

COMPUTER INTEGRATION IN THE ELEMENTARY CLASSROOM:
A TEACHER PERSPECTIVE ON THE CHALLENGES
AND APPROPRIATE SUPPORTS
BY
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Abstract

This study examines the issues which are dealt with by one classroom teacher and a collaborating teacher - researcher colleague, while attempting to integrate computers into the classroom. It identifies professional development strategies which might be effective in supporting a teacher in this type of learning situation. The Grade four teacher involved in the study was using the software program "Knowledge Builder" with Macintosh computers.

The conceptual framework for the study is drawn from Donald Schon's work in the area of reflective practice, as well as F. Michael Connelly and D. Jean Clandinin's work on narrative inquiry. This study attempts to incorporate the strengths of both perspectives as each are related to professional development of teachers, and computer integration.

The contribution of this study is the validity and voice which it gives to a classroom teacher and a collaborating teacher - researcher who are aspiring to improve teaching practice and learning in the classroom. The study identifies concerns and issues that arise in the areas of computer integration and the professional growth which occurs in both participants.

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I would like to dedicate this thesis to my parents, Jac and Connie Ketler. They have instilled in me a desire to learn, and to view the many demands one encounters along the way as challenges. Thank you for all your understanding and support.

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Introduction:

Over the past decade, computers have become much more accessible and affordable for the general public as well as the public school system. Furthermore, the capabilities of the personal computer have increased tremendously in recent years. However, many teachers that I have talked to do not feel that they have the training or the expertise to incorporate computers into the classroom, and find themselves in an uncomfortable situation, caught between their personal comfort levels and the increasing demands to integrate technology. The task of teaching with computers is complicated by the fact that there are few guidelines which outline a philosophical base, goals or strategies for a teacher to refer to.

Some teachers have expressed to me their feelings of inadequacy and apprehension about working and teaching with the computers because they have not developed a personal comfort level with either or both of the computer hardware and software.

At least one school division in Manitoba has developed its own computer software program, which incorporates student thinking and writing strategies. The majority of the teachers in the Division have been given three half day training sessions on the use of the Macintosh computer and the Knowledge Builder software. (See Appendix) Many of the Grades 4 - 6 classrooms in the Division have at least three Macintosh computers in the classroom for student use. While the Knowledge Builder program is not mandated by provincial

curriculum guidelines, the Division has developed its own priorities and outline for a computer program beginning in Grade Four. The Divisional guidelines incorporate thinking and writing skills through expository writing. The words that have been coined are "writing for meaning". An extensive document has been compiled outlining fifty - two thinking and writing strategies which have also been built into the computer software program. The general intent is that the computers be utilized in a variety of ways across curricula. The teacher is now expected to adapt lessons to incorporate computers, deal with the challenges of timetabling students for computer access, cope with any difficulties experienced by the students while using the program, as well as plan for the students who do not have access to a computer.

I have discovered that many teachers with whom I relate have concerns and anxieties about being required to learn enough about computers to use them with students in the classroom. Furthermore, several teachers have told me that they are uncomfortable working with a computer program that is very complex and which is not completely stable in that the program "crashes" at times, and students can lose work that they have done. I believe they are also hesitant to take their students into the computer laboratory because they are unsure how to structure their classes effectively. As an experienced elementary classroom teacher, I have dealt with many of these feelings myself. I have struggled with exploring this new medium composed of both hardware and software components, and with being afraid that something was about to explode if touched incorrectly. I am very

aware of the frustration of not knowing how to make the computer do something which I believed was so simple. I believe that teachers can support and assist each other in developing confidence and skill in using the computer. This type of peer support should make it easier for teachers to cope with the many challenges of a new dimension of classroom teaching. Overall, I believe teacher inservice and support are crucial for effective computer use in school classrooms to occur.

I am interested in the elementary classroom context, where I believe that the integration of computer technology has often been addressed in a less systematic way than for many other curricula. The role of the classroom teacher is critical, and I believe that role will be affected by the vision that the teacher has of him/herself, of computer technology and integration, and his/her confidence in integrating the computer in the classroom environment on a regular basis. This study explores some of the concerns and issues which arise in the course of inquiry into computer integration into one classroom and gives an account of what the participating teacher and I learned as we grew together.

Problem Statement

The purpose of this study is to examine existing and emerging problems and issues, and to search for effective inservice strategies or supports for an elementary classroom teacher who is integrating computers into the classroom. This study occurs within the context of one Manitoba school division, and one school's

"climate" of computer use in the school and its classrooms. It is important to indicate at the outset that the study is collaborative involving a single teacher - participant and a teacher - researcher with implications for each throughout the study.

The following guiding strands were originally constructed as starting points for the study and continued to serve to guide the entire study to its completion:

1. What concerns or issues arise when a teacher plans for and attempts to implement computer technology into the classroom?
2. How do inservice strategies or supports influence the classroom teacher in her exploration and experimentation with different possibilities of computer integration?
3. What reconstructions of meaning do the teacher - participant and the teacher - researcher make in the context of their collaborative inquiry into the use of computers?

Conceptual and Methodological Framework:

Following Max Van Manen's (1977) thinking about interpretive practice, the approach used in this study is not primarily to develop hypotheses and generalized statements about the effectiveness of teacher behaviour and the curriculum. Rather, it is concerned with making the educational experiences and actions of teachers and learners understandable to others. "The interpretive approach to curriculum seeks to analyze and clarify meanings, perceptions,

assumptions, prejudgments, and presuppositions. This approach attempts to make experientially meaningful the curriculum as a subjective and interpersonal process." (p. 213)

This study was further grounded in a particular theoretical framework which gave validity and meaning to the everyday activities of a classroom teacher. The framework, made up of ideas on reflective practice and the education of practitioners in the professions developed by Donald Schon (1983, 1988), and set in the wider context of "narrative inquiry" based on the work of F. Michael Connelly and D. Jean Clandinin (1985, 1987, 1988, 1989, 1990). This framework will be elaborated on in Chapter 2.

Donald Schon's ideas on "reflection - in and on - action" identify a particular way of dealing with events which occur in practice. By consciously or unconsciously "naming" the things one wishes to attend to in a problem context, and "framing", or setting the bounds for the context in which attention will be focused, an individual is in a position to test in practice possible solutions to the problems which have been constructed. Accordingly, this study examines the reflectivity and accompanying "sense - making" which occurred on the part of myself, a teacher - researcher and Lee a teacher - participant; especially that which occurred through collaborative activity. Focussing on particular problems in such a reflective way led to a course of action which was designed to improve the situation and gradually improve our professional practice.

The work of Connelly and Clandinin also deals with classroom experience, but encompasses the larger picture of how a perspective

on classroom practice is shaped within the context of a conscious construction and reconstruction (or "storying" and "restorying") of personal and professional life. This includes an examination of people's "historical" or "biographical" journeys, in an effort to find interpretive connections between classroom events, and life experiences. This narrative inquiry also includes a "future" as well as "action" orientations. The action taken is a result of living out images which have resulted from reflecting on past and present events. The process also results in new images of and possibilities for future actions. Connelly and Clandinin's conception of narrative inquiry includes the involvement of a collaborator who plays a major role in suggesting interpretive connections between past and present, and possible or imagined future events. This allows the possibility of a practitioner living out the narrative which has been constructed. Connelly and Clandinin (1989) claim therefore, that narrative inquiry is itself an act of school reform (p. xvi).

This study attempts to incorporate the strengths of both Connelly and Clandinin's narrative inquiry and Schon's more focussed ideas of reflectivity on problems of practice as each are related to professional development of teachers and computer integration in the course of the study. The study draws on both conceptual frameworks in the course of examining the challenges faced by a teacher attempting to integrate Macintosh computers into an elementary school classroom.

Need For The Study

The idea for this study resulted from the teacher - researcher's involvement with supporting teachers in her school who were trying to learn and use a Divisionally - generated software computer program on the Macintosh computer, referred to as the 'Knowledge Builder'. The teacher - researcher had been working with the software program for three years, and was in the second year of serving as member of a Divisional inservice team whose task was to brainstorm for and facilitate ways to assist teachers with integrating computers into the classroom more effectively. The teacher - researcher's personal questions about how to best assist and support teachers who were trying to learn and use the program generated the idea for the study. It was felt that many teachers were not using the computers effectively in their classrooms for a variety of reasons, and that no one had really listened to the teachers in the field to discover what frustrations and successes were experienced when attempting to integrate computer technology into the regular classroom routine.

Significance of Study:

Beyond the more personal significance implied under "Need For The Study" (p. 6) the local school Division should benefit from the careful study of teacher and collaborator experience using the "Knowledge Builder software program.

Whether or not a person is from the local school or Division, a study of this kind shows promise of transferability, which may facilitate interested readers in seeing parallel situations to their own. Being able to see themselves in the case in one way or another may lead to possibilities for their own growth. The intent is not generalizability, but rather "particularizability", where through the rich detail concerning computer integration, teacher perspective and professional growth of one particular case, readers may be able to see significance for their own lives and work.

Overview Of Thesis:

The thesis is divided into five chapters, each developing a particular aspect of the necessary text to allow understanding of the study's questions in the context of supporting literature, methodology, collected data and its interpretation.

Chapter One provides an overview of the structure and content of the entire thesis. It includes the Problem Statement and the three guiding strands which directed the study. This chapter also outlines the significance of the study, a brief outline of the conceptual framework and associated methodology, the organizational structure of the study, and the limitations of the study.

Chapter Two is a review of relevant literature which supports the themes referred to in the study. Five areas are addressed in the Literature Review: 1) Professional Development For Teachers, 2) Professional Development Using Computers, 3) Computer Anxiety

4) Donald Schon - Reflective Meaning Making, 5) F. Michael Connelly and D. Jean Clandinin - Narrative Inquiry. The literature reviewed in these areas provide a backdrop for the reading and understanding of the subsequent chapters.

Chapter Three provides an outline of the methodology used in the study. This chapter builds on the conceptual framework and links the methodology employed with that framework. It also includes in detail, the research methodology used, including things like criteria for selecting the participant and the enrollment of the teacher - participant's classroom.

Chapter Four contains the data collected during the time of the study. It includes data collected from interviews, journal entries, as well as conversations which focussed on the elaboration, interpretation and clarification of the data which was recorded. Each data section is given its own title. The chapter concludes with a summary of the highlights of the chapter.

Chapter Five consists of a discussion of the "case" presented in Chapter 4. Accordingly, it deals with interpretation of the case, its validity, and connections to existing theory. The chapter connects the practical and theoretical implications of the entire study. Some suggestions for assisting teachers who are attempting to adopt new technologies and curriculum into their classrooms are provided as suggestions for further research.

Limitations

There were several limitations of the study which became evident as time went on. While the teacher - researcher was hoping to gain additional data from the noon hour inservice sessions which were planned, very few of these sessions actually occurred during the time of the study. The teacher - researcher was planning to be in the Macintosh computer lab with the teacher - participant once per cycle for six months. Due to a variety of events like special assemblies and field trips, a number of scheduled classes were not held. The teacher - researcher and the teacher - participant were able to work together in the Macintosh lab sixteen of the twenty - one potential computer classes.

Chapter 2

Review of Related Literature

The literature reviewed will be set in the theoretical framework provided by the work of Donald Schon (1983, 1987) and F. Michael Connelly and D. Jean Clandinin (1985, 1987, 1988, 1989, 1990). For Schon, Connelly and Clandinin, a common purpose is to outline an epistemology, or study of knowledge of practice in which the starting point for inquiry is a practical event - seen for example as an incidence of teaching in a computer class. Both lines of scholarship promote or favour rational inquiry along the lines set out by John Dewey (1933), and see such inquiry as part of professional growth. Both also recognize the importance of "teacher perspective" in the context of the teaching act and the underlying assumption or frames which support them. For both lines of scholarship, change in the "perspective" which results from inquiry is seen as the key to professional growth - and indeed, school reform as it results in new and improved action.

In the subsequent chapter, there will be differences in emphasis such that discussion of Schon's scholarship will emphasize his idea that reframing (ie. comprehending or hearing and seeing elements of the practice setting in new ways) and thus professional growth occurs in the context of what he calls "reflection - in and on - action". For Connelly and Clandinin, a more deliberate, collaborative search for a perspective will emphasize the role of a broader "life story" or "narrative" in helping to bring a teacher

perspective (including images for the future) and changes in perspective to light.

In the above context, "inservice education" and "computer inservice training for teachers" may be seen to fit into the framework and the review of literature. Thus to the extent that the inservice component is removed from the classroom it may be seen more as a longer range, biographical "story" which may contribute to the larger narrative and may eventually help shape the perspective which the teacher brings to the teaching act. To the extent that the inservice component consists of a kind of collaboration more closely linked to the teaching act (including various forms of classroom interaction), it may also become part of the developing narrative, yet more closely aligned to Schon's work to the extent that his more specific activities such as "modelling" and "coaching" are included.

The sequence of literature reviewed will be: i) Professional Development and Inservice Training, ii) Computer Inservice Training for Teachers, iii) Computer Anxiety, iv) Schon's Reflective Practice, and v) Narrative Inquiry.

Professional Development / Inservice Training

The Literature shows that while professional development for teachers is deemed important, the way in which it has often been undertaken has not been particularly effective. In order to facilitate a change of practice, teachers need on - going, collaborative support rather than isolated, independent inservice sessions.

Much time, effort and money are put into forums which are designed to facilitate change among teachers in the profession. Ellis (1990) comments that the method most often used to encourage change is a "one-shot" inservice session from which the teacher is expected to glean all the information necessary to bring about immediate change in the classroom. Unfortunately, while this particular format often does deliver useful initial information (Hord & Austin, 1986), it has been reported that "one - shot" workshops that had no follow - up implementation support have not been proven to be effective either for changing teachers behaviors or increasing student learning. (Ellis, 1990)

Educational change is a long and tedious process that does not end with the adoption of a new curriculum or approach to teaching (Ellis, p.55). Or, stated another way, "implementation" does not equal delivery of an innovation, as has been widely assumed in the past. (Hord & Austin, 1986)

Hord and Austin (1986) claim that recent research show that at least three factors are most often overlooked in the process of implementing curriculum:

- 1) Realization that various types of actions that support teachers will be required.
- 2) Identification of who is responsible for facilitating the change that the teacher will make.
- 3) Understanding on the part of faculty (or Division) that change takes a great deal of time and that even under the best of circumstances, implementation takes several years. (p. 97)

These statements highlight the importance of examining what is being done and reported in the area of teacher professional development.

Judyth Sachs and Lloyd Logan (1986), in their study entitled "Control or development? A study of inservice education," explore the notion of professional development often being perceived by teachers as being compensatory rather than developmental. They believe that "inservice education, embedded either consciously or unconsciously in assumptions rooted in bureaucratic control, increases teacher dependency through a process of deskilling and reskilling" (p. 473). The study determined that in the majority of inservice sessions activities focussed unduly on practicality and relevance in regard to the teachers' responsibility for improving instruction, and this at the expense of organizational factors.

Taken together these two characteristics contribute albeit inadvertently, to the diminution of the control teachers exercise over their own practice and its development. That is, an overriding concern for 'relevance' and 'practicality' serves to contribute to the deskilling of teachers through containing the focus to, and heightening the importance of, immediacy. (p. 377)

Those responsible for professional development of teachers must realize that the most effective type of inservice is one that

teachers decide is necessary and relevant to their situation (Sachs & Logan, p.5).

Indeed, the effectiveness of an inservice training session is determined by how a teacher perceives the session itself. Hord and Austin (1986) believe that "if the people expected to implement a program judge it to be of poor quality, or not appropriate for their situation, they may not be enthusiastic about it" (p. 98). While it is not feasible for teachers to have a choice in what they are asked to implement, it is important that those involved in the communication of the "new information" provide an opportunity for the participants in their program to dialogue about the realities of the new program, and provide a framework in which the new developments can be put into perspective.

Consistent with Sachs and Logan (1986), Mary Beattie (1989), in her thesis Teacher Learning and Inquiry As Curriculum Development observes some difficulties with conventional inservice strategies:

Over the years I had also found myself becoming increasingly uncomfortable with the way teachers were treated and viewed by curriculum developers and it seemed highly inconsistent to me that workshop leaders promoted a view of the student learner as self-motivated, self - directed problem solver at the same time as they were treating the teacher learner as a receptacle for current teaching strategies and skills. This attitude towards teacher learning gave very little credit to our individuality as teachers, our different backgrounds and our different levels of experience and knowledge (p. 40).

Beattie emphasizes the importance of treating teachers with respect and is consistent with a view of an individual's developing

life "story" which results in different perspectives which will be addressed throughout the review.

Burrello and Orbaugh (1982) believe that "collaborative approaches to inservice programs are the most effective" (p. 385). This process would include providing personalized information specific to a teacher's need, and explaining each teacher's use of the program through clarification and solving individual problems. Hord and Austin (1986) also note the importance of process:

What we now understand is that helping teachers change their practice is a process. Thus, school staff development sessions for teachers, and providing different training as they develop understanding and skills regarding a new curriculum are much more effective than a three day inservice workshop supplied prior to the opening of school (p. 107).

While ongoing support is imperative to the success of a new curriculum being implemented effectively, Hord and Austin (1986) point out that the kind of support necessary varies at different points along the implementation timeline:

When a major change in a program is to be implemented, it is relatively safe to assume that the majority of people are starting at or near the same point, and need the same general kinds of information and assistance. Therefore, it is reasonable to provide interventions that are less individual at the beginning of implementation. During the ensuing stages, teacher skill in use of the new curriculum develops at varying rates, and in diverse ways and teachers require more individual attention to support their innovation use, thus the need for even more consultation in year two (p.108).

Burrello and Orbaugh (1982), through extensive study of numerous inservice education attempts outline six major observations which they believe constitute effective inservice education. Accordingly, inservice education programs should:

- 1) Be designed, integrated into, and supported by the organization.
- 2) Be designed to result in collaborative programs, with input from a wide variety of sources.
- 3) Be grounded in the needs of the participants and the use of problem - solving skills should be a part of inservice training.
- 4) Be responsive to changing needs, should model good teaching strategies, and peer teaching strategies, should be directed toward changing teaching behavior. The implementation strategy should include continual professional growth activities, and the local development of collaboratively prepared materials.
- 5) Be accessible, be conducted primarily during the participants' normal working hours, at convenient locations.
- 6) Be evaluated over time, and be compatible with the underlying philosophy and approach of the area. Evaluation can be used to i) determine needs, ii) plan programs, iii) revise activities, and iv) judge impact (p. 385-386).

