Teachers' Perceptions and Roles in the Implementation of Telecommunications in Middle Schools.

by

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ABSTRACT

This study examined teachers' perceptions of the uses and effects of telecommunications on teaching and learning, and their roles in implementing telecommunications at two middle schools. The data were collected by means of a survey of the teachers and analysis of the telecommunications user logs. Interviews to enrich the survey data were conducted with seventeen volunteers to examine their perceptions of the uses and effects of telecommunications on their teaching and their students' learning. The majority (72%) of the teachers had positive attitudes towards telecommunications. The schools were found to be significantly different at the $p<.05$ level in attitudes towards telecommunications and their concerns about students' access to computers for use in telecommunications. The general trend was that teachers regarded inservice training, time to learn to use the technology and integrate it into their instruction, and access to computers as essential to successful implementation. Demographic factors that were important to teachers' perceptions of telecommunications were gender, teaching subject area and level of training in telecommunications. Recommendations are given for implementing technological innovations in middle schools. The success of any innovative technology program in attaining its goals and objectives depends, ultimately, upon the support of the teachers. Teacher support for a new initiative will be increased if it is perceived as meeting their needs and expectations. Teachers' perceptions of telecommunications as a tool for teaching and learning have serious implications for the implementation of this technology in schools.

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CHAPTER 1: INTRODUCTION

There is much evidence that the schooling system in North America is facing a host of problems and failing to meet the needs of the public and private sectors. There is low achievement, absenteeism, a high dropout rate, an increasing number of parents that are choosing to pay for private education or home schooling and tax payers that are complaining about the high cost of public education. Looking at the mainstream of education today, its main forms and methods are little changed from that of 200 years ago (Bates, 1993). Children and young adults are taught in groups, within institutions called schools, with instruction provided by teachers face-to-face. While many of the problems facing schools are the problems of society, the reality is that schools are expected to educate the citizens of tomorrow using the tools of yesterday, such as, graded classrooms, textbooks, lectures and tests.

As long as schools have been in existence there has always been opposition to the status quo. Educational philosophers and writers have written of the need to make drastic changes to teaching and learning (Apple, 1985; Dewey, 1916; Fullan, 1991; Goodlad & Anderson, 1959; Holt, 1972, 1976). In response, many schools have experimented with dramatically different ways of facilitating the teaching and learning endeavor and have been reportedly successful. Yet, on the large scale, successful innovative models have not become institutionalized. They have flourished and then died regularly throughout this century. Electronic innovations are particularly prone to succumbing to this pendulum effect (Maddux, 1990; Randhawa & Hunt, 1984; Robyler, Castine & King, 1988). This does not imply that we should not continue to try new approaches in the area of technology, to the education of the next generation.

Telecommunications

One of these new approaches is to provide online education which has the ability to connect multiple computers together over short or vast distances to allow communication. This technology, known as telecommunications, introduces unprecedented options for teaching, learning and knowledge building (Harasim, 1990). Worldwide, growing numbers of school based networks are linking learners locally, regionally and internationally, to discuss, share and examine a broad range of subjects such as, environmental concerns, science, local and global issues. Computer networking for, and by teachers offers opportunities for peer collaboration, information sharing and support. Educational networks allow students and teachers to engage in activities far beyond the walls of their schools which in the current educational system so effectively separates them from the rest of society (Levin, Riel, Miyake & Cohen, 1987). However, we know little about how technological innovations in education are diffused and adopted, as research in this area is only beginning (Teles, 1991).

Teachers

Teachers are the "gatekeepers" of education and they play an important role in facilitating change (Lortie, 1975). Telecommunications in education involves learning how to use the technology and learning to teach with the technology. Support for this innovation can only be justified if creative use of it in the classroom proves to be durable. If an innovation is regarded by teachers as just another passing "fad", then its effective utilization will be limited. Some teachers may retain elements of the innovation in their practice, but others become cynical of all innovations. The successful implementation of a new technology program, such as telecommunications, into schools depends to a great extent on the positive attitudes and active support of the teachers involved (Fullan, 1991; Hall, George &

Rutherford, 1979; Hargreaves, 1992; Riel & Levin, 1990). Teachers consistently tend to revert to the old patterns. However, these patterns are no longer effective to meet the needs of many individuals and produce the flexible, innovative problem solvers that society needs today. The dramatic increase in the use of computers and telecommunications by society has increased the need to implement this technology in our educational institutions. Ultimately, teachers are going to need to have an understanding of, and a reasonable level of proficiency in the use of telecommunications both for their own professional purposes in preparing for the classroom, and for instructional purposes while in the classroom (Woodrow, 1991).

