." Further, she then told her students that she would only help them solve problems not provide answers to them. Once she had told her students that she was not going to give them answers they began "to solve the problem they were discussing." After reflecting on her problem and testing actions she seemed pleased that her initial problem was solved and her class seemed to function well.

It seems that the vignettes assisted these teachers in framing a problem with their practice and provided information that motivated them to reflect on their practice to solve these problems. Further, it seems that these teachers improved their classroom practices.

4. THESE TEACHERS WHEN VIEWING VIGNETTES DID NOT ATTEND TO ORAL COMMENTARIES OR CAPTIONS.

No evidence in the data suggested that teachers, when

viewing vignettes, attend to oral or captions in the vignettes. The vignettes provided several captions and oral commentaries about the use of science processes in the science class. However, none of the teachers mentioned the science processes in the interviews. This lack of comment about science processes such as predicting, measuring, comparing and so on suggests teachers apply their own interpretation to vignettes. These interpretations seem to depend on problems teachers have framed with their teaching practice. Further, if information is not related to their problem, the teacher may ignore information provided by the vignettes.

5. THESE TEACHERS INTERPRETED THE VIGNETTES IN WAYS THAT WOULD ASSIST THEM IN THEIR TEACHING

During the interviews teachers discussed issues that were of interest to them and their teaching practices. Kent's comment, "I was looking at how she had the materials set out. I also saw how those lessons worked," and Susan's comment, "I remember watching the way the kids on the videotape neatly passed things and the way they [students] went and got materials to the group and it [lesson] went well" suggest that the teachers were looking for ways to improve their own teaching practices. Velma commented on the way students discussed questions among themselves and then encouraged her students to do the same. It appears that vignettes demonstrate to teachers practices that can be useful to them to improve their practices.

5.3 Limitations of the Study

The factors that may limit the generalizability of the study are the setting, the nature of the relationship between the researcher and teachers, and the time frame used in collection of the data.

The first factor, the isolated setting in which the study was conducted, has some unique characteristics which must be considered when interpreting the findings of the study. In particular, the nature of the relationship between the researcher (who served as consultant in the School Division at the time) and the teachers was an important factor in establishing the type of "trust" which facilitated the procedures involved in carrying out the study. For example, the role of the researcher/consultant was one of providing new materials for teachers in the Division, of offering advise and support to teachers rather than evaluating their practice, and of soliciting other forms of support such as providing substitute teachers to allow the teachers in the study to participate in videotape viewing sessions and interviews. The setting and the relationship between the researcher and the four teachers must be considered by the reader in interpreting and generalizing the findings.

Finally, the time frame used in the collection of the data must be considered as a possible limiting factor since, in

several instances, up to two weeks lapsed between the classroom observations and the interviews. This duration may well have contributed to the interpretations of the classroom events and actions being "reconstructed"'somewhat by both teacher and the researcher.

5.4 Implications of the Study for Professional Development in Remote Schools

In my experience as a science consultant, professional development means that teachers are asked to implement suggestions from a presenter. This format of professional development has resulted in limited changes in teacher practice. It seems that teachers are unable to reproduce actions and incorporate them into their practices. This study offers an alternative to this method of professional development. The study proposed that videotaped vignettes could be used as a tool to overcome shortages of presenters, and provide low cost professional development opportunities. Vignettes can be sent to schools or transmitted via satellite. Once the vignettes have been viewed by teachers, the implications of the innovation demonstrated in the vignettes can be discussed by the teachers involved. This discussion may focus on the implications the innovation has for each teacher and school. Information provided by the vignettes and the problems framed by teachers can be discussed at the school level. A structure promoting this discussion should involve the teachers, principal, and if

need be a consultant. The following discussion examines the roles of the teacher, principal, and consultant in this structure.

5.4.1 Teacher

Kent suggested that teachers could discuss amongst themselves the implications of the vignettes to their classroom practices. Susan commented that these practices may not be transferred unchanged from the vignettes but personalized by individual teachers. Teachers must be the ones to frame and solve problems with their practice if they are to improve their classroom practice. They may be able to do this by using information from vignettes coupled with a problem solving format.

One format for solving problems that has been found to be successful is action research. The goal of action research according to Grundy and Kemmis (1982) is to promote the development of judgment. Wise judgment is acquired through rational reflection on classroom practices. A teacher is asked to formulate a problem and hypothesize solutions, which are attempted in the classroom. The hypothesized solution may come from a thought experiment as in reflection-on-action. To ensure the success of such a plan, teachers must be encouraged to share their problems and reflect-on-action. By involving teachers in action research the school environment is being affected by

increasing dialogue, collegiality, experimentation, continuous assessment, and effective school development (Fullan, 1987, Kemmis, 1987). These dimensions of action research provide opportunities for enhanced professional development for teachers and an improvement in a school climate where learning is encouraged for students and teachers alike.

To ensure continued professional development, teachers should meet regularly, share their problems, and keep a written log book of their continued progress as professionals. The log book should contain framed problems, information provided by vignettes and discussions, and hypothesized actions and observed outcomes of these actions. Fullan (1991) sees teachers and others working in small groups interacting frequently in the course of planning, testing new ideas, attempting to solve different problems, and assessing effectiveness (p.142). This structure for school level professional development should also involve the principal.