These observations about inservice education highlight the importance of teacher involvement in facilitating change.

Consistent with Burrello and Orbaugh (1982), Fullan (1982) points out that when a teacher is asked to change his/her particular teaching style to accommodate a particular curriculum, she/he is being required to change several dimensions: the use of new materials, alterations in their teaching behaviour, and changes to their beliefs and attitudes.

Also consistent with Burrello and Orbaugh (1982) Hord and Austin (1986) state the importance of follow up support:

Follow up support is critical if the most effective change is to occur. We believe that the success or failure of implementation is determined by the frequency and effort of one to one follow-up interactions with teachers that focus on their problems and concerns about changing their teaching practices. Such actions are powerful interventions, when they respond to teacher's needs for information, encouragement, and personalized assistance in understanding how to make a new program work for them and their students (p.108).

What supports and structures make it easiest for the teacher to learn new strategies and gain new insights? A teachers' knowledge and experience must be included and drawn upon where ever possible. Though referring to her own study, Beattie (1989) draws a very powerful, even poignant conclusion which can be applied to inservice training and professional development in general. She states:

I believe that the significance of this study lies in observing, understanding and describing how a teacher's personal knowledge which is experiential, embodied and based on a narrative of experience, is use to plan, to inquire, and develop curriculum for the present and future. Such understanding could provide new ways for thinking about preservice and inservice education for teachers, and for school reform. A research tradition which nourishes teaching and teacher growth, as opposed to any version of teacher training and the technology of teaching, will be, I believe, a worthwhile and valuable contribution (Ch. 2 p. 30).

Beattie's conclusion fits well with the ideas on reflectivity based on the work of Schon and Connelly and Clandinin which are discussed later in the chapter.

Teachers should be encouraged to participate in professional development on an ongoing basis. They should take some ownership for their own professional development to ensure that the issues dealt with are supported by on - going, long term support by credible, knowledgeable support people. Change in practice does not occur in a vacuum, collaboration and communication are important elements in facilitating change.

Computer Inservice Training For Teachers

The integration and incorporation of computers into the classroom setting has presented some unique challenges for the teachers involved. The role of the teacher must change from the "giver of knowledge" to one which facilitates learning by others, even though the teacher does not necessarily have all the answers. The most effective strategy for inservice training in the area of computer integration is one in which teachers are supported over a long period of time, by individuals whom the teachers believe are credible.

Classrooms and labs equipped with personal computers are no longer a dream of the future. While providing the necessary number of computers deemed adequate for the educational system is a financial challenge for school divisions, the greater challenge seems to revolve around teachers' feelings about, and ability to, integrate the personal computer into the regular classroom environment. Burkholder (1987) states: "As schools take steps to purchase computers, teachers need to be prepared and trained in order to feel

confident and use computers effectively in education." Teachers are used to being in charge and knowing the content of what they teach. They have prepared themselves for their profession by taking several years of university training, and have strived to become comfortable with the curriculum which they are required to implement. Accordingly, Akker, Keursten and Plomp (1988) state:

Teacher's often experience unanticipated problems with their instructional roles. Computers challenge teachers' existing instructional routines by requiring a shift from expository teaching toward a role in which the teacher is more of a partner and guide to the student. Many teachers feel uncomfortable about these changes and therefore try to minimize them. This factor is particularly important because research has shown that the way a teacher integrates computers through his ongoing instructional decisions is critical to the impact of computer use on learners and learner results (p. 70).

The trend towards the introduction of computers into the classroom appears to be a real challenge for many teachers.

The integration of computers may require the teacher to continue to move from the role of "information giver" to that of "facilitator". In order to assist the students in assimilating all the knowledge and information that is being directed towards them, the teacher must be willing and able to teach the students how to access, sort and process the information which is applicable to them at the particular time. About this highly integrated and complex task, and in the context of the previous quotation (Akker Keursten & Plomp, 1988), Mecklenburger (1991) states:

Today's mix of technologies - a reliance on lectures, reading and testing, organized in attendance centers called schools and classrooms and supported fitfully with small quantities of electronic learning- is not optimal for education. Electronic learning must play a more important part in the mix, even at the expense of some customary practices. Today, students and educators alike can create, receive, collect, and share data, text, images, and sounds on a myraid of topics in ways more stimulating, richer, and more timely than ever before - if they have access to the appropriate technology and the ability to use it (p. 108).

However, teachers may find it unnerving to be asked to work with computers when they do not feel comfortable with the technology. Those who are learning to use a computer should be active participants in the learning process. With regard to teacher anxiety, Kathleen Fulton (1988) states:

...inservice training in technology must be sensitive to the concerns of anxieties with which teachers approach the use of technology. A teacher taking a course in other subject areas generally has some experience or background in the topic. But many teachers, especially those who consider themselves "B.C." - before computers - have not yet worked with computers and admit to being "technophobic". (p. 34)

The question needs to be asked; is the technology itself a barrier? Stern (1991) does not believe that the technology is the problem:

Technology per se is not the barrier. Instead, it is our attitude about using technology in schools that is the barrier. Our attitudinal problem is that educators are reluctant to move toward a system that is more technology - intensive and less labor - intensive (p.10).

Unfortunately, many schools purchase computers or various forms of technology first and then attempt to make decisions about how they should be used. According to Levinson (1990) "Technology could be used to solve significant (educational) problems, but for change to be effective, the problem should drive the use of the technology" (p.122) and not the other way around. It is essential to focus on and identify the problem to be solved, and not on the introduction of a "new" type of technology which someone may be interested in. Cohen and Brawer (1986) believe that:

If technology is to work within the school context, people in schools cannot perceive it as something that has been imposed. It must be rooted in institution, must be accepted personally, and seen as a way of thinking that demands modification of technology based on results obtained. (p.82)

Grimmett and Erickson (1988) believe that "problem resolution is influenced by inferences drawn from the observed phenomena of past experiences which are tested as the basis for future action" (p.6). Teachers should be actively involved in problem resolution, rather than having a solution imposed from without (Grimmett & Erickson, p. 6). Payne (1983) also believes that if teachers are provided with the opportunity to improve and update their skills in the areas of expressed needs, they will respond favorably and accept the challenge of providing continued excellence in their classrooms (p. 6). She also believes this accepting type of learning environment is best be facilitated when inservice programs meet the needs of the teacher's they serve (p. 2). While these points apply generally to "inservice education" they are made here to indicate that their

relevance is particularly important to the topic of computer inservice training.

How does the individual educator find the necessary assistance? While self - motivation probably works well with those who are very interested in computers, how are the others reached? Sachs and Logan (1984) believe that:

As inservicing reaches more reluctant computer users, there may be a greater need for a different type of approach, one that puts less emphasis in the self-motivation of the learner. One will probably have to create material which puts computer application in the context of how computers have a positive effect on the teachers' life with minimum effort on the teachers part (p.47).

Following another aspect of motivation, there is a perception that teachers will respond to the belief that they are partially responsible for the knowledge of the students they teach. As Dickerson and Pritchard (1981) state, "Unless the teacher can command and direct the technology, the students who follow will not be prepared for the demands of a technological society" (p. 9). According to this argument the teacher does not need to have all the answers, but rather be able to facilitate the students accessing the necessary information.

According to Wagschal (1984) the implementation of computer technology into the classroom will be most effective if teachers are involved in the placement and use of the computers:

Decisions regarding the appropriate place of computer technology must be made by individual teachers, because they are the only ones who can sensibly and realistically determine how best to use this new technology to help their students

learn. Teachers cannot make such decisions, however, until they have had sufficient hands - on experience with the computers to give them a practical understanding of the potential uses (and abuses) of this new technology (p.253).

Mecklenburger (1990) believes that it is imperative that teachers perceive a need for computers in the classroom, or they will not be used.

Teachers should be allowed a great deal of flexibility and freedom when integrating technology into the classroom. Imposed restrictions on uses of the technology only assist in stifling creative and personal incorporation of technological advancements. Technology should empower the teacher to invent new kinds of educational venues, because much of what we call school curriculum can and will take many diverse paths (p. 107).

In the preceding writing, much emphasis has been placed on teacher characteristics, including articulated needs. The need to develop effective computer related inservice sessions accordingly, has proven to be a challenge for those people involved in trying to teach teachers how new technology can be of benefit in the classroom. Akker, Keursten, and Plomp (1988) reflect that:

A criticism of past inservice approaches is that the emphasis on technical aspects was too strong, while too little attention was being paid to the integration of computer use in the daily classroom practice and also to the skills in selecting and evaluating courseware. Teachers need a strong support to overcome their (initial) problems of uncertainty and their concerns about teacher/student relationships and about accountability (p. 68).

There are particular characteristics which seem to increase the effectiveness of computer inservice training. These characteristics include:

- i) an appropriate balance between lecture and guided practice
- ii) detailed curriculum guides and plans for the course
- iii) clear training objectives
- iv) inservice lessons linked to the teachers' own instructional practice
- v) peer interaction including communication during hands - on activities
- vi) strategies for teaching heterogeneous groups
- vii) follow - up support and guidance.

(Akker, Keursten & Plomp, p. 68)

A framework for inservice education such as the one outlined, would give teachers a comprehensive and practical context within which to contemplate how they could integrate computers into their classrooms. Learning needs to take place within the context of practice, so that direct application of the technology as well as problem solving strategies can be implemented. A teacher must learn how to use the computers effectively, but must also learn some basic 'trouble shooting' strategies which can be drawn upon when there is difficulty. A component of a successful experience with the computers occurs when the "teacher succeeds in an effective lesson execution without major problems and is aware of his own contribution in this respect" (Akker, Keursten & Plomp, p. 71).

The integration of computers into the classroom usually requires a change in practice on the part of the teacher. Fullan

(1982) isolates several characteristics which are influential in facilitating the concept of change and which seem to me to apply particularly well to computers. These characteristics include:

- 1) Need and Relevance. What is the need for and appropriateness of the change? What is the priority of the efforts to implement the innovation relative to other concerns?
- 2) Clarity. How clear are the goals and essential features of the innovation? How clear are the practical implications for the users?
- 3) Complexity. How many components of instructional practice are affected and how much do they differ from existing practices and beliefs? How difficult is it to learn the necessary changes?
- 4) How well developed and tested are the products? How certain is the impact of the innovation? What is the trade-off between the actual benefits and the personal and organizational costs? (p. 33)

Weaknesses in one or more of these outlined areas can cause major difficulty when trying to implement a program. Especially when working with computers, teachers need to feel confident that they are being asked to do something that is well thought out, and can begin implementation without too many alterations to the existing program. This includes "adapting to the teacher's level of computer competence and focusing on applications which the teacher can customize or adapt to his or her specialized teaching situation" (Fulton, p.34).

An effective way to assist a teacher in obtaining a comfort level with a computer is to provide a computer for teacher use. Rhodes (1986) feels that the education system is the only institution that provides tools for its clients rather than its

workers (p.14). There is an argument being made for teachers to have the opportunity to become comfortable and confident with computers before being asked to use them in the classroom.

If computers are to be used effectively by the teachers as productivity tools, they must be readily and exclusively available for their use. Locked doors, priority given to student use, inaccessible labs and checkout policies that restrict teacher access discourage teachers' and frustrate attempts to learn more about computing tools (Minnesota State Department of Education (MSDE), p. 13).

Once teachers are more comfortable with the computer and what its capabilities are, then a more informed educated decision about classroom use can be made. "Only when teachers' have learned to use the computer as a tool to enhance their own thinking can they encourage a similar ability in their students" (MSDE p. 9). Decisions regarding the appropriate place of computer technology must be made by individual teachers because they are the ones in the best position to determine how that technology can fit into the daily routine of classroom life. Of course, such decisions cannot be made by teachers who have no experience with the technology (MSDE p. 9).

Unfortunately, short periods of inservice training are not an adequate enough support to assist teachers in their attempt to integrate computers into the classroom. In the following, a more collegial approach to inservice education, specifically in the context of computer is advocated:

Teachers must also be provided with ongoing support which will enable them to obtain assistance and support when needed. Teacher - users of all kinds of technology continually expressed the same needs, that is, the need for sufficient

hardware and software during and after inservice, the need for additional time to work with the technology both during and after inservice, the need for experiences which provide substantial peer interaction, and importantly, the need for inservice training personnel who understand the conditions under which the technology will be applied (MSDE p.9).

A teacher request which was received during the study in Minnesota (MSDE) in regards to the use of computers stated "We need someone in our building who will consistently help the novice computer user so he/she becomes familiar. It has to be more than a two hour inservice workshop, given a disk, and said 'go for it'" (p. 12). Teachers' should not be abandoned to fend for themselves once the initial inservice session has been completed.

Meeting the needs of teachers for productive use of technology is like building a four - legged stool with legs of enabling software, appropriate hardware, regular training, and peer support. Shaving the emphasis off one of these legs unbalances the stool and lessens the probability of teachers effectively using the computer as a productivity tool. Removing one of these legs will send the system crashing to the floor. This stool is one essential component needed around the table for restructuring schools and instruction. Teachers properly trained, supported and with access to computer work stations and productivity tools, can maximize their effectiveness. It is important that they be expected to demonstrate productive behavior in the areas of instructional effectiveness, teacher collaboration and staff efficiency (MSDE p. 3).

A critical link in the process of implementing new practices is that of individual and ongoing assistance to teachers in the form of coaching. As Trainor and Fregosi (1986) state: "What better people to teach our teachers than their peers who have a personal and professional interest in our system, who have a sense of the

hardware and software available, and who are keenly aware of our curriculum?" (p. 81) The process must include providing personalized information for specific teacher needs, and facilitating each teachers' use of a new program by solving individual problems, and clarifying any issues which are unclear. By definition, consultation and coaching interventions are directed to individual teachers (Hord & Austin, p. 107).

If teachers are going to integrate computers effectively they need to be given immediate and ongoing support from someone who understands their situation and who can provide resources that meet the demands of the particular situation. The integration of substantive improvement in practice cannot be incorporated into classroom use in one year. The second and third years of implementing a new practice requires as many interventions and as much facilitating and energy as year one (Hord & Austin, p. 112).

The literature seems to be particularly supportive of the idea of follow - up support in the area of computers. Rebecca Clemente (1991) believes that follow - up support may be the single most important factor contributing to the successful implementation of new ideas and materials. Follow - up by her definition means that either trained teachers or the facilitator is on call to help when problems and concerns arise (p.28). She believes that during implementation, the teachers are involved in three critical development stages: i) They are adapting the new ideas or materials to their teaching styles; ii) They are clarifying in their minds and in their practice just what it means to utilize the new ideas or materials; and iii) They have routinized the new idea or materials.

This means that the new ideas or materials have become part of their teaching (p.29).

There is no shortcut in facilitating educational change. In order to have effective curriculum development ongoing monitoring and consultation must take place. Genuine change in practice only comes with continued support and intervention to deal with the questions and concerns which will arise as teachers try to answer questions about technology and the impact that it has on the classroom. Fulton (1988) summarizes:

The most crucial factors (that underlie whether or not a teacher adopts technology into the classroom) are time and support - allowing plenty of time and support both in class and afterward to give teacher's the opportunity to develop confidence and competence (p. 34).

The training of teachers to use technology should be a long term and continual process. In arguing for lifelong computer and technology training, the Office of Technology Assessment (OTA) in the United States recommended that innovative inservice programs and follow - up support will require incentives to encourage teachers to stretch beyond their current levels of expertise or to encourage technologically experienced teachers to train colleagues. Fulton (1988) suggests a number of incentives including additional pay, school release time, availability of extra hardware and software, paid time to participate in conferences, engage in computer - related work and finally, increased authority, status, and pay as master or lead teachers in schools (p. 36).

Computer Anxiety

A special problem unique to computer use in schools is that many individuals, including teachers, indicate that they experience anxiety about personal use of the microcomputer. Whether it is a lack of confidence, technical skill, or understanding of the usefulness and place of technology in the classroom, many teachers feel unprepared for what is being requested of them.

Payne, (1982) in a survey of Kentucky teachers, revealed that while there were many microcomputers already in the schools, the teachers had no training in using them and wanted assistance in learning more about them. Payne elaborates:

They (the teachers) also identified many stumbling blocks - the greatest of these being anxiety about using them. This fear (anxiety) toward the microcomputer has been referred to by some as "chipophobia". There seems to be an unsettled feeling about sitting in front of a screen touching keys and hoping nothing breaks or that no one jumps out of the screen. Some teachers actually believe it's too difficult and complicated for them to learn about the microcomputer so why bother. If they are tenured teachers they may realize that there will be few implications for their job situation or salary (p.2).

While computer anxiety might be the label given to a lack of interest or desire about using the computers, Yeaman (1992) rejects the idea that people are afraid of breaking them. He argues that people frequently use other highly technical equipment like a dishwasher, television or telephone, and that there is little hesitancy in using

these pieces of equipment (p.23). He believes that expressing a fear about breaking the equipment is a front for hiding other feelings.

Expressing a fear of breaking computers could be a mask to hide ignorance. Although it is a way of saying "I do not want to touch that," fear may be neither the underlying motivation nor the intended message. Another interpretation is more plausible. A reversal of the statement could be more valid. Instead of "I am afraid of breaking the computer" the statement can mean "I do not want to be distressed." That sentiment also expresses a complaint, "I don't want to be confused by having to learn something notoriously frustrating" (p. 24).

It is often difficult to identify the exact cause of anxiety when it comes to computers. Burrows and Deibitsky (1984) believe that the root may be in a persons' childhood. The computer appears to make them feel powerless possibly much like they felt as a child trying to cope in a world that they did not understand.

As professionals, and people who often feel that they need to be in control, teachers often have difficulty accepting the notion that it takes time to learn the necessary skills to interact with computer technology. Burrows and Deibitsky (1984) feel that teachers do not like being "challenged by a box", and like it even less when some of their students know more about computers than they do (p.5).