Implementing Change

Telecommunications, as a tool for teaching and learning, offers a great deal of promise for education. However, classroom reality often inhibits the potential of a new technology (Lehman & Campbell, 1991). Other technological innovations that came and went without lasting impact were often implemented without much deliberation and prior planning (Randhawa &Hunt, 1984). Effective implementation is the key to the successful infusion and adoption of an innovation in the classroom. The implementation of computer learning environments is a complex process that involves a wide range of pedagogical, social, cognitive and phenomenological issues. We must better understand the implementation of innovation if we are to successfully realize the promise inherent in this new technology.

Statement of the Problem

Any change or innovation introduced into a school must be viewed as a complex, multifaceted process (Aust, 1991; Fullan, 1991; Woodrow, 1991). However, to a great extent it is the teachers, who determine the success or failure of the implementation of an innovation in a school. If teachers see a proposed

technology innovation as fulfilling neither their own nor their students' needs, and that their concerns regarding the technology are not being addressed, they are likely to resist all attempts to introduce the technology into their practice (Woodrow, 1991). Developers do not always take cognizance of these factors in the implementation of an innovation and their programs do not achieve their intended goals. The managers of the change process who have the task to develop and implement telecommunications systems in schools are confronted with the problem of how to get the maximum number of teachers in a school involved in using the system for professional and instructional purposes. While some teachers eagerly grasp at any new technological innovation, others are more reluctant to modify their existing teaching strategies and programs unless they are convinced that the new technology will address their own and their students' fundamental needs and concerns (Farragher, Francis & Riecken, 1990; Hall, George & Rutherford, 1977).

What are the factors that influence the introduction and implementation of a new technology, such as telecommunications, in a school? One way of trying to understand the dynamics of how a new technology becomes an integral part of a school is at the level of the teacher. In this study teachers' perceptions, views and concerns towards telecommunications in teaching and learning and their roles in the implementation of telecommunications at two rural middle schools were examined.

Purpose of the Study

Although the setting of this study is specific to two middle schools in Western Canada, an examination of the literature suggests that the problems and issues surrounding the educational implementation of telecommunications in the school context are similar, wherever the implementation is being tried (Collis, 1992). The purpose of this study is to look for common trends and insights based

on the research literature, and the findings of this study about teachers' perceptions and roles in implementing telecommunications in their schools. From the common experiences that emerge, recommendations can be made for more effective support of telecommunications use in the middle school setting.

The findings from this study will have implications not only for the schools involved in implementing telecommunications, but also for other schools that will be expanding their technology programs to include telecommunications in the future. In addition, the findings of the study will be made available to provincial policy makers and software designers to inform them of teachers' views concerning the process of change.

Importance of this Topic to Education

While the frequency and variety of the use of computers is increasing in classrooms, in many areas of application the results remain disappointing (Atwater, Jackson, Wiggins, Simmons & Hale, 1993; OTA, 1988, Woodrow, 1989). Teachers need to develop their professional skills in employing this powerful medium to enhance students' learning. There is a large body of research which concerns itself with integrating computers in education and managing the process of implementing electronic innovation. A more recent area of innovation is telecommunications and how it affects the teaching and learning process. Research on telecommunications to date has largely focused on operating and utilizing systems and building networks that work (Gould, 1991; Honey & Henriquez, 1993; Hopkins, 1991; Lehman & Campbell, 1991; Riel & Levin, 1990; Teles & Duxbury, 1992). The emphasis has been on the computer's role, the technical aspects of how and where to use telecommunications and the successes and failures of online education. According to Smith & Dunn (1991) and Harasim (1990), very little research has been devoted to understanding the human aspects of technological

innovation and, specifically, how teachers perceive a new technology will improve teaching and learning and their roles in its implementation. While much research has been done on implementing computers in schools there is a need for research in the area of teachers' perceptions and roles in the implementation of telecommunications. This study addresses such needs.

Definition of Terms

1. The term, telecommunications, is used very broadly in the literature. The simplest definition of telecommunications is, "communicating over distances" (Collis, 1992). In this study it refers to computer-mediated communication which can occur using electronic messaging (email) and for online access to electronically stored information, such as the Internet, within the context of a traditional school environment. In this study, online education encompasses computer-mediated communication through the use of telecommunications. These terms are used interchangeably throughout the study.
2. Technological innovation is used to denote a new program that will require changes in teachers' classroom practices and in student behaviour and is the focus of the teachers' perceptions and concerns.
3. Successful innovation is indicated by how widely the innovation was used in a school, how much it had enhanced teachers' professional skills and pupils' learning. This includes the effects of the innovation; changes in everyday classroom practice, increases in repertoire, better rapport with students, cognitive growth, improved self efficacy and self-image, transfer of skills to other areas and other staff, and improved attitudes (Huberman & Miles, 1984).
4. Concerns: A person's perceptions stimulate their concerns, not necessarily the reality of the situation. The feelings, thoughts and considerations that we give to an issue may be called concern (Hall et al., 1979).