5.4.2 Principal

The principal must be included in professional development opportunities as he or she is responsible for evaluating staff and ensuring that an acceptable standard of education is maintained within the school. However, in a school where the staff is taking control of its own professional development opportunities, the principal must take a leadership role and act

as a facilitator.

As a facilitator, the principal's role should be one of a reflective leader. Fullan (1991) states that principals should critically reflect on whether their own conceptions of the role are placing unnecessary limits on what can be done (p.168). What is important is that principals must stay informed of the problems teachers are attempting to solve and support their efforts. Principals should monitor meetings and agree with the staff on the criteria used to evaluate effectiveness. This evaluation should support communication and productive problem solving. This may be done by encouraging the staff to frame problems and reflect-on-action. At times problems may arise that neither staff nor principal can solve. At such times an outside consultant should be contacted.

5.4.3 Consultant

In a remote school the consultant can provide advice via computer, telephone, or satellite transmission. Working with teachers and staffs who have framed problems the consultant can bring vignettes and information that may assist teachers to solve their problems. If the particular problem is a subject area problem, then a consultant, with expertise in that area, should be contacted. Time should be allotted for teachers to view vignettes, frame problems, and discuss these problems to support reflection-on-action. The benefit of contacting a

subject-area consultant is that reflection-on-action conducted by teachers should require input consistent with a subject area. One benefit of reflecting-on-action within a subject area is teachers may increase their pedagogical content knowledge. Another benefit of involving outside consultants is that principals and staff can be informed of innovations or trends in education such as sustainable development.

5.5 Recommendations for Further Research

1. Studies should be done in an urban setting to determine if urban teachers respond to vignettes in a similar manner to teachers in remote schools.

Urban teachers have more access to professional development opportunities than teachers in remote schools. Studies should be undertaken to determine if teachers in urban areas frame similar problems and conduct thought experiments or reflect-on-action similar to the teachers in this study.

2. Studies should be conducted to determine what factors need to be considered to promote professional development using video technology.

This study determined that teachers are skeptical of vignettes but, when individually approached, engaged in professional development. What needs to be done now is to examine the factors involved in using video technology with a staff.

3. Vignettes with demonstrations of other subject areas should be carried out to determine the problems teachers frame in response to these vignettes.

Vignettes of social studies, language arts and health education may enable teachers to frame problems in different ways. This information could help determine the use of vignettes as a professional development tool.

5.6 Summary

This chapter has answered the research questions and, provided the major findings, implications, and recommendations associated with the study. The data in the study suggest that teachers possess knowledge of pedagogy. Further, they use this knowledge to interpret videotaped vignettes. These interpretations may make it possible for teachers to frame problems with their teaching practices.

Teachers seem to use mainly general pedagogical knowledge to frame and solve problems with their classroom practices. The lack of evidence of pedagogical content knowledge suggests that teachers have specific problems when teaching science. Vignettes may assist teachers in framing problems with teaching science and provide information to solve these problems. There is evidence in this study to suggest that videotaped vignettes can provide information that may be used to further professional development for teachers in remote schools.

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APPENDIX A

DESCRIPTION OF THE VIGNETTES

The twenty minute videotape used in this study was produced by the Alberta Department of Education in 1982. The videotape was produced to introduce teachers to the inquiry method of teaching science. The videotape demonstrated ten activities where students manipulate materials.

The science processes of observation, controlling variables, hypothesizing, predicting, classifying, communicating, and measuring were related to science teaching. A description of the activities follows:

ACTIVITY 1. ISOPODS

Students were provided with a piece of tin foil, hot and cold water, two hamburger containers and five isopods. With these materials the students were asked to determine the temperature of water isopods prefer. The videotape demonstrates students constructing a small trough and suspending it between the hamburger containers. After adding water (hot at one end and cold at the other) to the trough the students introduce several isopods. Each group of students record the number of isopods in each section of the trough. In this activity the students were asked to control variables.

At the end of the lesson the teacher engaged the students in a large group discussion and graphed the results of their collective data. This activity which involved observation and recording of data demonstrated students collecting and interpreting data.

ACTIVITY 2. MYSTERY POWDERS

In this activity the students were asked to determine the contents of foil tart containers. To determine the contents the students held the tart trays with wire loops and observed the colour changes as the Plaster of Paris and sugar were heated. The teacher encouraged students to make predictions by asking open-ended questions such as "What do you think is going to happen?" before the activity.

ACTIVITY 3. BATTERIES AND BULBS

Students predicted and then gave reasons(s) for their prediction(s) before testing the battery/batteries and alight bulb connection(s). In doing this activity students were asked to consider variables.

ACTIVITY 4. ELECTROMAGNETS

Students were asked to make an electromagnet by coiling coated wire around a large nail and attaching the coil to two

batteries. As the number of coils and batteries increased the students recorded the number of paper clips the electromagnet attracted. The intent of this activity was to have students see relationships between variables.

ACTIVITY 5. CLASSIFYING MATERIALS

Students were asked to classify materials using a magnet. By classifying objects in this manner students explored properties of objects. Later the students were asked to justify the groups of objects they created.

ACTIVITY 6. CIRCUIT BOXES

This activity instructed students how to construct a circuit board. As the students did this activity the teacher asked open-ended questions. The teacher also challenged the students by asking them "What would have happened if . . ."