The concepts of instant or immediate gratification and satisfaction play a role in computer confidence. Burrows and Deibitsky (1984) illustrate:

They seem to want to know it all right away. This is no more

possible than with any other tool Somehow intelligent adults either believe they will be able to use computers proficiently in a very short amount of time, or they feel if they can't, they must be profoundly stupid (p. 3 - 4).

Akker, Keursten and Plomp (1992) remind us that teachers often lack the technical skills in using computers and software. The lack of technical knowledge "often leads to uncertainty, especially when the level of computer familiarization of the teacher is the same as or even lower than that of the students. A consequence of this phenomenon may be that educational computing will be restricted to the limited level of expertise of the teacher" (p. 70). Teachers who feel that they are lacking in technical skills may find the challenges of classroom management and their personal role in the classroom more difficult.

Teacher anxiety about the use of computers may be observed as resistance to change. Ellis (1984) outlines several reasons for teachers and administrators being anxious about the computer technology and implementation. There is a wariness about educational innovation and apprehension to committing large amounts of time and money to new goals, technology and methodology. There is a dependence and security in continuing with the 'tried and true'. Akker, Keursten and Plomp (1992) support Ellis' claims. They conclude that "the major barrier for computer use is that it is unclear for teachers how the potential contribution of computer use can outweigh the costs involved" (p. 71).

Computer anxiety may be an excellent current example of what perhaps may be the most significant barrier to implementation of

any educational innovation, namely teacher resistance to change.

Ellis (1984) summarizes;

Teachers want to know: "How is this change going to affect me? Will this change require me to change behaviors that have proven effectiveness? Will I be replaced by the computer?" Educational computing has the potential to restructure the way we teach. Some teachers and schools will welcome the new innovation and adapt easily. Others will resist. However, if educators are to fulfill their responsibilities, they will not only have to adapt to the requirements of the information society, but also assist all citizens in making the transition (p.204).

Yeaman (1992) places the learning and use of computers within a social context. He believes that the problem is not a fear of computers and for assistance to change, but a lack of questioning about the usefulness of computers (p.27). It is important that we ask what the cultural and social implications of computer usage might be.

More important than promoting the use of computers in education is understanding the constant social agenda for "improving" education, the long term relationship between teachers and machines, and the de-skilling and standardizing threats of educational technology. Computerism teaches people they are helpless. The myths of computer anxiety make people ineffective and incapable by prescribing special lessons to overcome alleged ineffectiveness and incapacity. Teaching instructors and students they are computer anxious, helpless and need remediation may be an act of oppression. It may be oppressive not only against instructors but against their future students as well. Educators need awareness of this social context (p. 28).

Olson (1990) supports the idea of teachers and the larger school system itself examining the role that they expect computers to play. He reminds educators that one must come to terms with the use of technology in the classroom.

...It is valuable to reflect on practice in relation to its institutional setting and why teachers must become alert to the ways in which the institutions of schooling can undermine their own practice. Thinking critically about those conflicts is a way to improve practice itself and build valid institutions in which practice can improve. Reflecting on practice aids in developing good schools through ethically justified innovation. This is the link between research on teacher thinking and the process of innovation that ought to be made (p. 78).

Theoretical Framework

Much of the work already reviewed in this chapter implies or suggests that a more relevant and socially interactive form of activity is needed to promote computer integration in the schools. Accordingly, many authors' work could be reviewed when attempting to outline the methodological framework for this study. The two primary sources which will be referred to are the works of Donald Schon, as well as those of F. Michael Connelly and D. Jean Clandinin. These sources will be reviewed for their perspective on how practitioners view the events around them, and how they attempt to make sense of the problems which arise during the course of their personal and professional lives.

Schon's Reflective Practice

Donald Schon's concept of reflection has its roots in John Dewey's book How We Think (1933). Dewey differentiates between reflective thinking and other forms of thought by two characteristics: 1) A state of doubt or hesitation in which thinking originates in the practice situation, and 2) An act of inquiring to find material that will resolve the doubt and do away with the unsettledness of an issue (p. 14).

In the suspense of uncertainty, we metaphorically climb a tree, we try to find some standpoint from which we may survey additional facts and, getting a more commanding view of the situation, decide how the facts stand related to one another Thinking is not a case of spontaneous combustion; it does not occur just on "general principles." There is something that occasions or evades it (pp. 14 - 15).

Dewey cautions however, that any "conclusions" which are arrived at are not indeed, conclusive, and warrant further examination by:

The active, persistent, and careful consideration of any belief or supposed form of knowledge in light of the grounds that support it and the further conclusions to which it tends . . . once begun, it includes a conscious and voluntary effort to establish belief upon a firm basis of evidence and rationality (p. 9).

While information or questions about a specific situation do not necessarily supply the solution to the given problem, these

might give some suggestion as to which course of action should be taken:

Clearly, past experience is a fund of relevant knowledge at one's command. If the person has had some acquaintance with similar situations, if he has dealt with material of the same sort before, suggestions more or less apt and helpful will arise. But unless there has been some analogous experience, confusion remains mere confusion (Dewey, pp. 15 - 16).

A person commonly relies on the information which has been processed and understood about past experiences, and that information becomes the springboard for contemplating a new situation. If a person has had no experience which is believed to be somewhat comparable, sorting out the situation becomes more difficult (Dewey, 1933).

Donald Schon, (1983) in his book The Reflective Practitioner: How Professionals Think In Action, draws heavily on Dewey, but places the concept of reflective thinking into a broader professional context. He believes that "professionals have been loudly critical of their own failure to solve society's problems, to keep from creating new problems, and to meet reasonable standards of competence in their service to clients" (p. 12). He brings to the foreground the difficulty experienced by many professionals, and creates a framework and a common language in which dialogue about these dilemmas can occur.

Schon argues for a particular view of professional practice which he refers to as the model of Technical Rationality.

According to the model of Technical Rationality - the view of professional knowledge which has most powerfully shaped both our thinking about the professions and the institutional relations of research education and practice - professional activity consists in instrumental problem solving made rigorous by the application of scientific theory and technique. Although all occupations are concerned, on this view, with the instrumental adjustment of means to ends, only the professions practice rigorously technical problem solving based on specialized scientific knowledge (pp. 21 - 22).

Schon says that professional knowledge is generally viewed along these lines:

- 1) Underlying discipline or basic scientific component on which practice rests.
- 2) "Applied Science" or "engineering" component from which many of the day to day diagnostic procedures and problem solutions are derived.
- 3) Skills and attitudinal component which uses underlying basic and applied knowledge (p. 24).

These strands seem to provide the framework from which problems could be explored, yet such a 'scientific' and structured way of approaching a problem leaves little room for the reflections of a practitioner. Herein according to Schon, lies the tension between the 'theoretical' and 'real' worlds. From the point of view of Technical Rationality:

Real knowledge lies in the theories and technology of basic and applied science. Skills in the *use* (italics added) of theory and technology to solve concrete problems should come later on, when the student has learned the relevant science first, because he cannot learn skills of application until he has learned applicable knowledge and secondly, because skills are an ambiguous, secondary kind of knowledge (p. 27).

Schon (1983) however, describes reality like this: "In the real world practice, problems do not present themselves to the practitioner as givens. They must be constructed from materials of problem situations, which are puzzling, troubling and uncertain" (p. 40). The practitioner must struggle with and ponder the situation with which they are dealing. As the problem is examined, some practitioners construct and reconstruct their world in search of better understandings. Another way of phrasing the same concept is "problem setting is a process in which, interactively, we name the things to which we could attend and frame the context in which we attend to them" (p.40).

Schon argues against Technical Rationality and for reflective practice in the professions on these grounds.

Technical Rationality depends on agreement about ends. When ends are fixed and clear, then the decision to act can present itself as an instrumental problem, but when ends are confused and conflicting there is as yet not a "problem" to solve. A conflict of ends cannot be resolved by the use of technology derived from applied research. It is rather through the non-technical process of framing the problem situation that we may organize and clarify both the ends to be achieved and the problem means of achieving them" (p.41).

It is the blending of theory and practice which allows a practitioner to make sense of real life situations. Schon (1983) argues that a technical description of a practice cannot account for the "craft" and "artistry" sometimes displayed in the work of practitioners (pp. 48 - 49). There is an element of uniqueness

which some professionals possess and employ when dealing with new situations and problems. This uniqueness allows them to draw on past experiences and make practical applications of the theoretical knowledge which they possess.

Knowing - In - Action

Schon develops the concept of knowing - in - action to refer to the spontaneous, and intuitive awareness that practitioners bring to their work. The notion of carrying out a sequence of actions apparently without having to think about the sequence is of great importance.

When we go about the spontaneous, intuitive performance of the actions of everyday life, we show ourselves to be knowledgeable in a special way. Often we cannot say what it is that we know. When we try to describe it we find ourselves at a loss, or we produce descriptions that are obviously inappropriate. Our knowing is ordinarily tacit, implicit in our patterns of action and in our feel for the stuff with which we are dealing. It seems right to say that our knowing is in our action (p. 49).

MacKinnon (1989) summarizes the importance that Schon places on "knowing" and supports Schon's argument against a kind of "Technical Rationality":

. . . . for Schon, the existence and importance of 'knowing how' is central to the matter of learning a practice. This is not to say that 'learning by doing' without analysis is a substitute for 'learning by doing' with a theory. Rather, it is to say that 'learning by doing' mitigates some of the difficulties that arise when a practitioner is unable to articulate and analyze competent performance. Certainly, intuitive actions are

subject to thoughtful consideration and further articulation and understanding. The point is however, that the reverse is not the case: intelligent performance does not follow automatically from knowing a set of procedures or maxims that govern it (p.100).

The meaning of a situation unfolds gradually to a practitioner, usually in the context of working with, and then thinking about the situation. Schon (1983) writes: "When a practitioner reflects in and on his practice, the possible objectives of his reflections are as varied as the kinds of phenomena before him and the systems of knowledge in practice which he brings to them" (p. 62).

Reframing

According to Schon, one's ability to carry out a sequence of actions may not depend on the description of the sequence. More importance is placed on one's ability to recognize patterns in uncertain and unique situations and then having the wisdom to frame them wisely. In doing this, one is drawing on a repertoire of past experiences and ways of understanding those experiences, both of which lead to an ability to reframe problems in the light of the information received from the the actual situation. Schon refers to these processes as "reflection - in and on - action," which is like a reflective conversation that takes place between a practitioner and an uncertain situation. "Reflection - in and on - action is the mechanism which permits practitioners to continue to develop a rich repertoire of strategies and ways of making sense of experiences

that, ultimately, accounts for their competence in dealing with the "messy" problems of practice" (MacKinnon, 1989, p. 101).

Problem - setting and problem - solving are the strands involved in reflection - in and on - action. The central focus of reflection - in action is in tacitly, or unconsciously naming the things that one wishes to attend to and framing (setting the bounds) to which one will attend to in the "messy" practice situations. Reframing occurs when the practitioner reconstructs the problem with a new perspective, giving new meaning to particular components of the practice situation, or bringing to the forefront other features which appear to be relevant. Reframing is a new way of seeing a phenomenon. This process is a complex one which involves active construction and reconstruction of explanations of a practice situation, as well as considering and reconsidering implications for further practice.

In order to see what can be made to follow from this reframing of the situation, each practitioner tries to accept the situation to be framed. This he does through a web of moves. Within the larger web, individual moves yield phenomena to be understood, problems to be solved, or opportunities to be exploited (Schon, 1983 p. 131).

This deciphering continues its evolutionary process as further thought is given to the problem.

In reflective conversation, the practitioner's efforts to solve the reframed problem yields new discoveries which call for new reflection - in - action. The process spirals through stages of appreciation, action, and reappreciation. The unique and uncertain situation comes to be understood through the attempt to change it, and changed through the attempt to understand it (Schon, 1983, p. 132)

The concept of spiraling is integral to the naming and framing process. It is through the continual thinking, rethinking, and evaluation of what is going on in a particular situation which drives the practitioner to redesign and contemplate a variety of strategies. In Schon's (1983) words: "When a practitioner sees a new situation as some element of his repertoire, he gets a new way of setting it and a new possibility for action in it, but the adequacy and utility of this new view must still be discovered in action" (p. 141).

It is important to note that a practice context differs considerably from a research context. In a research context the practitioner is free to contemplate whatever possibilities come to mind with less consideration for the implications of outcome. In real world practice, all the information pertaining to the situation needs to be considered, organized, reorganized, and then action taken which is deemed appropriate for the situation. Schon (1983) states:

The inquirer's relation to this situation is transactional. He shapes the situation, but in conversation with it, so that his own models and appreciations are also shaped by this situation. The phenomena that he seeks to understand are partly of his own making, he is in the situation that he seeks to understand (p.150).

The meaning - making often happens intuitively, and at a sub-conscious level. This involves making on the spot adjustments to practice in action, which does not necessarily require verbal dialogue at the time of intervention. Spontaneous action can be influenced by what we have done in previous situations as we contemplate what we are about to do in a new situation.

The reframing which occurs allows us to make educated decisions about an event, and use that information to plan further action. The danger it appears would be in the temptation to accept a plan of action for a new situation too quickly, without carefully (including tacitly) examining all the possibilities and variables.

Reflection - On - Action

Reflection - on - action includes a conscious reconstruction of what has occurred during a practice situation. Schon appears to believe that many practice situations do not completely eliminate the possibility of thinking while one is engaged in a task as indicated by reflection - in - action.

There are indeed times when it is dangerous to stop and think. On the firing line, in the midst of traffic, even on the playing field, there is a need for immediate, on-line response, and the failure to deliver it can have serious consequences. But not all practice situations are of this sort. The action - present (the period of time in which we remain in the "same situation") varies greatly from case to case, and in many cases there is time to think what we are doing. Consider, for example, a physician's management of a patient's disease, a lawyer's preparation of a brief, a teacher's handling of a difficult student (p. 278).

The concept of conscious restructuring provides the opportunity for deliberate and focussed thinking and rethinking of a situation. Often a practitioner has more time to do such thinking and may be said to be in greater control than during reflection - in - action.

When naming and framing a problem, it is important to realize that the way in which one views a particular situation may have to be revised as more information is obtained. The practitioner should not be afraid of this process, but rather view it as a opportunity for learning.

There is the recognition that one's expertise is a way of looking at something which was once constructed and may be reconstructed, and there is both readiness and competence to explore its meaning in the experience of the client. The reflective practitioner tries to discover the limits of his expertise through reflective conversation with the client (p. 296).

There must be a recognition of the fact that the spiral of learning continues even after the situation draws to an immediate conclusion. The naming and framing which occurs in one situation will possibly be drawn on during a subsequent practice situation.

Within the context of research, it is important that the dialogue between "practitioner" and "researcher" be an ongoing process which is respected by both parties. Reflection - in - action is a difficult process for a teacher to engage in. The isolation of most classrooms is actually a deterrent to the process. Schon (1983) believes that "in order to broaden and deepen their capacity for reflection - in - action, professional practitioners must discover and restructure the interpersonal theories of action which they bring to their professional lives" (p. 353). A focus on reflection as a primary way of making sense of situations is necessary in order for reflection-in action to become a common and immediate response. "The extent of our capacity for reciprocal reflection - in -

action can be discovered only through an action science which seeks to make what some of us do on rare occasions into a dominant pattern of practice" (p. 354). Teachers and researchers alike must support each other in the quest for increased understanding of what occurs in the classroom.

Summary

Donald Schon highlights several components which are fundamentally important in this study. Knowing - in - action gives credence to the idea that there are times that a person 'just acts' and does not spend a large amount of time reflecting on the immediate information and data which is available. After a situation has occurred and a person has an opportunity to reflect, new ideas and conclusions may be drawn. The opportunity for reflection - on - action provides the context in which new learning can occur. The possibility of expanding one's understanding about a situation is exciting, and provides further knowledge from which ideas and information can be drawn from at a later time. This type of thinking leads to the naming, framing, and reframing of how a person perceives a particular situation based on the information and knowledge available at the time. It is through naming and framing, which can result in a spiral of learning, that a person can expand his or her comprehension of a particular situation, as well as a better understanding of how the information fits into the wider scope of theoretical knowledge.

Narrative Inquiry

The final section of the Literature Review will focus on the concept of Narrative Inquiry as described by D. Jean Clandinin and F. Michael Connelly. The review of some of their writings will focus on the concept of narrative inquiry, and several important facets which are brought to the forefront as a result of the narrative context. These include the importance of collaboration, narrative unity, the differences between Donald Schon's work and that of Connelly and Clandinin, as well as the similarities and differences between biographies, autobiographies, and narrative inquiry.

By its very nature, narrative is a complex, involved concept with many dimensions. To begin with, the study of narrative is primarily epistemological, but has deviated from epistemology by focusing on personal experience rather than upon reconstructed formal logic. In the study of teaching, narrative focuses primarily on reconstructing classroom meaning in terms of narrative unities (to be elaborated on later) in the lives of classroom participants (Connelly & Clandinin, 1987, p.130). A person's experience, or story is not examined in isolation of the events surrounding it, but rather within the confines and breadth of a larger situation. Lives' narratives are the context for making meaning of school situations (Connelly & Clandinin, 1989, p.3). These narratives are imperative for continued insight into teacher-learning situations.

Importance of Collaboration:

Central to the development of narrative inquiry is the concept of collaboration.

. . . Collaborative research constitutes a relationship. In everyday life, the idea of friendship implies a sharing, an interpenetration of two or more persons' spheres of experience. Mere contact is acquaintanceship, not friendship. The same may be said for collaborative research which requires a close relationship akin to friendship (Clandinin & Connelly, 1988, p. 281).

Narrative inquiry cannot occur if the parties involved do not develop a close and trusting relationship. The very nature of the narrative requires that the teacher - researcher and the teacher - practitioner have a closeness which may be less common in a more conventional study.

When viewed in the context of research, it is important that the researcher listen first to the practitioner's story, that it is the practitioner who first tells his/her story. This does not mean that the researcher is silenced in the process of narrative inquiry. It does mean that the practitioner, who has long been silenced in the research relationship, is given the time and space to tell her/his story so that it too gains the authority and validity that the research story has long had (Clandinin & Connelly, 1989, p. 6).