5. Culture of the school refers to those aspects of any one particular school which make it a unique institution, separate and different from other schools.
6. Inservice training is used to discuss the activities arranged by a school that are intended to develop and extend the professional competencies of teachers in various areas.

CHAPTER 2: REVIEW OF THE LITERATURE

The questions asked in this study are theoretically based in two areas of the current research literature. The first area is research in educational computer-mediated communication, or online education, which has the ability to connect multiple computers together over short or vast distances to allow communications. This technology, which uses telecommunications, introduces unprecedented options for teaching, learning and knowledge building (Harasim, 1990). The second area sets the context for the study in the field of educational change which has the perspective that any change or innovation introduced into a school must be viewed as a complex and dynamic process (Aust, 1991; Corbett & Rossman, 1989; Eisner, 1985; Fullan, 1991; Huberman & Miles, 1984; Woodrow, 1991). These two areas are linked in this study, which addresses teachers' perceptions and roles in the implementation of telecommunications in middle schools. Before the issue of educational change through implementing a new technology, such as telecommunications, in a school can be discussed it must first be placed within the context of telecommunications and online education in general.

Telecommunications and Online Education

Computers and Education

The children of our society will never again know schools without computers. School offices have achieved greater efficiency through computerizing clerical and administrative functions and greater numbers of teachers are depending on computer tools to help them in the task of teaching. Students are learning practical computer skills as preparation for college and for life in a knowledged-based, technological society. The ability to work comfortably with computers and collaboratively with other learners and workers in global information networks, and

the ability to access and make sense of large databases and other information services are all important skills in the new workplace. John Dewey's (1916) sentiments at the turn of the century, that school experience should weave into its very fabric the values, social order and processes it seeks to impart and not merely teach about these processes, are relevant to us at the turn of the next century. It was initially thought that educational computer use would revolutionize education and schooling. However, many of the anticipated benefits of computer use have yet to appear (Riecken, 1990). A nation-wide study published by the United States Office of Technology Assessment reported that by 1988, only half the teachers in the U.S. had ever used a computer (OTA, 1988). Nonetheless, the computer age has had an impact and computers have earned a permanent place in our educational system. Initially, it was expected that computers would be used as a tool by which students could learn individually, known as Computer Assisted Instruction (Teles, 1991). However, classroom practice has been changed more widely as a result of computer applications (Robyler, Castine & King, 1988). The literature is rich with claims of unique effects of various computer-based methods and some authors maintain that the new kinds of learning which computers make possible are changing the goals and the curricular structure of education (Bates, 1993; Harasim, 1990; Levin et al., 1987). In particular, they predict that online education will provide a more effective education for the citizens of a modern information society. However, society has some very specific measures for the effectiveness of its education system: student achievement, student attitudes and dropout rates to mention a few. The impact of computer applications and in particular, telecommunications, on these measures is largely unknown. At a time of declining resources for education, while educational decision makers grapple with the fiscal demands of maintaining and expanding the instructional computing movement, it is

necessary that objective information be provided about the uses and effectiveness of computer applications, such as telecommunications, in schools.

Online Education: An Historical Perspective

Computer-mediated communication, using telecommunications, is a relatively new phenomenon which appeared in schools in the early 1980s (Harasim, 1990). Telecommunications can be incorporated into the school environment in many ways. During the early years of practice, the use of telecommunications was approached from one of two traditional perspectives: as an extension of distance education, or, as an add-on in classroom activity (Harasim, 1990). However, neither perspective adequately utilized the technology. An effective use of telecommunications is as a tool for students and teachers to extend their learning through the creation of electronic networks. Like distance education, learning networks using telecommunications are time and place independent yet have the added attribute of allowing collaboration among learning peers. Traditional distance education emphasizes the learner's independence, focusing on individual rather than group activity. Learning networks however, support interactive group communication. Historically, the social, affective and cognitive benefits of peer interaction and collaboration have been available only in face-to-face learning. Telecommunications opens unprecedented opportunities for enhancing the social process of teaching and learning in group settings.

Online education is made possible by means of electronic communication in the form of electronic messaging (email), file transfers via computer connections, direct talk modes via networked computers and access to the databases of the Internet. The Internet is a conglomerate of nearly two million computers across the world. This network of networks has become the world's largest and most complicated library with more than fifty thousand databases in the system (Russett, 1994). The Internet is the evolutionary product of Arpnet (a United States Defense

Department network of the early 1970s) and NSFnet (a network set up by the National Science Foundation for linking colleges and universities in the early 1980s) (Russett, 1994). People use the Internet for various purposes but it is fundamentally a highway for exchanging information (Hart & Henman, 1992). By providing teachers and students with direct Internet access they can become partners in a worldwide community with unparalleled opportunities and equally important responsibilities (Hart & Henman, 1992).

Telecommunications in the Classroom.