ACTIVITY 7. CAR EXHAUST

This activity demonstrated how a study of car exhaust could be used to make inferences. Four students with one teacher held a piece of white paper a specified distance from a car exhaust pipe. By observing the different amounts of matter given off by the exhaust students determined the pollution created by the car's exhaust.

ACTIVITY 8. TESTING AN INDICATOR

Scientific thinking was promoted by having students measure amounts of vinegar and ammonia and then testing them. As students added drops of vinegar and ammonia to an indicator they noted colour changes. A second colour change was noted when carbon dioxide was added to the indicator.

ACTIVITY 9. TEST GASES

Carbon dioxide was produced by adding vinegar to baking soda. Students were asked to examine what happens when a burning splinter is introduced to a container of carbon dioxide. Throughout the activity the students were asked to make inferences and hypotheses.

ACTIVITY 10. EXPANDING BALLOONS:

Students used carbon dioxide to make a balloon expand. To do this the students required a 10 cm glass tube with two one-holed rubber stoppers at either end. A balloon was attached to the upright stopper. When 15 cm each of citric acid and baking soda were added to 25 cm of water the reaction produced gas, which caused the balloon to expand.

APPENDIX B

CLASSROOM OBSERVATION FORM

SHELVING

WINDOWS

CHALKBOARDS

DESK ARRANGEMENT

BULLETIN BOARDS

TEACHER'S DESK PLACEMENT

CLASSROOM EQUIPMENT (computers, sink, animal cages)

TEACHER-STUDENT INTERACTION

APPENDIX C

The following letters were unsolicited and show the support of one of the principals for the study. The other principal and superintendent gave verbal support and made arrangements for travel, purchased videotapes, and arranged teacher substitutes. Hiring substitutes allowed the teachers to take part in the study during regular class time.

FRONTIER SCHOOL DIVISION NO. 48

DUCK BAY SCHOOL

DUCK BAY, MANITOBA R0L 0N0

(204) 524-2394

September 21, 1988

Murray Smith
Area II Math-Science Consultant
121 1st Street S.W.
Dauphin, Manitoba
R7N 1M9

Dear Murray:

The Duck Bay School Staff and I are very intrigued with the Video Inservicing project you are initiating in Area II Schools. We are extremely pleased you have selected Duck Bay School as a site for part of your study. We feel this will be a very positive learning experience for everyone involved.

You are entering this project with all of our support and cooperation. We are looking forward to getting things under way.

Thank you for choosing Duck Bay School as one of your participants.

Sincerely

Norm Brown
Principal

NB/pf/rml

FRONTIER SCHOOL DIVISION NO. 48

DUCK BAY SCHOOL

DUCK BAY, MANITOBA R0L 0N0

(204) 524-2394

February 28, 1989

Mr. Murray Smith
Frontier School Division #48
121 1st Street S.W.
Dauphin, Manitoba
R7N 1M9

Dear Murray:

On behalf of the Duck Bay School Staff I express our sincerest thanks for the time you spent with us Monday, February 20, 1989.

The session was very interesting and informative. We have recognized areas which need work and we feel we are headed in the right direction.

Once again thank you.

Sincerely

Norm Brown
Principal

APPENDIX D

SAMPLES OF THE INTERVIEW TRANSCRIPTS

First Interview with Velma, October 11, 1988
(The interview was conducted in the Resource Room at Dog Bay School during school hours)

1. Murray How long have you been teaching?

2. Velma I have been teaching for four years. I taught two years in another school and I taught the past two years in Dog Bay and this is my third year in Dog Bay.

3. Murray What sort of goals and objectives do you hope to achieve in teaching science?

4. Velma I think in a sense what science is doing is helping children to learn how to solve problems.

5. Murray Do you think science has to use the scientific method all the time?

6. Velma Not always. I don't always use it anyway.

7. Murray Umm.

8. Velma Right now we are learning about nature and to the students this is interesting as they live in the country.

9. Murray Would that be a problem solving activity?

10. Velma No, I guess not. In a sense it wouldn't.

11. Murray To what extent in your classes do you have students manipulate materials to solve problems?

12. Velma At this time of year I don't have too many (problem solving) activities because basically what I'm doing is developing a control of the classroom, getting a feel of whether they can work together in groups and stuff and whether they can work on their own. Basically atmosphere controlling, but once we get beyond that I hope that we can do more of the experiment type things. Once you get past the first month or month and a half we can get right into other

things.

13. Murray This classroom control has to be a component of the classroom

14. Velma Yes.

15. Murray The hands-on activities have not really caught on in this province. Even my own daughter in Grade 10 gets very few hands-on activities.

16. Velma I think you have to have the right questioning techniques in order to have good hands-on too. They have to understand why they are doing that. I spent all my time in junior high school on hands-on. We spent all our time in the lab. I remember that well.

17. Murray How did the kids like that?

18. Velma Oh, yes. We dreaded the days we had to go to the classroom and do book work, but we did have to and then we were challenged to do our own projects. This was in Austin where I went to junior high school and that was a few years ago. But when you get into high school we did fewer activities.

19. Murray Isn't that interesting.

20. Velma But grade 10 you did some grade 11 also. I like hands-on. The kids like it and they remember more I think when you do hands-on. And then they are not day-dreaming. If you are discussing they can use hands-on as long as the students are grouped.