The intertwining of two peoples' stories allows both to have a voice.

Multiple Levels of Meaning

When attempting to work through the many dimensions of narrative inquiry, one must be cognizant of the fact that there are multiple levels of meaning which one must be aware of. A person must have:

. . . an understanding of the process as one in which we are continually trying to give an account of the multiple levels (which are temporally continuous and socially interactive) at which the inquiry proceeds. The central task is evident when it is grasped that a person is both living their stories in an ongoing experiential text and telling their stories in words as they reflect upon life and explain themselves to others. For the researcher, this is a portion on the complexity of the narrative since a life is also a matter of growth toward an imagined future and, therefore, involves retelling stories and attempts at reliving stories. A person is, at once, then engaged in living, telling, retelling, and reliving stories (Clandinin & Connelly, 1989, p. 7).

The many layers and dimensions of the narrative process are a real challenge to the researcher, as there is need to 'make sense' of the information one has, and to be able to communicate that information to both the participant and the reading audience.

The researcher cannot merely stand back and remove himself from the situation, but also becomes part of the process.

Seeing and describing story in the everyday actions of teachers, students, administrators and others requires a subtle twist of mind on behalf of the enquirer. It is in the tellings and retellings that entanglements become acute for it is here that temporal and social/cultural horizons are set and reset. . . . When one engages in narrative inquiry the process becomes even more complex for, as researchers we become

part of the process. The two narratives of participant and researcher become, in part, a shared narrative construction and reconstruction through the inquiry (Clandinin & Connelly, 1989, p. 7).

Connelly and Clandinin coin the phrase "narrative unity", which according to them, provides a comprehensive description of what narrative involves.

What we mean by (narrative) unity is the union in a particular person in a particular place and time of all that the person has been and undergone in the past and in the past of the tradition which helped to shape the person. The notion of narrative unity is not merely a description of a person's history but is a meaning - giving account, an interpretation of one's history and as such provides a way of understanding the experiential knowledge of classroom participants. . . . The notion of narrative unity allows us the possibility of imagining the living out of a narrative as well as the revision of ongoing narrative unities and the creation of new ones. It is in this way that we frame our understanding of how classroom participants know, and come to know, their situations (Connelly & Clandinin, 1987, p. 131).

The collaborative nature of the inquiry process demands that there is a mutual dependence of the enquirer and the participant. The researcher must also become vulnerable rather than remaining aloof, in order for the narrative to truly express the interplay of the events, thoughts and emotions brought forth in the narrative experience.

Before proceeding any further, it is important to place the concept of narrative inquiry in somewhat of a philosophical perspective. Connelly and Clandinin (1987) have attempted to provide some philosophical perspective particularly as it relates to

the the work of Donald Schon, (1987) and his book The Reflective Practitioner. It is here that they contrast their concept of narrative inquiry with Schon's concepts of reflection.

There are some similarities between the work of Schon and Connelly and Clandinin. Schon's key term of reflection - in - action, involving a particular set of assumptions, or a "frame", has some commonality with some of the terms which are used in narrative inquiry. Terms such as 'personal philosophy', 'narrative unity', and 'rhythm', are common when discussing the narrative process. Both 'reflection - in - action' and 'narrative inquiry' focus on the analysis of theory in terms of practice rather than practice in terms of theory. As Connelly and Clandinin (1987) state:" 'summaries', 'averages' and 'means' are not the ideational end. The specific event, and the theoretical repertoire required to account for it, is the intended end" (p.131).

While there are some commonalties between reflection - in - action and narrative inquiry, there are some definite differences as well. Schon creates a definition of practical rationality in terms of observed actions (p. 132). Narrative does the same thing, but does it by accounting for the teaching and learning action in terms of the participants' history, which may be shown to bear upon observed classroom events (Connelly & Clandinin, 1987, p.132). Schon does not place the same emphasis on the historical journey of the participant.

Connelly and Clandinin (1987) outline the similarities and differences between narrative inquiry and the writing of biographies and autobiographies. Narrative inquiry does share some similarities with biographies and autobiographies.

Narrative is concerned with specific, concrete events in a person's life and is concerned to give an account of a person. Furthermore, through the construction of personal philosophies, images and narrative unities, narrative method offers an interpretive reconstruction of parts of a person's life. It is a study which is historical, factual, causal in an interpretive sense, and designed to reveal what is meaningful in a person's history for purposes of understanding classroom actions (p. 134).

On the surface it would be relatively simple to make a blanket comparison and determine that the two forms were the same. But, these similarities do not make narrative method a biography.

"The study of narrative exhibits a sense of unity in a person's history not seen in the biographical or autobiographical work" (Connelly & Clandinin, 1987 p. 135). Rather, biographies, and autobiographies involve the confrontation of events or circumstance which refuse to agree with the personal knowledge given by the person, from past events or circumstances. Narrative also focuses on the person's past experiences but Connelly and Clandinin, (1985) argue that "the reconstructions that occur in the act of research lead to changes in practice. That is, research itself is an act of school reform quite apart from any possible uses of the products of research" (p. 130). Narrative is concerned with the everyday, mundane events which occur as part of school, even though some of the events may appear to be problematic to the person. In narrative

the researcher and participant enter into a close collaborative relationship with each other, while in biographies and autobiographies the researcher is removed from the process.

The emphasis on personal knowledge illustrates one of the primary differences between narrative and biography.

The primary focus in autobiography and biography . . . is on method. For both cases, the purpose of the method is to reveal something about individual persons. In both cases, the proximate ends are set in terms of long-term ends, social reconstruction and evaluation of educational experience respectively. But the burden of the writing is on method. . . . In contrast, the emphasis in narrative, at least as defined in the study of personal practical knowledge, is on how people know classrooms. Method is subsidiary (Connelly & Clandinin, 1987, p.136).

The greatest and most important differences between narrative and biography have to do with research purposes.

The methods of biography and autobiography, are used primarily for personal reflection. While narrative has this quality because of its collaborative method, its ultimate purpose is to develop an understanding of the teaching process more generally and to develop a language of classrooms tied to the emotional, moral and aesthetic character of classroom life. Reflection - in - action, while aiming at general terminology, does so in a depersonalized way. Whereas the claims of biography and narrative are personal in character, those of reflection - in - action are cognitive (Connelly & Clandinin 1987, p. 136).

It is the desire to help a practitioner to understand her/his perspective and the teaching process in a more comprehensive and personal way, drawing on the thoughts, feelings, and questions of

the teachers involved which sets narrative inquiry apart from other forms of study. Such an understanding, and changes in understanding which come about through narrative inquiry, is what is hypothesized to lead to teacher growth and indeed to school reform.

Summary

Donald Schon as well as Connelly and Clandinin have a strong basis to support their particular styles of study and research. While Schon focuses on reflection - on and in - action of classroom events quite directly, Connelly and Clandinin put greater emphasis on the effect of cultural milieu in developing a practical perspective and explaining the changes, (including new forms of classroom action) which result from the inquiry process. A search for such perspective is often made in the broader perspective of one's life history. It is the indepth study of a number of personal experiences, often embedded in "stories", which set narrative inquiry apart from other forms of research. These personal studies take into account the more mundane aspects of classroom life, as well as giving value to the less tangible information cues like a teachers' thoughts, reflections and emotions. Reconstruction of teacher perspective is common to both research orientations and is at the heart of teacher change and school reform more generally.

Chapter Three

Methodology

The purpose of this chapter is to discuss in general the research methodology used in this study, and the framework in which it is used. The chapter includes two sections, the first one focuses on the research perspective which frames the study. The second section provides a listing and explanation of the investigator's research activities.

Conceptual Framework

The study is framed within the structure of narrative inquiry which provides an appropriate context in which to examine a person's experiences, thoughts, intentions, and reflective activity. F. Michael Connelly and D. Jean Clandinin (1988) define narrative inquiry as "the study of how humans make meaning of experience by endlessly telling and retelling stories about themselves that both refigure the past and create purpose in the future" (p.24). This type of storying becomes the vehicle by which issues come to light and can be further explored. The restorying, or restructuring provides an individual with the opportunity to examine an issue from a new perspective, thereby facilitating the possibility of alternative interpretations being considered. These new interpretations, or new meanings, may at least in part be called learning.

The study combines the narrative inquiry perspective detailed by Connelly and Clandinin with the more focussed type of reflectivity advocated and outlined by Donald Schon. The blending of the two perspectives provides a rich framework within which the guiding questions of the study may be examined.

Thus while narrative inquiry provides a framework in which to explore a person's past and present experiences, thoughts and intentions leading to new meanings, Schon's ideas on reflection and "educating practitioners" provide an additional framework or focus which helps to emphasize the need to examine reflective activity in the context of a more conscious, more deliberate, and indeed more limited active search for improved teaching practice. Grimmer and Erickson (1988) summarize Schon's perspective on the concept of reflection. They refer to the need for reflection - in - action as well as reflection - on - action. Both types of reflection involve an attempt to identify and give meaning to problem areas. Schon (1983) states the following about examining a problem:

In real world practice, problems do not present themselves to the practitioner as givens. They must be constructed from the materials or problematic situations that are puzzling, troubling and uncertain. . . When we set the problem, we select what we will treat as the "things" of the situation, we set the boundaries of our attention to it, and we impose upon it a coherence which allows us to say what is wrong and in what directions the situation needs to be changed. Problem setting is a process in which, interactively, we *name* the things to which we will attend and *frame* the context in which we will attend to them (p.40) (Emphasis in original).

Thus in the present study, the naming and framing allowed the teacher - researcher and teacher - practitioner to focus on problems which they themselves deemed relevant and which they saw as manageable within the framework of their roles as practitioners. The "narrative" framework meanwhile, provided a way of broadening the reflective process beyond problems deliberately constructed from practice to include more diverse, often less obvious experience and subject these to reflective activity as well.

Collaboration, related as it is to reflection, is a necessary component which occurs within narrative inquiry. Thus collaboration assists with the construction of problems (in the Schonian sense) by helping participants to "name" and "frame" such problems, and to help construct and identify personal responses to their situations. In the context of narrative inquiry, the full range of Schon's reflective activity occurs in a more natural way as participants live their personal and professional lives and express themselves and their lives through concrete instances and experiences, often reported in anecdotal form. Both the researcher and the participant entered into the process of constructing meaning from / in this context. Since everyday experience including that embodied in rhythm and habit for example, may be held up to scrutiny, collaboration is an important part of the process because another persons perspective may help bring out something which may have remained outside the realm of conscious reflections by the other. Once meaning is made by either party, it helps the other person to further reframe / restory as meaning - making, and thus the learning continues. The collaborative nature of this type of

research process is one in which all participants see themselves as participants in the community which has value for both researcher and practitioner, theory and practice. (Clandinin & Connelly, 1990)

This reflective process provided both the researcher and the participant with 'voice' and validity to think about the events that occurred and were then reflected upon. Connelly and Clandinin (1990) view this process as 'living the story'.

(Narrative inquiry) is an understanding of the process as one in which we are continually trying to give an account of the multiple levels (which are temporally continuous and socially interactive) at which the inquiry proceeds. The central task is evident when it is grasped that a person is both living their stories in an ongoing experiential text and telling their stories in words as they reflect upon life and explain themselves to others. For the researcher, this is a portion of the complexity of narrative since a life is also a matter of growth toward an imagined future, and therefore, involves retelling stories and attempts at reliving stories. A person is, at once, then, engaged in living, telling, retelling, and reliving stories (p. 6).

This approach to research moves away from the notion that practice must follow the direction that is first established by theoretical foundations, but rather begins in experience, and flows out of a reciprocal, dialectic relationship (Wood 1990). The framework is also consistent with a view of professional development which views practitioners as active agents in their own professional development, albeit with the supportive help of others.

Together the teacher - participant and the teacher - researcher examined issues which arose when integrating computers into the regular classroom routine. Through a mutually reflective

process set in the context of the theoretical framework described, we learned more about our own teaching and personal understanding of what dealing with possible computer anxiety, computer integration in the classroom, as well as building effective support mechanisms. As we collaboratively explored the dynamics of classroom computer integration, we attempted to give meaning to the combined experiences of the teacher - participant and the teacher - researcher.

At the conclusion of this study, I anticipate that the participant and I, in agreement with Connelly and Clandinin (1990), and consistent with the questions I have generated, will be able to:

. . . return to present and future considerations and ask what the meaning of the event is for them and how they might create a new story of self which changes the meaning of the event, its description, and its significance for the larger life story the person may be trying to live (p.20).

This continuing spiral of rethinking and reflection are necessary components in facilitating personal growth and possible change in action.

Research Procedures

An outline of the research activities employed is given to provide an overview of the study. The overview will include comments on the need for the study, selection of the participant, school composition and computer facilities, timetabling, and the teacher - researcher's role in the school.

Selection of Participant

The teacher selected for the study, who will be referred to as Lee, (or L.S. at times in quotes and citations) is someone concerned with the implication of and need for computer integration in the classroom. She is interested in developing her own teaching skills. Lee had a basic understanding of the hardware and software involved, and was attempting to have her students participate in activities which would provide them with a greater comfort level with the computer, as well as be able to complete some of their assignments using the computer. The participant's willingness to discuss ideas, problems and solutions in regard to the use of computers made her an excellent choice.

School Setting

The setting for this study is an elementary school with a population of 450 - 500 students. It is located in a suburb of Winnipeg, Manitoba, Canada. The catchment area consists of a diverse range of economic backgrounds, with the students also coming from a variety of cultural and social backgrounds. Almost one quarter of the school population is made up of English as a Second Language (ESL) students. The grade taught by the teacher - participant (Lee) was Grade Four.

School Facilities

The school in which the study took place had three classes of each grade level with Grade Six being the exception with only two classes. Each classroom at the grades four to six level has three Macintosh computers in the classroom. Every grade has an 'Image Writer' printer somewhere in the area for immediate use. The school also contains a Macintosh "Lab", which has sixteen Macintosh computers, two Image Writer printers, the Server, an overhead projector and a data projection unit. The lab is organized into two long rows of computer tables back to back with eight computers down each side. Four computers are situated at the back of the lab, each on individual tables. The Server and the printers are against the same wall as the four free - standing computers. The data projection unit, more commonly referred to as the 'Data Show' is situated among the two rows of computers. The 'Data Show' projects what is on the screen of the SE Macintosh computer onto an overhead screen hanging in the Lab. A teacher can visually guide students through components of a program, or demonstrate specific skills and the students in the lab can either watch, or follow along with their computers, depending of the desire of the teacher. The Lab also contains enough large tables and chairs for at least half of a class to have comfortable work space if not working on the computers.

The school involved is known in the Division for its creative teachers and their involvement in a wide range of activities which provide the students with many experiences not found in every

school. The staff struggles yearly with trying to prioritize the nature and extent of commitments for the student body, while trying to be fair to the staff members themselves in regard of workload and time away from 'regular' curriculum instruction.

Timetable

Each classroom teacher in Grades Four through Six had the opportunity to book four thirty-five minute slots in the Macintosh Lab per six day cycle. The teacher had the choice of whether or not these would be individual slots, or back to back resulting in a seventy minute block. There was an understanding among the teachers using the lab that there were a few unscheduled slots that could be booked as the need arose. As well, there was flexibility which allowed for someone who was working on a special project to ask someone for permission to use their regularly scheduled slots for a cycle or two. Lee had chosen one set of back to back slots, and two individual slots scheduled in a six - day cycle. She chose this configuration of slots because she believed that it was more effective and versatile to be able to take her entire class into the Lab for an extended period of time. This provided better opportunity for teaching time as well as working time for all her students while in the lab. The two individual slots were Day 5, from 10:30 am to 11:10 am, and Day 2 from 3:10 pm until 3:45 pm.

Researcher's Role In School

The researcher was a member of a Divisional leadership committee (Knowledge Builder Instructional Training Team, KBITT) which was exploring how best to support classroom teachers in their attempt to use the Knowledge Builder program and the Macintosh computers in the classroom. Each of the committee members was trying to assist teachers in their particular building to increase the skills which they possessed with the Knowledge Builder program and the Macintosh computers. The committee was in its second year of existence, but was disbanded before the end of the 1992 - 1993 school year because the Division chose to pursue a different focus with the computers.

The school that the researcher taught in supported the use of the Knowledge Builder program by providing the teacher - researcher with two preparation classes per cycle available to go into classrooms and/or help teachers learn more about the computers and how they could be integrated into the regular classroom. Prior to the study beginning the teacher - researcher and Lee discussed the possibility of the researcher spending a regularly scheduled time in the Lab with Lee and her Grade Four class. Through the process of comparing and juggling timetables, it was agreed that the researcher would come into the Lab with Lee's class every Day Two from 3:10 pm. until 3:45 pm. It was the only time which would work when comparing the two teachers' timetables with the regular Lab timetable. Discussion about the limitations imposed by the time of day chosen will be discussed at further length later in the study

Design and Procedure

The following is an outline of the design and procedures of the study as it progressed.

Overview of Design

1. Initial Discussion
2. Beginning the study; Determination of initial conception of teaching and of the role of the computer in the classroom.
3. Inservice sessions
4. Pre / Post Conferences
5. Classroom participation / Observations
6. Data collection / Collation
7. Data analysis / Feedback
8. Themes identified / Interpretations
9. Limitations

Initial Discussion

Following the clearance of the Ethics Committee of the University of Manitoba, the researcher and Lee held an initial discussion about the study. The discussion included some initial questions by the researcher, as well as an opportunity for both people to discuss the study and discuss any questions which needed answering. The meeting, which took place in a local restaurant, became so lengthy that a second meeting was held at school over the lunch hour the following week. The researcher took notes during the discussion which were later transcribed and given to the participant to review.

The initial meetings provided the opportunity to gain more information about the participant and outline the requirements of the study. Since the teacher - researcher was already working with Lee and her class on a regular basis, it was decided that the already established pattern would continue. As previously mentioned, the researcher was in the Macintosh Lab with Lee's class one sixty minute slot per six day cycle. The role that the researcher played during that class varied, depending on the objectives Lee wanted to meet.

The initial discussions provided the opportunity to glean some of Lee's thoughts and feelings about the computers since they were first introduced into the school. It became clear that Lee had shown an interest in computers long before the Macintosh computers were introduced into the school. This information will be elaborated on further in Chapter Four.

Beginning the Study

Since the researcher was continuing with an already established routine when participating with Lee's class, there was no need to have a familiarization period for the class to become used to the researcher being in the Lab setting with them. The study was formally begun at the end of January 1993, after the initial discussions had taken place, and when the participant felt comfortable with beginning. The researcher and Lee discussed what Lee thought and felt when trying to incorporate the use of computers into regular work.

Lee expressed an interest in learning more about particular components of the software program, and how they could be used by students. These interests became the focus for lessons during subsequent computer classes with her students, or inservice times with staff members.

Inservice Sessions

The teacher - researcher had been holding noon - hour inservice sessions for interested staff in her school for the past year. The purpose of these sessions was to provide the staff with an "in house" inservice opportunity where they could learn more about the hardware and software without having to leave the school.

While the concept has merit on paper, there were numerous difficulties which were experienced while trying to accomplish this. Since the sessions were held at lunch hour, there were continual conflicts with other committee meetings being held in the school. As previously mentioned, this particular school is very involved in providing unique opportunities for students, which are proceeded by numerous planning meetings. Also, the unique makeup of the student body population in terms of its ESL population, diverse cultural mix, and the demand for special needs programming took up many teachers' time over the lunch hour on a regular basis.

As the school year progressed and the pressure of the classroom and extension activities grew, it became increasingly clear that the computer inservice sessions were not a top priority for the staff who had initially indicated interest in participating.

As a result, many in the group (which potentially numbered around 10) asked for the session schedule to be changed in order to accommodate something else, and when the new date was nearing, the meeting often had to be rescheduled again. Since teacher participation in these sessions was strictly voluntary, the teacher - researcher did not feel right about placing pressure on teachers to attend, nor was there any tangible way of having some sort of accountability to the group.

Most teachers attended the sessions because they felt uncomfortable with using the computers with their students. While they realized that they needed assistance in becoming more comfortable with the computers and software, it was also very easy to go back into the classroom and ignore the existence of the machines because computers are not part of the formal curriculum. While there was a desire to learn on the part of the teachers involved, it was often difficult for them to push past their discomfort with the computers to try using them with their students. Unfortunately, there was not enough available support time to develop individual plans of action with each teacher, and also be available to support the the teachers in the classes.

For a variety of reasons, including school events, other lunch hour meetings, as well as the political climate in the school the noon hour inservice sessions were terminated at the beginning of March. Later meeting dates were proposed, but none of the sessions ever occurred.

Pre/Post Conferences

The original design of the project upon which this study is based was to include a pre and post conference in conjunction with each computer class. The researcher checked with Lee prior to each computer class to determine what she would like accomplished during that time. The researcher's role included providing formal instruction to the entire class, supporting Lee as she taught a formal component to her students, as well as working with individual students as they were completing a task which had been assigned previously. There were times when the students were completing something which they had begun in a previous computer class, or something which had given to them while in the classroom sometime during the cycle.

Lee's objectives during the classes which were taught by the teacher - researcher were primarily to learn how a particular feature of the software program worked, or to observe a format and strategy on how to teach a particular segment of the program. There was a relaxed atmosphere between the teacher - researcher and the teacher - participant which allowed either person to interject during the lesson if they had something to add. This allowed for the interchange of ideas and experiences which were of benefit to both the teachers involved as well as the students in the classroom.

It was more difficult to hold a post - conference on a regular basis. It was not uncommon for one teacher or the other to have a commitment immediately following school, making it difficult to

debrief about the class immediately. More informal discussions were often held in passing during the subsequent days and notes kept based on those discussions. These informal discussions and conversations frequently continued over a period of time as one or the other reflected on what had happened and what was being discussed.

Classroom Participation

As previously mentioned, the researcher worked with the Lee's class on a regular basis. In addition to being in the Lab with the class once a cycle, the researcher would often drop into the classroom to chat with the teacher. Outdoor and door supervision done by the researcher was in the same cloakroom and playground area as the class taught by the teacher participant.

Data Collection

The data collected was primarily in the form of journal entries and notes taken by the researcher. The journal entries were handwritten and reflected thoughts and questions which occurred as a result of working on the computers with Lee's class. Lee also made some journal entries. Interviews were also held on an on - going basis. During the interviews, the teacher - researcher would record the comments made by the teacher - participant and then transcribe the notes to a hard copy as soon as possible.

The conceptual framework used had implications for the collection of the data. In order for data to be collected for each questions a number of steps had to be employed. For the first question "What concerns or issues arise when a teacher plans for and attempts to implement computer technology into the classroom?", The teacher - researcher had to collect stories about experiences which Lee had with computers. Once the stories were collected, the "concerns and issues were summarized with the help of a "meaning giving" account (technically called a narrative unity by Connelly and Clandinin). The meaning - making accounts for the past and present experiences as well as images for the future.

The second question "How do inservice strategies or supports influence the classroom teacher in her exploration and experimentation with different possibilities of computer integration?" required looking for interpretive connections between inservice strategies and supports in the course of Lee's exploration and experimentation with computers to determine what has influenced her. The interpretive connections were checked with Lee in either oral or written form. My intent was also to look for present influences and imagined future supports which could be of assistance.

The third question, "What reconstructions of meaning do the teacher - participant and the teacher - researcher make in the context of their collaborative inquiry into the use of computers?" required the teacher - researcher to look for meaning and patterns of meaning - making based of the experiences and insights given by

collaboration of the teacher - participant and the teacher - researcher.

Data Analysis / Feedback

Once the study was formally completed, the teacher - researcher reviewed all the notes kept by herself and the teacher - participant. An initial draft of "Chapter Four" was written and given to the teacher - participant to respond to. The draft was then discussed and changes made. During this time also, questions would arise in the mind of the teacher - researcher and these questions would be discussed with the teacher - participant as well. This cycle of writing, reading, discussing, elaborating and revision was repeated many times. Each time the teacher - participant elaborated or clarified something in the draft, it was rewritten and then returned to the teacher - participant for approval. The teacher - researcher would also record her interpretation of what she believed was occurring, and this also was given back to the teacher - participant for approval.

There were times when the data analysis would follow a complete cycle, and then other times would be 'short circuited' by something like an informal conversation in the hall, or a question asked over a cup of coffee. Any insights gained at this time would be added to the draft immediately, rather than waiting for a previous draft to be read and discussed. This format was successful in obtaining additional insight from the teacher - participant,

because she was willing to take the time to go through the draft carefully and add elaborate on what she believed was important.

Chapter Four

Data Interpretation and Analysis: The Case Study

Chapter Four provides the data collected during the time of the study, including the meaning that was made of the data originally collected. Additional data, including meaning, was added by both the teacher - participant (Lee) and the teacher - researcher (I) during the writing and revision stages to obtain greater clarity, elaboration and additional construction of new meaning. The data collected came in a variety of forms including field notes, journal entries, excerpts of conversations, as well as additional written comments by the teacher - participant and the teacher - researcher.

Chapter Four is organized into numerous segments reflecting the background and key experiences which surround a particular problem or concern as conceptualized by the Lee and I. Each segment has a title providing an indication of the theme of the data included in that section.

There was continual dialogue between Lee and myself. Discussions would be held and additional written comments made, including elaboration and interpretation of events each time another draft was written. This cycle of revision also evolved into a pattern. The first number of times Lee reviewed the drafts, the comments and questions I asked were for additional information, clarification and meaning. Lee was also free to ask questions and probe for further clarification from me. As time went on, the focus of the revisions moved from clarification and additions to editing some specific words used in some of the quotations. The teacher -

participant did edit some of her quotes for greater clarity, grammatical structure and flow, but did not alter the intent of what was said.

To facilitate the reading of this chapter, each step of the revision process is not explicitly outlined in each segment. It needs to be understood that the revision cycle occurred throughout the writing of this chapter, although not always in the same sequential format. The interpretation of the data found in this chapter is a combination of, and weaving together, of my reflective activity together with Lee's. Typically, there is an underlying story followed by an interpretation.

As was outlined in the problem statement for this thesis, three guiding strands were identified at the outset of this study. These strands are:

1. What concerns or issues arise when a teacher plans for and tries to implement computer technology into the classroom?
2. How do inservice strategies or supports influence the classroom teacher in her exploration and experimentation with different possibilities of computer integration?
3. What reconstructions of meaning do the teacher - participant and the teacher - researcher make in the context of their collaborative inquiry into the use of computers?

These three strands, as well as some other questions which arose as a result of the study will be discussed in the following. A brief historical account of Lee's experience in the area of computer education will be given first.

Lee's Background Computer Experience

During the initial interview, Lee gave a brief summary of her involvement with computers since their introduction into the school in 1983. Her own words provide a good base for understanding her particular situation. She began by describing the first computers which were placed into the school:

The very first computers that were put into the school were Radio Shack. I didn't know anything about computers. I took a course at the University of Winnipeg. A computer consultant from one of the Divisions taught a five to six week course through Continuing Education at one of the local schools. It was difficult because it was mainly programming. I remember that I needed to know more about computers, I found it confusing. One teacher in the school gave tidbits of help, which I felt were useless. It was the type of program where every dot, dash and space meant something. Certain lines meant certain things. When he tried to help me, I didn't understand.

Then we got the Apples. That was easier. The disk was preprogrammed, so that all the students did was put the answers in. One of the teachers gave us some help. We were given no formal training. If something went wrong, I didn't know what to do. There was always the chance that the disc would show a system error. Or, if the disc drive didn't accept the disc, what do you do then? That type of thing still happens. If there is an error on one side of the disc, you have to flip it to the other side. You have to know to check the program and see if it has been copied on both sides.

Sometimes things weren't connected correctly at the back. The connections between the computer, disc drive, and monitor sometimes came loose. There were times when the cords were not plugged in where they should have been which meant checking underneath all the tables, to see what was plugged where or whether or not the power bars were on.

(January, 1993)

According to the forgoing excerpt, Lee's initial problems were:

a) learning "programming" which was not really useful in the classroom; b) introduction of Apple computers without formal training; and c) technical problems such as "system errors" and electrical connections. Lee indicated that she had no prior knowledge or training when she began trying to use the computers at the time they were introduced. It was her own initiative and interest which got her to get more information about how to work with and what to do with computers. The first computers introduced into the school were Radio Shack computers which required the person working on it to be fairly adept at computer programming. No training was provided for teachers at this time and unless someone had a computer science background, or spent a lot of time learning the programming commands on their own time, the computers were of little use. As Lee stated, it was a confusing endeavor even after taking a 5 - 6 week computer course through the Continuing Education Department of the University of Winnipeg.

Lee also reflected on her feelings about taking her students to the computer lab in past years. When asked if she took her students to the lab because she wanted to or because she felt she had to Lee responded:

Most of the time I looked forward to going, but if there was a problem, what do you do? Later I wanted the kids to type work and print it. I would ask them to type something simple like a poem or story from Creative Writing. It would take what seemed like forever because the students couldn't find the keys. I was the only one doing a typing program with Grade Three's called "Type To Learn". We would work through the program systematically. The class liked going to the lab. They liked the fact that they were using the computers. They thought that was neat. They could see that they were accomplishing something. They could see their story in print. They were proud of their work and wanted to show it off. They wanted to display the work, and then take it home. That hasn't changed, the students still like that. We only went into the lab one period per cycle, so things really stretched out, that was not as good as now (in Grade Four). Now they go to the (Macintosh) lab two to three periods a cycle, and use the computers in the classroom on their own time. The first year we had the Macintosh computers the kids were in there one period per cycle which was useless. It took a long time to accomplish anything. Even to learn one concept took forever.

There were always the difficulties of typing skills versus the hunt and peck method of finding the correct keys, as well as what to do when the program didn't want to save the work that had been done. There were too many interruptions. Not much was accomplished. We used Typing Tutor IV on the Macs, which was better than the typing software for the Apples. The kids wrote stories and printed them. At that time I didn't use Knowledge Builder (See Appendix A), I used Microsoft.

(January, 1993)

Lee seemed to indicate a positive attitude about taking her students to the computer laboratory. Her students also liked going to the lab to use the computers because they readily saw their learning outcomes. The students were proud to display their work. However, Lee felt that it took a long time for the students' to learn a concept, and their typing skills delayed their learning as well.

Lee agreed that as technology advanced, the work of the teacher became a little easier. With the introduction of the Apple computers, teachers and students were able to use preprogrammed discs. The teacher was still responsible for showing the students how to start the machine, load the program, troubleshoot for any malfunctioning disc or machine, and shut the machine down again. Lee commented that she received no formal training on how to use the Apple computers, and if there was a problem like a disc error, she didn't know what to do. This type of situation was complicated by the necessity not only to problem solve, but to maintain classroom discipline.

Introduction of Macintosh Computers

Lee's experience was such that the introduction of the Macintosh computers and the Knowledge Builder program was not accompanied by an adequate support base. Lee outlined the initial training and assistance which she received as she was thinking about attempting to introduce Macintosh computers and the Knowledge Builder (K.B.hereafter) program into her classroom.

I had two or maybe three half days of training. I went to the workshops when I taught Grade 4. They were held about three quarters of the way through the year. The first class was held at Infotech, and the Divisional computer consultant taught the classes. He would go so quickly, and then the computer would crash. A 'bomb' would appear on the screen and the program was locked. I would have to restart the Knowledge Builder program, which was like starting from the very beginning again. I would try to get caught up to the rest of the group, and

then forget how to get to a particular point in the program. It was very frustrating. Another session was given but it was on the Writing Process. How did this (Writing Process) fit in with anything? I would have been more comfortable with a session on the mechanics of the computer and then move into the Writing Process. I still can't figure it (the Writing Process) out. The students can do the Writing Process in their notebooks, and conference without the computer. I didn't understand how the mechanics of the machine and the use of the K.B. all related to the Writing Process.

One session was held at the Board Office. It was mostly mechanical, and we were given a 'tour' of the K.B. program. The training was twofold. One aspect was how to use the Macintosh computer, while the second component was to learn the Knowledge Builder program which had been created specifically for the Macintosh. At this point there were still many problems with the Knowledge Builder program.

At the Board Office several people did presentations about different components on the Knowledge Builder program. One of them (Board Office personnel) had a contest going with the principals. There was a draw and the school that won got one of the Board Office personnel to teach in one of the classrooms in their school. It was good that someone from the Board Office spent some time in the classroom, because that resulted in some necessary changes.

How long have I been doing this now? Three to four years. After training I still felt incompetent. It was not a good experience. The computers kept crashing. The screen would go blank and the software program wouldn't work. I felt so frustrated. There were just too many glitches. When I think of the writing process sessions, I wonder where a person would find the time during the day to do all of that?

The problem remains that there appears to be very little contact with the classroom, so there are still many glitches and crashes. While it is not so bad with the Grade Four students because they wouldn't type in large amounts of material. The real trouble comes with older students doing projects.

(January, 1993)

Lee suggests that the initial inservice training that she received was not very helpful because the pace was so fast, and there were

always technical difficulties with the Knowledge Builder. She would have preferred to learn the mechanics of the computer first, and then focus on the writing process. She found it difficult to make all the connections between the mechanics of the computer, the Knowledge Builder program, and the writing process.

When one thinks about the potential for experiencing difficulty while teaching a computer class in the lab, the possibilities are enormous. Sixteen computers (there were also two different types of Macintosh computers in the lab), multiplied by sixteen copies of the program (the version of which changed on a regular basis), multiplied by the number of students in a class, (which in the case of Lee's class was twenty - two or twenty - three), creates tremendous potential for difficulties in learning to occur. The number can be somewhat unsettling, with the possibility of error at each stage of the progression. For example, a person could experience difficulty as a result of the computer itself, the program, the students, or any combination of the three. The students are just learning to use both the hardware and the software, so a teacher must accept the fact that they will experience some difficulty. The challenge is to effectively eliminate as many of the potential difficulties as possible before the students begin to use the computers.

While students are often willing to experiment and explore, they come to rely on some basic guidelines and procedures when feeling the pressure of completing an assignment within a given time frame. When these guidelines change, as many did when a new version of the software program was installed, there were no

references provided by the Division to highlight changes, additions or deletions to the program or how it functioned. The command to "scroll" to the next page on a document might work on one version, but not on the next. Lee agreed that this cycle of 'forced relearning' was frustrating for both the teacher and the students.

Two - Year Rotation

Lee experiences the additional difficulty of not being able to work with the computers every year. She is on a two - year teaching rotation between Grades Three and Four, and has access to the Macintosh computers in Grade Four. Divisional guidelines make it difficult for Lee to obtain any access to the Macintosh lab for her Grade Three students. She expressed her feelings about having to relearn the program as well as some the mechanics every other year:

Now it's the same thing. Last year the students worked on the Apples and the new version of Type To Learn, because we got the version updated. They learned the home row keys, but I didn't want to do that all the time, so they worked on the other software programs.

This year (in Grade Four) I teach my own "computer" classes in the Mac lab, but I was uncomfortable at the beginning. They (the students) started with Typing Tutor IV, which is better than the other one (on the Apples); it is easier.
(January, 1993)

Lee's initial comments outlined her own experience and feelings about the 'Knowledge Builder' support which she received from the Division during the last school year (1993). The Division

had just recently provided each teacher with a manual outlining the commands and components of the Knowledge Builder program.