21. Murray To what extent do you find your students talking to one another about the activity? Do you see that as a problem?

22. Velma Some of them do. I tried one group activity this year, and found two groups that would talk together. Basically they wrote down their own answers. If they disagreed or whatever, they would just sit there. I tried to get it across that they need to talk together.

23. Murray Do they do the activities?

24. Velma Yes, but they don't talk to each other unless somebody does something wrong.

25. Murray How easy is it to teach science in this school? Do you find equipment and support for your science program?

26. Velma It's not too bad. You have to really be organized in order to do science because to be a science teacher you have to get your stuff from the science room. Therefore you have to know ahead of time. I found that in the last couple of years. I also have boxes of equipment in our classroom. I didn't have one in the other school when I taught 5 and 6 there.

27. Murray Do you have any other thoughts on teaching science?

28. Velma Like with science, I really enjoy it but it's not my top area as far as my capabilities are concerned. I know last year, the grade 6 teacher did not open that box at all. We have to get on procedures and hands-on procedures because with the Science Fair we have in our division, the kids would have to understand that. I remember going crazy my first year because I hadn't taught my students the procedures and therefore they did not understand the procedures. I think I have always wanted to be innovative things, I like to try new things. No I don't think I have changed that way. Sometimes I'm frustrated that I don't come up with more new ideas to try in my classroom.

29. Murray That's some of the excitement of teaching.

30. Velma There is so much to do in preparing kids work.

31. Murray Do you think it is worth the preparation?

32. Velma Yes, because number one your students enjoy themselves and very often when you start asking they suddenly start thinking.

33. Murray What do you do with the processes which are in the K-6 guide?

34. Velma Chuck them. You look at them a few times and you think, oh yes, you go out and teach these. But I have a hard time. If you can teach something that is relevant to the child, I try and follow the curriculum as much as possible but it has to be relevant because otherwise the child hasn't learned anything.

35. Murray Let's watch the video tape and see what you think of it.

ALBERTA VIDEO TAPE SHOWN

36. Velma The kids must have been with the processes. They definitely have done these things before.

37. Murray Are there any other observations about the videotape you wish to share?

38. Velma I thought it was great the way they got them to do things like that. They likely learned more than if you said, "Well if you had two different cars what would happen?" I mean that isn't going to have the same effect as if they go out there and actually do it.

39. Murray I'm still wondering about your first question. It's a good one. How much programming was done with those kids before they went into the classroom?

40. Velma It seemed that almost all of them were learning and I can see some of my kids not catching on. It is quite idealistic in the that you have 3 or 4 different groups of 4 or 5 students and I would be working with one group and there would be no questions coming from them. The other groups would not be saying teacher, teacher excuse me. What do I do next if only one group was getting those questions. Was she making it so all the groups were asking the same questions? Some groups were thinking. Maybe some groups don't need it as much as others, I don't know. It looked really good, I thought. I would like to see my science class run like that but it seems really idealistic in some ways.

41. Murray Could you get your class to preform the way the class performed on the tape?

42. Velma Maybe if you do enough programming before. Like "You don't kill those bugs" or "we won't do experiments any more. We won't get to do these kinds of things." I would have to do that before because I could see the boy and girls doing their experiments and killing the bugs. If they didn't keep them alive, you couldn't finish the experiment. Possibly you know they had learned that this was the expected behaviour and that was the way they were used to doing hands-on

activities. They were used to doing things very systematic. They would look at their instructions and follow them very closely. The students on the videotape had work sheets and they knew their predictions. It wasn't like the class comes up with a hypothesis at the beginning. It seems they were given their procedure and they had prediction sheets.

43. Murray If you were a cooperating teacher with some of the teachers on the video tape, what would you comment to them regarding their teaching?

44. Velma I think I would really commend them on their preparation before the lesson because obviously they were well prepared on their questioning of individual groups.

45. Murray Do you think you could tell them things that they could improve upon?

46. Velma It's hard to say. I didn't understand the purpose of some of the lessons. There was a definite direction to her lesson and she was letting the students arrive at the purpose of the lesson with the bugs. They were just trying to find out what environment their bugs preferred. The one with the bugs, I liked that. I thought she did a really good job of questioning. She used good questions to check up on the learning. It was good. You could use different techniques. It is so visual for the child. They could understand the lesson when they were adding up their data on the board.

48. Murray What was it that you paid attention to on the videotape?

49. Velma The preparation and questioning.

CLASS VIDEOTAPED NOVEMBER 10, 1988

SECOND INTERVIEW, NOVEMBER 17, 1988 (The interview took place in the Home Economics room).

1. Murray In the lesson that you did, did it turn out the way you had planned it?

2. Velma Just about . . . I didn't expect it would take as long as it took for them to complete it. Basically, as far as the kids coming up with results . . . they did better than I thought

they would. I didn't expect the background information that they had would be incorporated so well into their lesson. I thought they had done really well. We had dealt with the three scientific laws but they would think about those when they were doing this whole experiment . . . I was really surprised they actually thought about them and used them.

3. Murray Were there any other surprises that came up?

4. Velma Yes, they were good. They were well behaved and they worked together really well. The groups that worked together were really working well.

5. Murray One of the things that surprised me during the lesson was the group that got it didn't realize that every other group had already done it. When it actually happened for them, they all put up their hands for your approval.