When I got the K. B. manual I started going through it, I thought that this should be easy enough. I still had to ask for help. Then I began to get different stories, and found out that things were being taught differently in the other Gr. 4 classes. Now having gone through a bit more of the program I am more comfortable. Next year I'm back to the same thing of not being able to use the Mac computers. I wish I could do something at the end of the year in terms of inservicing on the Macs, which would deal with both the mechanics of the computer and the K.B., to get back into using the Macintosh computers. The Division did offer inservices on the Writing Process last year. However, it was cancelled. There still isn't anything being offered.
(April, 1993)

In one of our discussions about the many challenges which she faced every year that she used the Macintosh computers, Lee brought to light what she perceived may be a possible assumption being made by the School Division. Lee raised the question (in regard to K.B. update training) "Is the Division making the assumption that everyone, even new teachers are trained (on Knowledge Builder), and that present teachers 'know everything'? (August, 1993)

The additional difficulty of having to reintroduce herself to the program every other year makes using the computers an additional challenge for Lee. She summarizes:

There has always been a different version every time I come back to use the program. It is like starting over again. Without help I would have had more trouble, because there is no inservice training. I guess the Division thought that if a person read the binder they would be O.K. Well, I read the binder and still didn't understand things, and had to ask

somebody. A person's comfort level with others is important. There are some people I would never ask. I'd ask you or a couple of others if worst came to worst.

When asked for further clarification about 'a person's comfort level' Lee emphasized that "some people are better at explaining things, and individuals have different knowledge levels to begin with" (L.S., August 1993). Thus an individual has to find someone with whom they are comfortable asking questions, and the same person would have to have the knowledge, or know where to obtain the information necessary to assist the other person. When asked for a further explanation Lee elaborated:

Some people are very knowledgeable. However, they speak in technical jargon. The jargon complicates the explanation and makes it difficult to understand. People who are knowledgeable, yet are able to simplify the explanation by using easy terms, are more beneficial to the person asking the questions. The comfort level is higher with the latter.
(October, 1993)

Many of the "glitches" in the software program have been dealt with, leaving a person with a more stable version than was previously available. Teachers now (October, 1993) have a copy of a binder outlining the program, with its capabilities and commands to refer to when working with the software program. While this is a definite asset, and a potential reference tool, it has not been the solution to many of the questions asked by Lee on a day to day basis.

Lee commented on her perspective of whether or not having the K.B. binder in her possession and having received the outlined

instruction from the Division was an adequate base for starting to use the program initially.

I don't think so. There still needs to be someone to troubleshoot. Someone who knows more than you do. How are you going to learn more? You get to a certain point and then get stuck. The binders do not always answer the question! My brother just bought a computer and got a handbook called "DOS For Dummies". It has everything in it. It has an Index, Table of Contents etc. Our Knowledge Builder binders don't have that.

There are also different types of people. Some people can take the manual and work through it step by step. A friend of mine took the Hypercard manual and worked through it. His wife and I would tend to take a course to learn the program, rather than read a manual from cover to cover. I like the more "hands on" approach. Our Division has taken the "Here's the manual, go for it" approach. I find it more beneficial to take a course and refer to the manual, but that is personal preference.
(July, 1993)

There appear to be a variety in teacher learning styles which may not have been adequately accounted for when planning for teacher training in using the computers and the software package. While there are some people who can learn in a more isolated environment, Lee as well as others feel that they learn better in a more supportive environment. Hence, apparent differences in learning styles should be considered when considering how best to facilitate the learning needs of teachers.

Classroom Issues and Concerns

The following section will identify and elaborate on the issues which Lee felt created the greatest amount of concern for her when

incorporating Macintosh computers into the classroom. The issues that were identified were: a) Students' Difficulty With Keyboarding, b) The Influence of Classroom Composition on Computer Learning, c) Time Constraints and Lesson Planning Incorporating the Computers, d) Mechanical Concerns, Hardware and Software.

Students' Difficulty With Keyboarding

Lee had made the decision that teaching her students some basic keyboarding skills was important so that they would be more adept at the actual typing of assignments. (January 1993) During the initial interview, Lee commented that "I insist that my students practice with home row keys. One student kept asking "Where's the D?" etc. That drove me crazy!" (January, 1993) She had gone to the effort of ordering a typing program which her students could use in Grade Three on the Apple machines. As was previously mentioned, the Macintosh computers are only accessible for Grades Four to Six students. The Apple program was satisfactory, but was only used for part of the year before some of the discs showed 'error' messages and didn't work. Since the discs had been ordered from the United States, they had to be returned to the publishing company, and the school had to wait for replacement discs. Only the discs showing error messages were sent. After several months, new discs arrived at the school. When the discs were checked, it was discovered that the new discs were a different version than the ones which had been returned. Lee now had to outline the instructions for two separate versions to the students every time the class was

working on the typing program. The Apple lab had no "Data Show", or any means of projecting at least one version of the program onto a larger screen so that students could see one version, and have the differences in the other program explained in relation to the projected program. The new discs had also taken several months to arrive at the school, making a continuous program impossible.

When Lee took her class to Grade Four, she was looking forward to using the 'Typing Tutor IV' program on the Macs, a program the students were familiar with from their Grade 3 experience. The 'Type To Learn' program designed to be used with the Apples, was discontinued, and the class began to use the 'Typing Tutor IV' program. The program was on a separate disc which was then inserted into the Macintosh computer every time someone wanted to use it. This is where the students ran into difficulty.

There was a problem with the keyboarding programs. The 'Typing Tutor IV' program didn't work anymore. The problem with that was that some computers were on System 7, and some were on System 6, which made the software incompatible. If a disk had been formatted with a System 7 machine, it would not work in a System 6 machine, with the reverse also being true. It was impossible to continually sort the disks out and remembering which disk had been used on which machine.

I had the idea that the first few minutes of each computer class could be spent using this program. I think that the class would have benefited from the keyboarding. As for as typing things, out, some couldn't type at all and some were quite proficient. The ones who could type got a lot done and were good at following directions. (L.S. July, 1993)

The issue of a keyboarding program was discussed again as we sat together discussing how Lee felt about what had been written thus far in Chapter Four. (September 1993) Lee agreed with what was written, and then talked about the continued developments in trying to get an appropriate software program for classroom use. A month of the new school year had passed when Lee provided the following information.

A new typing program called 'All The Right Type' was ordered last spring. When the order arrived in June it was discovered that the wrong size of disk had been ordered, so they were returned, and a new order placed. The new disks arrived in early September, but no one has seen them yet. The disks are sitting in a cupboard. Apparently copying the disks to be used on the Apple computers is an issue. Two sets of the same program have been ordered, one for the Apples, and one set for the Macintosh. There is also a problem with the Macintosh computers. There is not enough memory to place the entire program onto a regular double density disk. The program needs to be placed onto a high density disk. However, high density disks do not work with the machines that are still on System 6. The typing program was going to be placed onto its own disc rather than onto the network to lessen the time needed for students to access the program. If the typing program were to be put onto the network, then each student would have to log on every time they wanted to use the program, taking up valuable time. No one is available or has the time to do all the copying of disks. I think it should be organized so that one person takes the suggestions, places the order, receives the order, and then follows up anything that needs to be done, such as copying the disks. Right now there are too many people, and no assigned ownership or responsibility to the duties.

(L.S. September, 1993)

The continual difficulty with trying to implement a keyboarding program took a lot of time and energy. The best intentions and well

laid plans were short circuited by a combination of incompatibility of the software and the hardware, and lack of ownership among the staff for the ordering of programs. Even when attempts are made to correct and better a situation, things become bogged down because there is no easy routine way of dealing with all the issues that arise.

Two of my journal entries written the second last month of school highlight the difficulty with keyboarding skills:

Typing skills (or lack of them) are still an issue. It takes many of them a very long time to get anything typed.

(B.W. May 14, 1993)

The students were to be editing their speeches today. Many are still working on things that are actual typing skills, ie. spacing, formatting, etc. I wonder what the high school typing teachers will be saying about this in a couple of years?

(B.W. May 21, 1993)

A student's inability to type even adequately made it more difficult for him/her to actually attend to the task which had been given, which was usually to type something out. Lee tried her best to deal with the problem because she saw it as an issue, but was unable to attend to it in a significant way because of the limitations of the software and hardware available for her to use. Lee agreed that she was left trying to deal with the problem of poor keyboarding skills in the classes which she taught. Even though she wished to provide more assistance in the area of typing skills, Lee was unable to do so adequately due to the lack of suitable resources available to her.

The students were given lessons on keyboarding as well as formatting their work, which go hand in hand. Observations I made after following the lesson plan that I had written indicate some of the difficulties and challenges which were faced when working with the class.

Typing Format

Objective: The students will observe and practice how to develop standard typing formats for their work. This will include spacing between words, between sentences, proper punctuation, and margins.

Procedure: Students will observe a demonstration (using the Data Show) of proper typing format. They will then have the opportunity to edit a previous piece of work, or write something new, and edit that piece.

Observations: Students appear to have difficulty seeing the difference between one and two spaces after a sentence etc. When it is pointed out to the student, they will change it, but they tend to make the same type of mistake shortly thereafter.

A person feels a bit like a broken record when you go through the same dialogue time after time.

I wonder if more time on the computer would make a big difference in this area - though I kind of doubt it because many of the older students have the same difficulty.

How does one instill a certain degree of pride and concern for doing a good job of an assignment? So many students don't seem to be bothered by a sloppy or poorly completed assignment. There are some who definitely do take more care on an assignment when it is on the computer than pencil/paper, in particular those with poor handwriting skills.

Still having difficulty with system crashes. There is still some instability in the program which causes numerous crashes, resulting in work needing to be redone.

Many students are still having difficulty remembering where to save their work. When the time is up many are in a hurry to log off, and are saving their files on the Workstation disk or another equally wonderful place and then not knowing why they cannot find their work the next time they go on.

I don't think the students really understand the different components of the KB program, because they often call up the wrong part of the program when looking for their files.

It is often difficult for two adults in the class to keep up with the questions and problems of kids on 16 computers. What can be done to make this easier? Is the problem the program, the learning the process, or a combination of these or other factors?
(B.W. April, 1993)

Lee's response to these questions was that she believed that the problems experienced in the classroom were a result of a combination of the difficulties with the software program as well as incorporating the learning process while specifically using the computers in the classroom. She felt that using the computers with students would be made easier if she was able to use a software program which contained no errors and ran more smoothly. She also believed that more student time on the computers, more teacher support, and adequate inservice training to update knowledge were essential. (L.S. April 1993)

Lee confirmed my concerns about adequate time for teachers to become familiar with the program and the teaching of typing skills. She responded with "When does the teacher have time to learn all the ins and outs of the program, and if the teacher never took

typing as a student, what help can he/she give the students in terms of proper formatting? Who helps the teacher and when?" (August 1993) She also offered the following insight. "Others (other teachers in the Division) may not feel that keyboarding is important. There may be no keyboard in the future, it may work by voice activation. However, until then, what is important?" (August 1993) Lee had come to the conclusion that the teaching of keyboarding skills was an important issue for her.

As one reads through the lesson plan it becomes clear that the issue is not as simplistic as just teaching the keyboarding skills once and then being able to assume that they are committed to memory and be used systematically. Whereas the objective of the lesson was to teach formatting components, many other issues came into play.

The issue of an elementary teacher teaching keyboarding will need to be considered by people throughout the educational process. Typing, which has been a option at the Grade Ten level, is now being dabbled with at lower grade levels out of necessity. What types of habits a person learns may or may not be habits which are conducive to rapid typing and keyboarding. Typing is a specialized skill which is now being required at a lower level than before. Lee does not have any formal training to teach keyboarding skills, but feels that she has to attend to the issue in some way because her students need some basics in order to function within the context of her class and the assignments which she wants to give. What ramifications that has for student learning in future years has yet to be determined.

The Influence Of Classroom Composition On Computer Learning

Although the guiding questions of the study deal primarily with concerns directly related to computers, it became clear to both Lee and I that the combination of students in Lee's class was a consideration when attempting to integrate computers into the classroom. The combination of students had a definite bearing on how class time could be structured.

As previously outlined, Lee had a class of between twenty-two and twenty-three students during the school year. There were continual additions and deletions to Lee's register throughout the year. Lee did not complete the school year with many of the students she began with. The students who represented the numbers brought with them a variety of skills and challenges. Lee described her class in the following way:

The numbers in my classroom changed throughout the year. The interesting part is that they were not the same students the entire year. This brought with it many challenges. Most of the students transferred in from other Divisions and so therefore had never used the K. B. program, and most had never used a Macintosh computer. If they had used anything it was an IBM. This meant that every time a new student came in I had to start at the beginning with them, and that often slowed the entire class down because they required my attention.

I had a few other students that made things interesting!

Sam: - Behaviour problem, volatile behavior
- Had frequent outbursts-was physical- hitting, throwing articles like chairs, desks as well as what ever he could get his hands on.

- Academic - low average.
- Often missed class (computer and otherwise) because he was in 'time out' from recess or misbehaving during class time. As a result he often didn't know what was going on.

George: - Low academic, 2-3 years below grade level in all areas.

- Behaviour was volatile - would throw things when something didn't suit him.
- Got frustrated using the computers - he hadn't used them before coming to our school, so he didn't know where the keys were, he needed keyboarding skills.
- Couldn't focus in on the listening part even though the information was projected onto the overhead screen by the Data Show. He experienced difficulty transferring what was on the screen to what he was doing. The pace was too fast for his learning style.

Ryan: - Really bright

- Never used computers before so he had no keyboarding skills. He had problems finding the letters, and that was very frustrating for him.
- When he was frustrated he took a "I don't want to do this anymore" attitude. He didn't want to attempt a task that he had difficulty perfecting.
- Things had to come easily - he didn't like to figure things out.
- Spent more time looking around the room than he did working on his assignments.

These students took up so much of my time. They would get frustrated and then they got into arguments. As a result they were asked to leave the room. This type of disruption caused the continuity to disappear. The others had to wait. They always had to wait for these students to settle down, and so they didn't benefit as much. The days when those students weren't there things were better, and ran more smoothly.

There were also many positive students in my room.

Susan: Had taken a computer class through the Challenge program, so she knew how to do a lot already. She even practiced her keyboarding on her typewriter at home.

Colin: He had a computer at home, so he already knew a lot and was able to help others. He could help in general terms but when it come down to using our system, he had to learn it. He was the one who liked to work on Superpaint even when it was inappropriate to do so because of the limitations of not being able to adequately write text in that format.

The rest of my class was somewhere in the middle.

(L.S. July, 1993)

The composition of a class for a given year will have an effect on what and how material is covered by the classroom teacher. Lee had three particularly volatile students in her classroom which had an effect on her as well as the other students in the class. On the other end of the spectrum, the stronger students were able to help others when they ran into difficulty.

The three problematic students in the class needed to be assisted more than the other students. They were all new students to the school and had no previous, or very little computer experience. Their behavior in class disrupted other students and myself. Therefore, continuity in the class was lacking. (L.S. July, 1993)

Even with two adults present in the Macintosh Lab, it was difficult to assist individual students quickly enough to prevent them from simply sitting and waiting during a computer class. The following observations were made after a "typical" class in the lab.

The students were working on a variety of things. Some were working at the tables doing assignments in other subjects not requiring computers, others were at the computer trying to finish their "How To Do -----" speeches on the computer. They were working at several stages, both writing and editing.

I assisted several students who were working on their speeches. I was impressed by the quality of the content in some of the speeches. Many kids still have difficulty remembering the details of how to edit, ie: "How many spaces after a period?" I helped them organize the content of their speech into sequential order so that it wasn't one mass of 'run on' writing.
(B.W. April, 1993)

The students' close physical proximity to each other can sometimes be distracting for those who would rather be doing something else than attending to their work. The layout of the lab doesn't leave a teacher many alternatives except moving a student to another computer station if there was room, or asking them to leave the lab.

It is difficult for a teacher to deal with the many demands during a class such as that. Everyone is at a different place, and if someone has difficulty, they have to wait until someone can get to them. Also, the editing process is slow, though it is better than doing it with a pencil and paper, because the corrections are done immediately and neatly.

(B.W. May 14, 1993)

The combination of personalities of the students in any given classroom has an effect on the amount of material covered, as well as how the material is presented. When Lee reflected on what she had done with her students over the year she commented on what another class had done using the computers.

One thing that another class did that was really good. They made a book. They typed the sentences, printed them and then cut them out. They glued the sentences onto the page and then did the graphics. So in some ways they did more things. That class of kids was easy to teach. Classroom makeup makes a

difference. I had kids that transferred in and out. I also had students who were behaviour problems. The lack of computer knowledge was an issue.
(L.S. July, 1993)

Time Restraints and Lesson Planning Incorporating the Computers

During the initial interview, Lee commented on what she considered when planning lessons where the computers would be used:

It's (planning the lessons) like looking at an assignment in a different way, the old way being pencil/paper to complete the finished product. Now I give much the same assignment, and the students use the computer from the beginning to the finished product. I must allow them enough time to do the assignment. I have to make some decisions, such as "Do the students know how to type well enough to complete the task within the prescribed amount of time?" I have to allow time for the students to do the assignments. I have to give 3-4 classes. On the last assignment, my computers were always busy, so we used computers in two other classes as well because I was not sure how many would finish on time. They (the students) surprised me. Most handed it in, and I only had to send one person to the Lab to finish.

(L.S. January, 1993)

Lee liked what the computer could do for the students in terms of neatness and also something that they were keen to work on, so they were more inclined to complete an assignment on time.

At the conclusion of the study Lee was asked if there were any further considerations which should be included when planning lessons for computer use. She drew the following conclusions:

The students do need the time to complete their assignments on the computer. They have to do the typing and that takes time. The question really is, "What does a teacher delete from the curriculum in order to accommodate the time spent on the computers? It is not always the students who have finished their work who need to go on the computers. Often it is the students who are slower in completing their regular school work who are also slower on the computer. It would be great if a person could convince the students to do the necessary work on the computer at school, and take their other work as homework. The students who have a lot of motivation would be more willing to do that. (L.S. September, 1993)

Completing assignments using the computer is not as simplistic as just modifying the lesson content. A teacher must also attend to the difficulty of getting the task completed.

Mechanical Concerns: Hardware and Software

Teaching by its very nature brings the challenges of working with many students at many different levels of progress. When a teacher includes the use of the computer, the dynamics of classroom instruction increase. During our first discussion, the topic of hardware and software arose as an issue.

As soon as we had talked about the study, we began discussing a problem that she (Lee) had during her last computer class. The Data Show didn't 'want to' work properly again and the students were having trouble saving their work in the correct file. We discussed the possibilities of what might have gone wrong. (B.W. January 12, 1993)

During the first week of the study we ran into difficulty with the program.

We ran into a problem with the K.B. program during the past week. One of the students had a three page Draft Writer document and it would only print the first page. We couldn't get it to print. We were not sure why it would print some multiple page documents and not others. Lee was frustrated with the whole program. Around midnight I thought of a possible solution which did end up working. It meant creating a new document and putting the page that wouldn't print in there and then printing from the new document, a bit of a problem, but at least it printed.

I had a student with a similar problem this week. In her case it would print three of four pages. We did the same thing. We dumped the fourth page into a new file and printed from there.

(B.W. January 23, 1993)

Difficulty with the software program slows down the work of the student and demands the time of the teacher. Fortunately a workable solution could be found or the students' would have had to redo work they had already done. The teacher has to make a decision about how long to spend working on a solution for the problem during class time, as well as what to tell the student whose work wouldn't print. The student is concerned because the work has already been done, but they are unable to retrieve some of it in print form. No one was that keen about redoing a portion of an assignment which had already been completed.

When I reflected on what I had written about finding solutions to problems at midnight, I realized that I carry many of the unanswered questions of the day with me when I leave the school. A

question will follow me around, and I will contemplate possible solutions, or ask new questions about the same issue. Teaching is not a nine to five job for me. What I do in the classroom goes with me as I try to 'think ahead' and attempt to learn from past experiences and be better prepared for 'the next time'. As Schon (1983) states, "In the real world practice, problems do not present themselves to the practitioners as givens. They must be constructed from materials of problem situations which are puzzling, troubling, and uncertain (p. 40). Another thing that occurred was that when I encountered the problem with the printing for the second time, I was able to use the knowledge gained from the previous situation and apply it to the situation at hand. The "lens" through which I saw the situation had changed, a cycle of reflection had occurred and the knowledge gained could now be applied to another situation.

Lee and I worked together teaching her students on the computer. One issue that we had to deal with continually was that of difficulty with either the program or the mechanical supports. My journal entry of April 23, 1993 provides a glimpse of some of the issues at that time.

I taught the second class using Writing Organizer and the Concept Map today. It still takes so long to log the entire lab onto the network. It is difficult - not all the students follow directions at the same time. Even with the Data Show, it is helpful, but it doesn't account for stragglers. We reviewed some of the tools and the idea behind the Concept Map. They were given an example and then the assignment was to create a Concept Map of their own which they would save at the end of class and then finish another time.

When it came time to 'Save' and 'Log Off', two groups of students didn't follow directions and lost their Concept Map. The instructions were to pull the 'File' menu down and go to 'Save'. When looking for the appropriate place to 'Save', click the 'Drive' button of the screen. Continue to click the 'Drive' button until you arrive at the school icon. Search for the name of the classroom teacher in the list that is on the screen and open that file. Then, locate the file number which is the same as the number the individual used to 'Log On' to the machine. Somewhere in that process the two groups of students did not follow directions and closed the program without pulling down to 'Save'. As a result, the program closed without saving their document, and they will have to start over again.

(B.W. April 23, 1993)

The difficulties experienced by students while attempting to function with the computers raises several potential problems for the classroom teacher. There are still students having difficulty logging on to the network which slows down the start of the class because the teacher is often called upon to assist. When everyone in the class is logging off and saving their material, it is impossible for one person to ensure that everyone is following the correct procedure. Unfortunately the process is very unforgiving in the sense that once the material has been saved in an inappropriate place, or not saved at all, it is very difficult, if not impossible to retrieve. Searching for lost documents also takes up a lot of time. Students are usually very willing to help a classmate, providing that they do not get behind themselves, but the students do not necessarily understand where to look for misplaced files either. The teacher is somewhat limited in the situation as well. The hardware and software limit the choices that the teacher's can make, in the sense that they must remain within the constraints of the program.

Unless the software program is changed at the Divisional level, the classroom teacher must learn to deal with the imposed limitations and subsequent frustrations.

Problems with the software program were not the only difficulties experienced on a regular basis. The comments made after a class in the Macintosh Lab on May 21, 1993 provides a glimpse of what a 'typical' class could be like:

Had an interesting class to end a Friday afternoon. There were Start Up discs missing from a number of the machines again. I had to send several students to get Start Up discs from both their classroom and another room.

Some students still haven't figured out where they are going in the program - on one hand you can't blame them because it is so complex, on the other - it's frustrating because the majority know what they're doing. A few are still saving' who knows where, because their files are impossible to locate the next time.

We experienced a major disruption when the majority of the machines displayed a 'collision' or a 'bomb' message on the screen. Couldn't bring the program back from either message so everyone ended up having to restart right from the beginning with having to log on again. We lost a good 10 minutes (of a forty minute class) and it really set the students off. It did a great job of breaking their concentration. (B.W. May 21, 1993)

Lee and I agreed that there is no one issue that can be singled out as the major difficulty in teaching with computers. It is the culmination of many smaller problems and situations which build up to the point of being a larger problem. Lee summarized the situation in the following way; "There is no single issue that can be singled out because many small problems create havoc with having computers in the classroom. Issues range from hardware problems,

operation problems and the software itself." (October 1993)

Excerpts from Lee's journal during the last two months of the school year indicate that even though she personally had a much better understanding of the computer and the program there were many outside issues that had to be contended with on a regular basis:

Lab was occupied by a class doing art. It was disruptive and non - conducive to teaching 'computer'. Also, the overhead bulb on the 'Data Show' was burnt out. The typing program has been unuseable for a month now. Therefore, students are unable to learn more typing skills.

(L.S. May 5, 1993)

Network down and students unable to work on assignments.

(L.S. May 13, 1993)

Network problems and student computers all crashed.

Files/heaps colliding.

(L.S. May 21, 1993)

I got extra lab time to make up for lost classes. Only one period was available. Unfortunately one computer has been missing from the lab for quite some time leaving two people without a computer. I had to make alternate arrangements for them which were inconvenient.

(L.S. June 9, 1993)

Double period! Worked on multicultural story; finished product. Showed class : Title (how to), Underline, Bold type, Change size of story print to enhance presentation. Class liked the idea of doing that to enhance the presentation of their stories.

One computer was down, inconvenient. One computer would not print in the lab and the location on the 'Chooser' wouldn't change. I had to ask a teacher if the story could be printed in her class.

(L.S. June 14, 1993)

Had a double period. Two computers were malfunctioning. One was due to appropriate icon not showing up on the screen. The other, one of the plugs at the back was incorrectly connected.

I fixed one and we got a different Start Up disc for the other.
All this was done with a delay in class time at the computers.
(L.S. June 22, 1993)

The journal excerpts are an indication of some of the difficulties experienced by one classroom teacher on a regular basis. The use of the computer lab by another class, a typing program that didn't want to work, difficulties with the network as well as the computers themselves, presented many challenges for Lee. None of the problems are insurmountable, particularly in isolation. It is the combination of these difficulties combined with the everyday and all day routine of managing a classroom which become compounded and create the challenges of integrating the computers into the classroom.

The Saga Of The Cords

Difficulties with the software were not the only trials that Lee experienced. Trouble with the mechanics of running the computers also came into play. The following example is typical of the type of difficulties which could be experienced by a classroom teacher on a regular basis, and which Lee herself experienced.

The Saga Of The Cords

Many of the computers in the Lab suddenly bombed during the Lab time resulting in many assignments being lost, and creating the need to 'reboot' many of the machines 'manually'. (A manual restarting of the computer means breaking the power supply to the computer by pressing a 'reset' button on the side of the machine, and holding the button down for 10

seconds. This means that when the button is released, the computer returns to a 'Log On' position, and the student has to start over by 'logging on' again.)

This problem had occurred several times in quite a close time frame, which made us ask ourselves how and why these crashes were occurring. The interesting thing was while the majority of the machines were crashing there were a few which seemed to appear to remain stable, at least for a longer period of time.

We finally discovered that the cords on the machines at the back of the lab were swinging quite loosely at the side or underneath the table which the computer was on. As students swung their feet they accidentally kicking the cord, resulting in the connection to the main server to be interrupted, which was enough to cause a large number of machines to crash (often about 14 machines).

Lee went to the teacher in charge of the computer hardware and explained the problem which was occurring. She received a response much to the effect of 'too bad, but nothing is going to be done about it'. Lee and I had a discussion about the problem and decided that it was probably not that difficult a situation to rectify. We decided to locate some duct tape and tape the cords down ourselves. As luck would have it there was no duct tape in the school, so it took a few extra days before the cords could be taped down. After the cords were taped down, the problem was basically eliminated. Now why should such a simple solution take that much time and effort to correct? What if the teacher got 'put off' after bringing the problem to the one teacher and took it no further? She would have had to continue to deal with machines crashing during class time. (B.W. March, 1993)

This saga continued for approximately a two - week time period, during which numerous thoughts, comments and ideas were shared. Because no one else (including the person technically 'in charge' of the Lab) was prepared to assist with the situation, the two teachers involved took the matter into their own hands and found a solution to the situation as they saw fit. Lee elaborated:

This was another example of how a problem creates difficulties for teachers. It seemed that there was no ownership for duties relating to the computers, the hardware and their operation. Even the technical person in charge of the computers did not feel it was his role to repair the problem, even though it was minor. Personality entered the picture as well. The technical person did not believe that enough release time was made available to sufficiently maintain the system.
(L.S. October, 1993)

There are several reasons why this type of crash is very disruptive. Whatever work the students had done since the last time they "saved" would be lost. This upsets the students, and if there is a timeline on the assignment, places the student further behind. The entire class gets disrupted because many have lost their work and need to restart their machines, and those who still have their work are concerned about everyone else and lose their concentration as well. Manually restarting the machines means that each student must log on to the network again. It takes between seven and ten minutes for a class to log on to the network due to the complexity of the program being used and the speed that the server can process all the information. If this type of situation occurs during a thirty-five minute class, which it did on several occasions, a large percentage of the teaching or work time is lost.

This problem was solved and rectified as a result of continued dialogue between Lee and I. Neither was about to let the problem continue without trying to determine what it really was, and how to solve it. Once the problem was identified, both of us continued to work at it until something was done rather than accept "no" or "lack of interest" as an answer. To Lee and I it was a very real problem.

It wreaked havoc with the teaching and work which was occurring during the class period, and increased the frustration level of both the teachers and the students.

Several concerns arose during the study and have been explored in depth earlier in this chapter. These include keyboarding skills of students, the classroom's composition, as well as mechanical considerations when using both the hardware and software.

Lee was very concerned that her students learned some basic keyboarding skills as part of their computer skills. She went to tremendous effort to try to ensure that her class had the opportunity for keyboarding practice at the beginning of each class. She never anticipated the difficulties she experienced with program incompatibility because the computers were on two different systems. The incompatibility of the computers with the two programs made the teaching of keyboarding skills ineffective and virtually impossible. What began as a real issue and concern to Lee remained a very real and most challenging (and vexing) problem for her throughout the duration of the study regardless of the numerous attempts at and steps made to rectify and improve the situation.

Thus, it is important to note that these concerns which were each identified and interpreted in the text simply highlight the major areas of concern. Within each area there were many problems, using Schon's terms, which were "named and framed" and to a greater or lesser extent resolved, leading to another cycle or spiral of reflectivity. Once identified, the current concerns or issues seemed no more important to Lee and I than the recognition, or metacognition that these cycles or spirals of reflectivity of

continually emerging problems had to be thought about and acted upon as best as we knew how. At the same time, the problems could be placed in the larger context of Lee's narrative of experience, which when trying to use the computers in the classroom resulted in a great deal of frustration.

Influence Of Inservice Strategies and Supports On Exploration and Experimentation

The influence of inservice strategies and supports on Lee's exploration and experimentation with different possibilities of computer integration has already been included in a series of "stories" earlier in this chapter. Together, these "stories" provide a narrative context which helps provide the framework for how Lee views herself and her teaching.

Lee has experienced a history of sporadic support in her attempt to integrate computers into the classroom. When computers were first introduced into the school, Lee took the initiative and got some formal training. (p 73) When the Macintosh computers were introduced, Lee received some formal training which was a beginning, but it did not prove to be adequate. Lee stated: "After training I still felt incompetent. It was not a good experience. The computers kept crashing. The screen would go blank and the software program wouldn't work. I felt so frustrated." (p. 79)

Barnes (Russel and Munby, 1992) attributes the following to Olson (1982): "Whatever 'dilemma's' are of first concern to teachers will strongly constrain their ability to act upon injunctions from

other people to change what they do in the classroom (p.10)". Clearly after a variety of courses and half day computer inservice sessions of various kinds (elaborated on earlier in the chapter) Lee still felt that she did not have enough information and experience to be successful using the computer herself, never mind with a class of students. Basic understanding of both the hardware and the software was not at a level where she felt she could use the technology without assistance. The rotation between two grades in alternating years also placed Lee at disadvantage. Trying to relearn the software program as well as remember the workings of the computer was a real challenge.

When asked what she would envision as necessary supports for teachers wanting to integrate computers into their classrooms, Lee had several ideas.

Inservices on how to use the computer as well as the program. Could be done on Microsoft to learn the mechanics of the computer. It would be helpful to go to a workshop. They should be offered periodically, like September, or near the end of the school year so a person is set up for the next year.

They (the workshops) should be offered throughout the year.

The first one should be a day, with another after Christmas; might have 3 - 4 half day sessions per year.

In between, there should be someone on staff to help. There should be enough people to ask for help. Some will catch on faster or have more interest, like if they have their own computer at home.

Ideal: To have enough computers in the lab so that everyone in the class could have their own machine. This wouldn't be as

frustrating. On the other hand, when a student runs into problems, sometimes the other person can help.

The idea of a support teacher is a good idea.

The Day Two's when you come in as a support teacher are a bonus. Now some have progressed with Typing Tutor IV.

(L. S. June, 1993)

What sort of support would be helpful to a classroom teacher who is attempting to become comfortable with both the computer and a particular software program while still maintaining a regular classroom routine and program?

Support Strands

Lee and I agreed that the areas where she believed support could be given to teachers could be classified into the following components:

1. The School Division should provide some basic training on a systematic and ongoing basis. These workshops should be progressive and easily accessible to teachers. Fulton (88) identifies some of the supports that are necessary for successful computer integration to occur.

Obviously equipment is critical. While it is possible to run an inservice session on a new reading or mathematics technique in a traditional classroom, teaching teachers to use a word processing or gradebook program requires a computer, preferably one per teacher. Furthermore, teachers can apply what they have learned in an inservice session only if they have access to the technology once the training has been completed. (p.34)

2. There should be someone readily available to assist a teacher who has a question about either the hardware or software. This person or persons has to be someone who is knowledgeable in the workings of the computer and the software program. The same person must also be prepared to discuss ways in which regular lessons can be adapted for use with the computer. When Lee taught a lesson incorporating the use of computers she had to factor in things like the time necessary to log on to the network, students not being able to take the assignment home as homework, and teaching time for computer related components of the assignment like formatting and spacing of materials.

3. The "resource person" must be accessible to teachers when the teachers have a need, rather than only at recess, or before and after school. The needs could range from a question about the logistics of using the computer, difficulty with a component of the software program or wondering about how best to teach a particular concept. While there are often people on a school staff who have the knowledge and are willing to help others, they may not always be available to assist a teacher at a particular time. I was scheduled in to be in the lab with Lee's class on a regular basis. This allowed for team teaching, as well as the modelling of lessons, for example the lesson on editing, so that the other person had the opportunity to observe a possible method of teaching a particular program component or lesson idea. Again Fulton ('88) underlines the importance of teacher support.

There are a number of critical factors that underlie whether or not a teacher adopts technology. These include: having a strong practice or "hands on" component of training sessions, having classes taught by credible sources (most notably other teachers), adapting to the teachers' level of computer competence, and focusing on applications which the teacher can customize or adapt to his or her specialized teaching situation. The most crucial factors are time and support - allowing plenty of time and support both in class and afterward too. (p.34)

The continual working together provided Lee and myself with the opportunity to become more comfortable with each other and therefore be willing to ask more questions and possibly risk making a mistake or trying a particular method or idea so it could be observed by the other and then discussed for further learning. This was our reflection, our collaboration and in the end, added to each of our narratives of experience and of school reform. The integration of computers, like changes in other curricular areas take time and energy to see any results. It is not a rapid process because it requires a teacher to examine and review what he/she has been doing and then make a decision about whether or not a change in practice is necessary.

Both Lee and myself were able to reflect on what was happening in the class, and as we became more comfortable and confident with each other, were able to express areas where we had questions and difficulties. It became easier for both of us to ask questions about something that we thought should be obvious; for example, "Why does the type keep going off the screen rather than returning to the margin?" Through dialogue, exploration and experimentation we were able to discover that the margin had to be

set in such a way that the text did not continue off the screen by activating a command called "Wrap To Window". Neither of us thought that setting the type text would take several days and a considerable amount of time talking and experimenting with the computers.

In order to interact on more than a surface level both of us had to feel assured that our questions, comments and sometimes lack of understanding would be treated with respect and genuine concern. We came to feel at ease asking the other person for their ideas and input, and knew that no problem was "too small".

Exploration and experimentation as outlined in the second question were a component of every class where Lee used computers with her students. Since this was the first time that Lee had actively used computers with an entire class, she had many decisions to make. For example, she had to decide on how to modify a lesson when considering the amount of time available on the computer, how well the students knew the various components of the program, and how well students would be able to transfer typing skills from practice to use with assignments. This type of continual revision of teacher expectation in regard to time lines and lesson content forced Lee to break each lesson down into smaller frames, where a number of smaller components were put together to create a larger picture. The use of the computers demanded that lessons be thought out and presented in smaller segments than many of the lessons which did not integrate computers because there were more variables such as 'Saving' and the difficulties with keyboarding that had to be specifically attended to.

Lee agrees that she gained the most skill and confidence when there was personal contact with other individuals in the school who could provide support and assistance. The interpersonal relationships with other staff members were an important component in Lee's growth as a person and as a teacher. The mutual support network which was built between Lee and other staff members made it possible for experimentation and exploration to occur in the classroom. Whereas Lee had previously relied on other people to assist her as she attempted to use computers in the classroom, she eventually began to take on a leadership role by sharing ideas and expertise with other teachers. Lee began dialoguing with other teachers about specific problems when she heard them discussed, be that in the hallway or staff room. Thus, Lee's past experiences and images for the future is connected into a kind of narrative unity which has placed much value on this type of personalized support in the past and sees it as important for her future growth.