6. Velma That didn't surprise me. They are very much that way and it is not just that particular group. I noticed that today, when we were going a step further with it, that there was more of that. You know, "We got it to work Ms. Luba, we got it to work" . . . When they raise their hand, " Come over here, we want to show you that we got it to work." It wasn't just "We did it", but they wanted me to see that they could do it. I noticed that even today it was the same thing again, that they really needed me to see that they had done it.

7. Murray Do you think they are looking for your approval or checking with you that they are doing it correctly?

8. Velma I think they are checking, trying to prove to me that they are doing it. For some reason, I think they think that they have to prove to me that they have done it and I don't know why they would because I have never doubted anything that they have done.

First Interview with Kathy, October 11, 1988
(The interview was conducted in the Resource Room at Dog Bay School during school hours)

1. Murray We are going to talk about science and then I'd like to get your reactions to a videotape. This would be your second year of teaching?

2. Kathy : Yes, it is my second year of teaching.

3. Murray What goals and objectives do you hope to achieve through the teaching of science?

4. Kathy Why teach science? So the students can acquire a knowledge of not only learning what's around them but also learning how to find out on their own what's around them. Hands-on Science can't be, "Okay kids here's a bunch of stuff go learn with it." That's what I see a lot of people doing. It's like learning what you want, the same thing with learning centres. Hand-on is fine after they know what they are supposed to be doing with their hands.

5. Murray What do you see as the happy medium?

6. Kathy : That's what I still don't know because there are different things, different ideas. I'll be giving more things which they will find more difficult. It depends on the kids and it depends on the activity. Some things you can give them a lot of freedom with. Even if you manage to accomplish what the teacher wanted you to do. You may not know what you have done at this point. I'd like to mention that saying I thought I should, and they don't know why they are doing it.

7. Murray They do that automatically, is that what you are saying?

8. Kathy : Yes, and at different places. They have no reason for it because they don't understand it. They are just mimicking what the others are doing.

9. Murray Are you saying students do certain things but don't know why they are doing them.

10. Kathy : Yes, in some situations.

11. Murray You used the word "think," How do you define thinking?

12. Kathy : That's a tough question.

13. Murray It is and it is one that is bothering me at the moment.

14. Kathy : Thinking, your ability to reason, to take some thing and to say now that's what I have to do.

15. Murray I see thinking is the process of learning.

16. Kathy : That's basically what it is.

17. Murray Coming back to something else that you alluded to was that your giving reason and I'm getting meaning out of what I am doing. Now, you said that's how we do it. We work with things and we mimic other people. Is that another way of getting to know what to do.

18. Kathy : They are really getting to know what to do though mimicking. That's what I'm confused about. They're just going through the motions. Because I see someone else doing it. My mind is still one step behind that persons because I'm doing it and saying, "Why am I doing this"? Meanwhile that person has got it all set up and doing the rest of it but I'm still not quite sure why I did this and before I can do that and understand that I have to stop and think.

19. Murray Are there other ways that we make meaning of the world? Like we experiment with things. We copy other people. What about talking? Is that helping us understand the world we live in?

20. Kathy : What do you mean by talking?

21. Murray Like discussing as we are doing now. Are we not looking for meaning?

22. Kathy I guess so.

23. Murray What is your class like to teach?

24. Kathy : Last year I had students with learning problems and behavioural problems. You couldn't do any teaching unless you had them strapped to their seats. So it was really a perfect chance for me to see that the ideal class does exist. There

are some kids that are different. So I had a chance to see that last year. I'm glad I had those first and now these because if I would have had these first and last year's class this year, I probably would have been in tears by now. I didn't realize that's the way it can be sometimes.

25. Murray Are you saying that you have a really good class this year.

26. Kathy : Yes, It's a group that I student taught with for six weeks and they were all sweet little clever students.

ALBERTA VIDEO TAPE SHOWN HERE

43. Murray What would you tell the teacher on the tape if you were a cooperating teacher with her?

44. Kathy : Are those really my kids?

45. Murray No, a cooperating teacher is where you would go into the other class and you would be working on solving a class problem. You've gone in, you have seen these teachers in action. What sort of comments would you make to them regarding what you have seen in their science classes?

46. Kathy : I think those kids knew what was going to be done. I think it was the video's problem, not the teachers.

47. Murray What sort of things do you see having to happen to get the kids to that level, to work in groups on things?

48. Kathy : We worked as one group and I had my recorder and everything but then we all knew. That would have been scary for me because I would have had two totally different answers but maybe one group did not want to do it and we would have to do it all over again.

49. Murray Did you get any ideas from the videotaped teachers?

50. Kathy : Actually yes. With the ecology bit of it, there aren't too many experiments you can do other than grow bread mould and we already did that. We all got to draw it and had a chance to participate with that as a class. I'd be interested in

seeing what the teacher did before. Do you realize I didn't answer that question that you asked me?

51. Murray Not specifically. You started to with, you would be interested in seeing what the teacher did before. So maybe one of the things that you would ask if you just dropped in and you saw that lesson.

52. Kathy : That's right. I would have asked that.

53. Murray But you also said something about and you mentioned this earlier you were interested in how the class was set up and that is one thing you zeroed in on in the video.

CLASS WAS VIDEO TAPED NOVEMBER 10, 1988

SECOND INTERVIEW, NOVEMBER 17, 1988
(the interview took place in Home Economics Room at Dog Bay School)

1. Murray How did you feel about that lesson that you did for the videotape?

2. Kathy It was really organized. I knew that I was going to be on tape. I wanted things to work out. So I really did a lot of planning with the kids before hand. We went over the cell. They knew from last year what a cell was but they didn't know the cell parts. What they said and noticed was all on their own. They didn't know what they were going to see unless they had seen a boiled egg before and put it into the vinegar. They thought it was going to explode and all kinds of wonderful things. They never saw it, just went in that closet and they kept looking to see what happened.

3. Murray Have you done a follow up? Have they seen the eggs?

4. Kathy We did that when we came back on Monday. We left it all weekend and what I did again was I had my egg and showed them how to take it out of the vinegar and put it on a paper towel and dry it off and then I gave each group their own egg and they dried it off and then they had the salt on the paper towel and I went around sprinkling salt on his paper towel and they rolled the egg in salt and left it there. While the egg was

sitting there in the salt, they came up, as a group, at the back table and watched me tear the cell membrane off the egg and the egg went slimy and everybody went "ooh." They looked at that. I was too frightened to let them actually do that with their own egg. I really didn't want to. I figured a lot of them have seen a raw egg before so they know what it looks like.

5. Murray This is my interpretation. You told me that one of the goals of science was the inquiry approach and what I saw is what I understand is an inquiry approach. I identify that as the inquiry approach, where they are coming up with their ideas with the hands-on material.

6. Kathy It depends on the kids and it depends on the activity.

7. Murray So, what you are saying to me is that you are trying to find a match between your kids and the activity and you mentioned that if it was too difficult it was wasting their time. This is a point that you mentioned about grouping kids. That you would lose a certain amount of control over what they were learning and I felt that was bothering you. You wouldn't know what the group at the back was really doing. Were they getting the right answers?

8. Kathy Yes. I guess, because you want them to get a certain thing out of it yet I don't think you can go into a lesson and just say, okay we are going to do this and whatever happens, happens because then you get too many things and it is hard to plan a lesson if you don't know what you want kids to get out of it. Thereis so many other things that they can get on their own by working on their own but there is still something that you want them to learn. . . . .There has to be. There has to be a reason for doing this. When I am working with four different groups, I can only really see what is going on in one group at one time. So those four kids, I know that they are doing this. Basically, I guess you do get the feeling of whether they are getting it or not, but you are not there all the time.

First Interview with Kent, October 11, 1988
The interview was conducted in the Resource Room at Dog Bay School during school hours)

1. Murray How long have you been teaching?

2. Kent Two years.

3. Murray I understand that you have a science background.

4. Kent I have a Bachelor of Science, Botany major and Psychology minor. I have most first year science courses. University physics, biology, chemistry and calculus and earth science as well geography. So I have a wide range and took weather and climate and things like that.

5. Murray You have a very strong science background compared with most teachers.

6. Kent Yes, I would guess that would be compared to most teachers, but not compared to my friends. One of them is going for his Phd right now.

7. Murray What are you objectives in teaching science?

8. Kent What purpose does it play? Science can be applied to anything. They use science to teach you how to plan a lesson. I think it is the most directly applied subject next to math. Science is like the scientific method. It's used in everything and it's logical thought goes through all kinds of pattering, observation skills, uses fine motor skills. Uses almost anything you want in an elementary class. In fact I always thought of science as the centre of any integrated unit. I wouldn't start with language arts as most teachers would. In fact I do have an integrated unit dealing with science structures.

9. Murray Is this a unit you planned yourself?

10. Kent Yes.

11. Murray What was the content?

12. Kent I think I mentioned it to you before. It's a hands-on bridge building unit. So it has art, science, language arts. They have to write up instruction on how to build a bridge. They have to make a blue print. Then they have to build

the bridge out of toothpicks. They must use the least amount of toothpicks, using a trial and error method. You can use math with weights and graphing. They have to apply the metric system, addition, multiplication and they learn about grams.

13. Murray And you have all this written up?

14. Kent Well I have most of it written up right now. The math and language arts end of it I could expand on. They have a contract at the beginning and they form a company. After naming the company they select a president and chief engineer. They name who is which and then expand on their idea and select a definite goal of problem solving.

15. Murray You mentioned problem solving. You mentioned the scientific method. How are those tied together or are they separate?

16. Kent You can apply science or the scientific method to any problem solving situation because it starts with a hypothesis. You have an idea that you may want to prove or disprove. Why or how you are going to prove this leads to objectives. You go on through each step. You must use materials and use your math similar to a math word problem.

17. Murray Do you use that in your teaching of science?

18. Kent In my teaching of science do I use that? Once every six day cyclic we have an experiment. So we go through the object, apparatus, method, observations, and conclusions. Right now, they are doing one on mould that will be continued because they have to do observations. They are doing it once every three days.

19. Murray How easy is it to teach science in this school?

20. Kent It's easy. Last year I had a science shelf of materials, that was it. Here we have tons of resources to use. Fossils, preserved insects and things like that. Last year I didn't have a library. This year we do. (Last year K taught at another school in the same division.) The science teacher is great and I can talk to him about the things I can use. It is a lot easier to keep interested in science.