Barnes, (in Russell, T. & Munby, H.) draws from Fullan (1982) and Lacey (1977) in supporting how Lee and I saw our work.

The professional element in school control reminds us how important support from other teachers is: when change is in question, a supportive anecdote from another practitioner carries more weight than the opinions of any university professor, local authority advisor or curriculum consultant. The possibility of substantial change in the subculture of teaching depends upon the mutual trust that can be developed in a professionally controlled institution (p. 23).

Lee, the teacher - participant and I, the teacher - researcher continue to attempt to meet the needs of computer education and continue to run into a variety of difficulties as this study comes to a conclusion. As an example, the school has recently purchased the site licence for the key - boarding program called "All The Right Type". The program has been installed on the network, and is running on the Macintosh computers used by the Grades Four through Six students. Lee is presently teaching Grade Three, which means she does not have access to the Macintosh computers this year. We are trying to get the program copied to be used on the Apple computers used in Grade Three, and are running into problems such as a broken copy program, obtaining the necessary materials, and getting time to copy the programs so there will be a class set. (November 1993) While much has changed, this is a "familiar" problem. Nevertheless, such frustrations continue to be alleviated in large measure by their familiarity and by the interpersonal relationships which Lee and I enjoy.

Collaborative Meaning - Making

The question of collaborative meaning - making "What reconstructions of meaning do the teacher - participant and the teacher - researcher make in the context of their collaborative inquiry into the use of computers?" is not easy to define in a clear way. Rather than a number of well defined "reconstructions", I believe that this process is more cyclical in nature. When a "problem" would arise, either Lee or I would begin thinking about the

implications. As was illustrated by "The Saga Of The Cords", the continual dialogue between us, and the eventual action that was taken demanded that the situation be dealt with over a period of time, rather than an instant solution. We would then discuss the 'problem,' make some adjustments, rethink, discuss, take action, and the spiral would continue. This "spiral of learning" continued, though did not necessarily result in firm and final decisions being made on each problem issue. It did lead to problem solving, and practical knowledge being generated. Also, new "frames" through which to better understand a situation were created. The new frames allowed new insight for thought, dialogue and action to be added. Schon (1983) would view this type of process in the following way:

In reflective conversation, the practitioner's efforts to solve the reframed problem yields new discoveries which call for new reflection-in-action. The process spirals through stages of appreciation, action, and reappreciation. The unique and uncertain situation comes to be understood through the attempt to change it, and changed through the attempt to understand it (p.132.).

Connelly and Clandinin (1989) state the same issue in different words. A person must have:

. . . an understanding of the process as one in which we are continually trying to give an account of the multiple levels (which are temporally continuous and socially interactive) at which the inquiry proceeds. The central task is evident when it is grasped that a person is both living their stories in an ongoing experiential text and telling their stories in words as they reflect upon life and explain themselves to others (p.7).

An example of a "continual process" is the pattern of constant frustration experienced when working with the computers. As soon as one problem was discussed, thought about, and dealt with, a different problem would arise. Lee (and I) added greatly to our personal practical knowledge bases, important dimensions of which have been documented earlier in this chapter. The result is a new perspective and more experience with which to address future problems - vexing as we expect them to be. The "new perspective" provides a lens through which we can process issues as they occur, and view them as smaller segments to be dealt with rather than an overwhelming situation. This historical pattern as exemplified in this chapter, gives an indication that the future will continue in much the same fashion. Connelly and Clandinin (1987) would refer to this "looking ahead" as an image of what is to come. Lee agrees that it is important to receive support in an ongoing way in order for a teacher to increase her skill and comfort level with the computers. The very nature of computer technology combined with students is, to us, a guarantee of continued challenges and difficulties.

The narrative component brought by the perspective of Connelly and Clandinin allowed validity and meaning to be given to the broader story of a classroom teacher as she experienced professional life and reflected on it. This type of "narrative unity" or meaning - making account, merges a past perspective with present understanding which then forms the basis for examining and making "future" oriented decisions. The theoretical framework provided by both Schon and Connelly and Clandinin provided a conceptual lens through which to focus on current and previous

events including ideas, intentions and general meaning - making which was occurring. The Schonian concept of naming and framing and problem solving, allowed both the teacher - researcher and the teacher - participant to identify, define, think about, and take action on the many challenges which emerged. This resulted in a spiral of problem solving occurring on a continuous basis, as there were always issues to be dealt with.

The fact that there were two people identifying with and trying to find solutions to particular situations allowed validity to be given to the concerns and the needs of the classroom teacher could be met in a supportive and collaborative manner. This format falls in line with the outline MacKinnon (1989) gives for "Joint Experimentation". In Joint Experimentation both participants take turns problem setting and reframing rather than only the "supervisor" (p. 193). This is consistent with what occurred between Lee and myself during the course of the study. We took turns identifying problems and discussing potential solutions.

The narrative framework allowed licence for the identified issues to be dealt within the context of past experience, rather than isolated incidents. As the "story" unfolded, the teacher - participant and teacher - researcher began to see common and repeated issues emerging. This allowed for some proactive, rather than only reactive planning to be done with the lessons for the students. This also allowed the teacher - participant the opportunity to be more prepared for possible difficulties, and make adjustments to the format of the class, or the required task to lessen the potential for difficulty. This would include strategies like teaching the lessons

in smaller segments and "buddying up" the students so that they could provide support for each other. Both the teacher - researcher and the teacher - participant experienced a process of change which incorporated more systematic and deliberate decision making in the sense that both had a better understanding of what the potential difficulties could possibly be, and some strategies to deal with them.

The support that Lee and I were able to give each other has increased both of our confidence levels when working with computers. This confidence has allowed Lee to experiment with more complex parts of the software program like the Writing Organizer and a variety of lesson plans with her students. These lesson plans included the components of the "Writing Organizer" such as the "Concept Map", "Outliner" and "Notebook". Each component required the students to have an increased understanding of how the software program worked in order for them to move from one "page" to another and remember on what "page" they had done a particular segment of the assignment. She has also been able to provide support for other teachers who have experienced difficulty with the computers, by listening to them and assisting them in problem - solving. She has become more comfortable and aware of the numerous decisions that one must make when incorporating computers. There are many teaching decisions that must be made, which are not always in the control of the teacher, but rather are embedded in the very nature of the hardware and software being used. For example, Lee did not have a choice in whether or not her students learned how to log on to the network. If her students were

going to use the computers, she had to find an effective way to guide them through a complex process, so they would meet with success. While the Division goals and vision about the use of computers is ever changing and expanding to include things like multi - school communication and an integration of business partnerships, I believe that Lee and I have begun the process of incorporating computers into the classroom in an effective manner.

The research process has resulted in personal growth for me. The opportunity to work closely with a colleague on a specific project has provided me with the opportunity to reflect on the many challenges facing the classroom teacher on a regular basis. I had never taken the time to individualize and synthesize the many factors and issues that must be accounted for by the classroom teacher on any given school day. Until I undertook the research I did not have any conceptual framework through which to filter the events in the classroom. Douglas Barnes (1992) gives credit to the frameworks which are used in the classroom.

The interpretive frameworks that guide teachers' choices of teaching strategies are not inferior to those of curriculum developers or administrators, but represent responses to different concerns and priorities. The possibility of principled change in teaching strategies and therefore in what is learnt by students, depends upon teachers' frames (p. 15).

The lens outlined by Barnes, provides the skeleton on which the work of Donald Schon and Connelly and Clandinin can be framed. "To describe the frames as 'teachers' knowledge' is potentially misleading, unless 'knowledge' is seen as value - laden and dynamic."

(p. 16) The structure and framework set out by Schon and Connelly and Clandinin have provided me with the language to think and write more clearly and confidently about events that occur within the context of classroom life.

Chapter Five

Conclusions, Methodological Issues and Implications

Objectives and Questions

The purpose of this study was to 1) examine the challenges encountered by one teacher when trying to integrate computer technology into the classroom, and 2) determine which inservice strategies or teacher supports best facilitated effective change with integrating computers into the classroom. Three questions were posed for investigation:

- 1) What concerns or issues arise when a teacher plans for and tries to implement computer technology into the classroom?
- 2) How do inservice strategies or supports influence the classroom teacher in her exploration and experimentation with different possibilities of computer integration?
- 3) What reconstructions of meaning do the teacher - participant and the teacher - researcher make in the context of their collaborative inquiry into the use of computers?

In order to study these questions, a teacher - researcher and a teacher - participant collaborated together over the length of the study. The complete analysis of the research findings can be found in Chapter Four.

Conclusions:

The study revealed that there were numerous challenges which arose and had to be dealt with by the teacher - participant. Lee had to deal with issues such as hardware and software difficulties, lack of computer skills on the part of the student, and difficulties which grew out of the composition of the classroom. The continual dialogue between Lee and myself allowed for collaborative problem - solving and mutual learning.

The "Schonian" perspective on reflectivity including the "naming" and "framing" of problems allowed reflection and dialogue to occur, and a "spiral of learning" developed which facilitated growth in both people. In the Schonian sense, the various problems surrounding the key - boarding program continues to be the "Problem of the Day". In a broader sense, Lee and I agree that even though we have conquered many problems as they relate to computers, the problems will continue though our past experiences give us a resource to draw on as we encounter and even anticipate future issues and our response to them. The exploration and experimentation which we have done thus far provides us with a solid experiential base to deal with upcoming situations.

The Literature supports many of the findings of the study. Lee spoke about the frustration and inadequacy she felt after participating in a few isolated inservice sessions. A number of researchers agree that "one - shot" inservices with no follow - up have proven to be ineffective in effecting change. (Ellis, 1990; Hord & Austin, 1986; Burkholder, 1987; Fulton, 1988; Cohen & Brawer,

1986; Akker, Keursten & Plomp, 1988; Sachs & Logan, 1984) Lee felt that there was very little carry over between the isolated sessions and her attempts to work with the computers at school. She believed that so much information was disseminated so quickly at these sessions with little opportunity to "practice" what was being taught, little was gained from attending the sessions. It is possible that the isolated inservice sessions were more of a detriment than an asset because they served to heighten the anxiety already felt because computers were involved.

Numerous researchers (Payne, 1983; Wagschal, 1984, Fullan, 1982; Trainor & Fregosi, 1986; Hord & Austin, 1986; Akker, Keursten & Plomp, 1988) support the notion that in order to have a change in teacher practice, implementation of a program which has the goal of a change in practice, must occur over time and teachers must receive on - going, long term support. Consistent with these researchers' views, Lee felt that she was able to work through many of the difficult situations which grew out of the desire to integrate the computers because she received the necessary on - going support.

In regard to computer oriented problems, this study affirms that there is a need to provide personalized information which is specific to the need of the teacher at a given time. Providing information and support which is relevant to the teacher's need at a particular time may include additional "background" material like manuals and other forms or written documentation, assistance identifying problems and developing appropriate solutions, as well as "trouble shooting" with technical problems.

In order for effective change to occur on a personal level, validity must be given to what teachers have to say about a situation (Beattie 1991). Lee's opinions about appropriate documentation and manuals, selection of key - boarding programs, and changes to be made to the Macintosh lab are only a few of the areas where first hand experience should be considered in broader decision making, be that at the class, school, or division level. The use of a collaborative approach (Burrello & Orbaugh, 1982; Grimmett & Erickson, 1988) allows the voice of the teacher to be heard, and the actions of the teacher supported. The continual support, the "listening ear" and assistance in trouble - shooting which the teacher - participant and the teacher - researcher provided for each other allowed the spiral of learning to occur.

The reconstructions of meaning which occurred within the context of collaborative inquiry were continual and varied in nature. As previously discussed, meaning - making included how each of us came to approach teaching while integrating computers, problem - solving as well as an orientation for the future. Both of us learned to break down the multi - faceted components of the lesson plans, and became more systematic in our instruction. We now approach the use of computers in a more confident, less threatened way, which enables further exploration and experimentation. Both Lee and I have realized that using the computers with students in the classroom has limited the number of teacher choices that can be made. The hardware and software provide a structure and a framework which guide a teacher's choice of strategies. One must remain within the confines and limitations of the program. When we

teach, we give instructions in a positive way, though at the same time wondering whether or not the hardware and software are going to "deliver".

Methodological Issues

I believe that there was a benefit to incorporating the Schonian and narrative frameworks into the study. Both gave some structure and focus when looking at the events of practice and when trying to make sense of the situations. The Schonian framework outlined the conscious and unconscious processes that a person undergoes when grappling with an issue. This framework allowed for a situation to be viewed in the context of a series of events or frames, which is helpful to be because it gives the unfolding of events a pattern, which in this case was very cyclical in nature. The narrative framework provided the opportunity to reflect on issues in a broader sense, including the past, present, and potential future events. The combination of the two frameworks became the vehicle by which the story could unfold. The frameworks also gave me a lens through which I can now view the future. When I think about the integration of computers in the classroom I continue to see a continual cycle of specific situations which require solutions. Increased understanding about the complexity of both frameworks became more evident as the study progressed. I grew continually as I was forced to think about and make sense of, past and present events which occurred. The continual cycle of reflection and further questioning has caused me to "hear" things discussed in other

contexts within the narrative and Schonian perspectives. This new way of hearing has allowed me to continue my personal attempt at school reform, examining the issues which I deal with on a personal level, and try to effect change in others through dialogue and modelling. I believe that continued dialogue and working together with other professionals who encounter similar situations will be a vehicle whereby school reform can occur on a broader level.

Implications For Practice

This study has described a case which suggests the need for long - term support for a teacher who is trying to integrate computers into the classroom. It involved providing a resource person who had time to develop a relationship with the teacher she was working with. Teachers and others who read the case may see enough that is parallel to their own situations for "transferability" to occur. That is, by identifying with the teacher(s), the situations and/or interpretations described, they may be encouraged to gain new insight into their own situations and otherwise grow professionally by engaging in reflective practice similar to what is described here. Effective change in philosophy and methodology will be more successful if an individual teacher feels free to ask questions, reveal weaknesses, and develop long - term action plans of effective teaching strategies. (Akker, Keursten & Plomp, 1988). One scenario could include a resource person who would be free to work in a collaborative and consultative basis with teachers at several sites during the course of a school year. Once the teachers

have established a methodological comfort level, the resource person would be free to move on to a new site, while still maintaining continued contact and collaborative interaction with the previous group. Teachers could be provided with a support structure consisting of colleagues who could assist each other both formally and informally.

Teachers should be involved in determining the needs for the school. Barret (1983) proposed the use of local needs assessment as do several other researchers (Burrello & Orbaugh, 1982; Hord & Austin, 1986, Akker, Keursten & Plomp, 1988). Teachers need to be involved in facilitating school reform! Connelly and Clandinin (1989) refer to school reform in the context of reflecting on past, present and imagined future experiences, with the consequence of school reform which grows out of new meaning which results from the process. School reform can become a reality if we allow teachers to reflect on what they have done and where they have come from, and use that reflection as a basis for future decision making. The naming and framing of specific issues can lead to viewing the issue in the broader context of what implications arise as we encounter future situations.

Implications For Future Research

This study does indicate that there is a need to support classroom teachers in an ongoing way if a change in practice is to occur. Similar studies could be done to provide other richly - detailed cases and perhaps to what degree similarities in dealing

with difficult issues in regard to teaching with computers would occur. A more extensive study of this nature incorporating more teachers would also provide further opportunity for the voice of the classroom teacher, the "one in the trenches" to be heard. The move towards a more conscious level of "taking stock"; "Where have I been?" and "Where am I going?", would provide validity to the "voice" of the teacher. It may begin at a Schonian level of consciously keeping track of events, thoughts and actions, and grow into a broader perspective of where issues belong within the larger picture.

The examination of the "larger picture" integrates the narrative perspective which includes past present and future considerations. This process would provide an opportunity to generalize from practice to theory, rather than the more common pattern of theory being used to generalize to practice. Practice examined through a theoretical "lens" would give validity to practice, and assist in the process of school reform. There is then the possibility that issues can be dealt with and solved through the perceptions and visions of the local teachers.

Appendix A

Knowledge Builder Program

The Knowledge Builder software program is designed to incorporate thinking and writing strategies for use on the Macintosh computer. The program has four principal components:

1) Draftwriter 2) Writing Organizer 3) Publisher 4) Knowledge Base. Each component facilitates a particular aspect of the thinking and writing process.

The "Draftwriter" allows the writer to type drafts of text and revise them as necessary. The writer is limited to a small number of fonts, but does have the flexibility to change size, style, margins and "proofread" the text with a spelling program.

The "Writing Organizer" has several features in it including the "Notebook", "Concept Map", "Outliner", as well as memo making capabilities. The "Notebook" allows the writer to jot down ideas, key words, or thoughts which may be incorporated into later writing. The "Concept Map" allows for a mind map to be designed with appropriate connecting "flow" lines and headings. The "Concept Map" can be used as an organizational tool during later writing of text. The "Outliner" allows for the construction of a typed outline which can be as simplistic or complex as desired. The program is capable of having numerous subheadings and subpoints under any given section.

The "Publisher" component accepts text exported from "Draftwriter" or "Writing Organizer" and allows for graphics to be added to the text. It is quite difficult to edit typed text in this

component, so the text must be accurate when exported into the "Publisher". This component allows the writer to set up a page in which ever way is deemed most appropriate before final printing occurs.

The "Knowledge Base" is the place in the program where completed writing can be placed so that other learners can have access to the information. Since the computers in the schools where this program has been piloted have been networked, a knowledge base file can be accessed from any computer in the building. Work is presently underway for schools in the Division to be networked to facilitate the sharing of knowledge throughout the schools.

In addition the the four major components, the program has fifty - two thinking and writing strategies that can be accessed through files in the program. This assists students who may have difficulty remembering all the information given to them when a particular writing strategy is taught.

The complexity of the program allows for many possibilities when incorporating writing using the computer into the classrom. It also brings with it numerous challenges for the classroom teacher.

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