ALBERTA TAPE SHOWN HERE

32. Murray What were your impressions of the tape?

33. Kent It wasn't bad. It was clear as to what it wanted you to know.

34. Murray What was the message on the tape?

35. Kent It's pretty clear that it is really pro hands-on science. Learning through discovery and the scientific method. It also uses the experimental approach. It was well put together and very clear. But seemed a little staged. One thing that bothered me though was the part on evaluation using anecdotal observations. I don't know about that. It's fine when you have four kids in front of you to do anecdotal observation but when you have ten or eleven all doing separate things it is a lot harder. I don't know about the carbon dioxide thing. I guess it would be alright if you were outside. The idea was good though, teaching kids about pollution using the exhaust from cars. My concern is kids inhaling exhaust. Another one of my concerns was the observation of burning things over a flame. I thought the teachers observations were pretty against what she was trying to do. You observed necessarily right. Like I said, science teaches logic and that's not logic.

36. Murray If you were a cooperating teacher with the teachers on the video tape, what comments would you make to them regarding their teaching?

37. Kent For the most part they were very good. The class was well controlled and organized. I would have suggested to one teacher that when adding drops to a solution that you stir the solution after each drop. I felt the teacher was guiding the student rather than letting them find out for themselves. That was the whole point of the experiment. The car thing still bugs me. You got ten kids out behind a car where is the rest of the class? Two are measuring the distance from the exhaust and the rest are standing around. Activities like this are difficult to manage.

38. Murray It might be something you would have to work out with an assistant.

39. Kent It takes more than what we saw on tape to do some of those experiments. Some of them are not viable for a single teacher and class to do.

40. Murray In your own class is grouping a problem for science then?

41. Kent Not really. They will even choose their own groups but what is hard for me is making observations. I would never use more than two in a group because I only have ten kids in the class. I try and keep them in small groups so that they can get feedback from someone.

42. Murray Why do you group in science?

43. Kent It's important in anything. Two heads are better than one and if one kid has a problem another may help him. If you get the two together they learn to work responsibly. There's a social factor involved. It's easy in science because they're interested in what's going on. They almost go automatically to the task without a lot of teacher persuasion.

44. Murray What would you be taking away from the videotape?

45. Kent: Some on the experiment ideas I would use. I don't do all my experiments discovering some are demonstrations, some are planned out for them and they just simply come up with the conclusion. Later I hope they can do the whole experiment themselves. However the discovery experiment is best. That way they can plan everything out for themselves and its more their own work. Later they write it out for me. They have to come up with a hypothesis and a procedure.

46. Murray What things didn't you like about the tape?

47. Kent One thing I missed with the tape is discussing ideas with other teachers. This is something you would get at an inservice. Teachers that might know more than you. They might have tried this and can give you advice which would save you a lot of trouble.

Second Interview with Kent, November 17, 1988
(The interview was conducted in the Home Economics Room at Dog Bay School during school hours)

1. Murray This is the transcript from our last interview.

I have highlighted some of the things that I want to check with you. That's to make sure that I understand what you're saying.

2. Kent Okay.

3. Murray Your lesson was teaching variables and controlling variables and you're using balancing balls. Do you think that you have achieved that goal in the lesson?

4. Kent In that one lesson?

5. Murray Yes.

6. Kent I think that I could introduce it to them, but I don't think that there's a lot more to it than just the one lesson, and then go on from there in the same general direction through the whole week. Just keep re-teaching it through all assignments.

7. Murray You were pleased with the results from that particular lesson.

8. Kent I was thinking about it after and I thought that the lesson was a little simple. I think that they could have done something a little more complicated, or that maybe a little bit more guidance, but as far as I could see, they understood that if they did different things, the ball would react differently in the end. I'll be finding out more by what they handed in.

9. Murray Good. Okay. Now, when I talk about the videotape I mean the original videotape that we looked at.

10. Kent Okay.

11. Murray Now that you have had a couple of weeks to consider the videotape. Have you thought any more about the videotaped presentation?

12. Kent Yes, I got some ideas on how to do activities. I noticed how she had the materials set out. I changed some of the things she did such as putting items into little cups instead of having them on a sheet of paper. We did the one on the different types of powders. I tried that, and we didn't heat it or anything, what we did was we found the properties of three different types of

substances, sand, sugar, salt. We put it under the microscope. So we did use some things from that.

13. Murray Besides ideas what else did you observe on the videotaped presentation.

14. Kent Yeah, I got some ideas on how to do it. I was looking at how she had the materials set out there. I did things different, like putting them in little cups and stuff, instead of having them on just a sheet of paper.

First Interview with Susan, January 18, 1988
(The interview took place in the library conference room at Milner School during school hours)

1. Murray How long have you been teaching?

2. Susan This is my second year of teaching. Last year I was in another school.

3. Murray I would like to ask you some questions about science then after showing you a videotape I'd like to get your opinions about the videotape. What is your objective in teaching science.

4. Susan I think science helps us understand the world around us. I think when we do experiments and apply the results to our surroundings we see how our surroundings affect us. i think that would be my major goal in science. Science is all around us and adapting it to our surroundings.

5. Murray To what extent do you have students manipulate materials in your class?

6. Susan At the beginning of the year not very much. Now I try to do an experiment every science class. We have done quite a few experiments and they are really enjoying it. They are more comfortable and are more willing to work now. Now that they are able to work with this stuff it is a lot easier to get the point across.

7. Murray Why do you think they enjoy doing experiments?

8. Susan They understand it more. It is a lot better than getting notes and reading a notebook and seeing other people do it.

9. Murray Was the change in your teaching style as easy as watching someone else work with your class and then saying to yourself "This is something we should be doing."

10. Susan I did a lot of hands on last year. However we have more equipment here. I prefer to have the kids actually doing something.

11. Murray Why do you prefer it, than another way of teaching? Wouldn't another way of teaching be easier just to talk about science?

12. Susan No, because often I was worried that it would be

boring and I was worried that I would lose their attention. With 24 kids I want all of them learning and doing something. If I were to stand up and talk I don't think the same kind of learning would happen. It is better if they do it and they learn it better than having me tell them.

13. Murray So, you feel that your science program is fairly successful?

14. Susan I think it is getting better. It has room to get even better.

15. Murray What are some of the techniques that you use in science?

16. Susan I usually keep in mind my objective and how I want to come across it through discovery. For instance in magnetism, the unit we are studying now, I want them to experiment and come up with their own conclusions. I don't tell them my objectives. I want them to give me their understanding of magnetism after their experiments. I think they have a better understanding of the scientific principles doing it that way. An understanding that sticks with them. I use questioning while they are working. I go around and talk to them about what they are doing.

23. Murray Tell me about the questions you use in class?

24. Susan I go around and ask them what they are doing and how is it working and what if you did it this way, whatever comes to mind.

ALBERTA TAPE SHOWN HERE

35. Murray Have you had the opportunity to watch someone else teach?

36. Susan Other than student teaching, no.

37. Murray What did you observe while watching the videotaped presentation?

38. Susan The main thing I kept thinking about was the teacher was only working with four kids. If I could only work with four kids it would be wonderful and I would probably get great results. The second teacher worked with several groups

and it was a little more realistic to me. That was the only thing that bothered me about the tape. The kids were very, very organized and either they have done it throughout the year or they have been doing hands on since grade 1. I don't think that if this was their first experience with hands-on material that they would have been that calm. They were very calm.

40. Murray The kids were calm?

41. Susan Yes, they were quite comfortable with the material. They obviously handled the material before and were well organized.

44. Murray Your kids have had experience manipulating materials?

45. Susan Although they haven't had much they are still exploring. When they get materials they will play and fiddle with them. That is alright providing some good things come out of the play.

46. Murray What other observations did you make while viewing the videotape?

47. Susan I liked to listen to the questions the teachers asked - good questions. I liked the way they got the group together and compiled the information and came up with the conclusions for the experiment. I like that idea. I've tried it and it didn't work that well, other things could have caused problems there too.

SUSAN'S CLASS WAS VIDEOTAPED ON JANUARY 24, 1989

Susan's Interview, April 27, 1989
(The interview took place in the conference room off of the library during school hours)

1. Murray In the last interview you said "I think they all work." I'm taking it that those were ideas.

2. Susan Yes.

3. Murray In the first interview you said, "All of the questions the teachers were asking were having the students think about what they were doing and they were learning in the process. They were answering her questions but at the same time they were figuring things in their heads and it was building upon what was going on." How do you see

questioning in promoting thinking?

4. Susan — It was just like I said there. I think that when you're working through something and if someone happens to ask you a question, you have to explain it to them in such a way that they're going to understand what you're saying. When you're explaining it to someone else, you're clarifying it in you own mind.

5. Murray — And this promotes learning?

6. Susan — Um-hum. They're learning it; I mean they're taking it in and it can stay there. Usually if you have to explain it, it's like teaching a lesson. When you teach a lesson, you often understand it so much better once you've explained it to the kids. If it's something you're not too sure of, and you've researched it and you know what you're going to say to the kids, and once it's been explained, and you have to explain it to someone who really understand it.

7. Murray — What implications does this have for group work?

8. Susan — Kids working together, asking questions and having to talk about it together. They probably have similar questions and they're having to answer them so the interaction is clarifying things for them.

9. Murray — Is there anything else you noticed on the videotape?

10. Susan — I remember one time when they were outside and she was asking questions about something to do with a car, and I remember thinking that she's asking good questions. The kids really had to think about what they're going to say to her, but they were questions that were natural things, I mean they were just coming naturally.

11. Murray — Now in relationship to that you mentioned "I like listening to the questioning that the teachers were doing. Good questions. I like the way they got the group together and compiled the information and came up with the conclusions of the whole experiment. I like that idea. I tried it in the beginning and it didn't work that well. Other thing could have caused problems there too." Now that to me indicates that you picked

something up from the tape that you were zooming in on the questioning. Did it have any impact on when you went into the classroom to question students?

14. Susan Yes. I've tried it several times after that in other classes too, and it works well sometimes, but then sometimes it doesn't. It all depends on the kids at the time. That's where I'm having problems with some of my kids. And I don't want to go with a large group they need individual attention. And I don't know why, other than kids.

15. Murray Do you mean the questions keep the kids on task?

16. Susan No, it may not. Nothing keeps them on task sometimes. But I remember when I was watching that video I was very impressed by the way she ended the lesson by bringing the whole group together and compiling all that information. I liked the way she did that. I'm not sure how it worked for her, but I can't really get it to work for me the way it worked for her. And I don't know why, other than kids.