It is the belief of some education policy makers in North America that educational telecomputing will revolutionize K-12 education by giving teachers new tools and new ways to inspire their students (Bull & Robin, 1992). Today, hundreds of schools in North America have the technology to create electronic, global communities, at a reasonable cost. This can enable students to exchange messages with other students and experts around the world and enable teachers to share new teaching ideas with each other (Gore, 1991). The most common form of interaction on electronic networks is the exchange of electronic messages. Text messages are typed on a microcomputer and relayed instantly through telephone lines, satellites and computers to their destination - the computer screen, printer or disk of the receiver who can then read and analyze the message. The message can go around the world to many different locations in a matter of seconds. Electronic messaging systems allow for many different kinds of interactions. These include one-to-one dialogues; one-to-many broadcasts, such as, teacher-to-student exchanges; and many-to-many group interactions, using email or electronic bulletin boards. The central idea is that individuals do not have to be in the same place as other individuals or groups or sources of information in order to make contact through electronic means (Collis, 1992). Information is sent instantaneously but without the demand for immediate attention by the receiver. It is as easy to specify

all users of the network as it is to specify a single receiver. While the form of the exchange is often informal there is a written record of the communication. Information can be electronically stored and retrieved as new members join an information exchange. A wide range of educational activities can be conducted including news writing, science projects, problem solving instruction and social science activities.

While other uses of computers in education have been built on conventional instructional models of classroom interaction, computer-mediated communication facilitates a wider interaction in which students learn skills and acquire knowledge in contexts similar to those in which they will be used (Levin et al., 1987).

Johnstone (1991) notes that one of the great advantages of telecommunications is that it provides a democratic setting. This is especially important for students, who are perceived on a similar basis regardless of physical handicaps, regional or national accents, assertiveness in face-to-face discussions and other characteristics that would tend to put students on an unequal footing in the usual classroom setting. Student-teacher and student-student interactions can be more effective than more traditional types of interaction (Johnstone, 1991; Rubio, Krajcik & Canty, 1993).

Electronic Networks

Learning is not a transfer process but a constructive process and requires a community of learners to participate in creating shared understanding. Telecommunications makes possible new forms of teaching and learning that pose challenges to the educational community. One way of utilizing telecommunications in the classroom is by creating computer networks that allow teachers and students isolated in classrooms a way to invite others to join with them in the educational process. Educators using these tools have begun to

redesign lessons, encouraging the student to become both teacher and learner in new systems (Riel, 1989).

The students are not the only learners in this distance forum. Teachers are traditionally isolated from their peers and from learning opportunities because they spend most of their working time alone in classrooms. When teachers work together to help each other extend classroom learning they become learners as well. Good teaching strategies and projects are not just shared with their peers within a school but provide them with an avenue for professional development while they remain in the classroom with their students. Riel (1991) summarizes the experience of a teacher the following way:

> Students enjoy writing more when they write for distant audiences. Attendance improves when other peers are involved in collaborative projects that are integrated into the curriculum. It develops curiosity and creativity; students begin to consider issues of global concern. And it promotes professional development for teachers as they learn cooperatively along with students (p. 7).

Electronic messaging systems allow for many different kinds of interactions. In their research on building electronic networks, Riel & Levin (1990) found that initially, electronic networks are viewed by their users as just a more efficient way to conduct the same kinds of interactions. However, they soon find that computer telecommunications can facilitate group interaction in ways that are qualitatively different than that provided by other media. There is the potential to create and maintain group interaction among people that are separated in time and space to form electronic communities.

There are many ways in which teachers have extended students' learning using telecommunications. For example, a science class with learning partners in local, national and international classrooms can share information about the location of their nearest nuclear power plant and debate over its safe operation.

Another example is of a Canadian class which was involved in a community action program to clean up a polluted lake. They asked their learning partners to describe any water pollution problems facing their local communities and any community efforts to prevent the problem (Riel, 1991).

Teacher as Facilitator

This technology supports learner-focused education, of special importance to educational reforms. The constructivist view of learning, which is characteristic of Dewey, Vygotsky and Montessori, holds that teachers should be facilitators who help their students construct their own understandings and capabilities in carrying out challenging tasks. This view puts the emphasis on the activity of the students rather than that of the teacher. According to Collins (1991), the constructivist view has made little headway in penetrating public education in America or, more generally, in the world at large. Learner-focused education requires change from the traditional roles, where teachers become more facilitative and less like sources of information, and students become more responsible for their own learning (Riel, 1989; Wellburn, Francis, Riecken & Farragher, 1993). Through telecommunications, the roles of the teacher and student are much less distinct than in traditional classrooms (Wellburn, 1991). Knowledge is expanding rapidly and even specialist researchers have difficulty in keeping up with developments in their field. Teachers are increasingly going to become advisors, managers and facilitators of learning, rather than providers of information. While part of a student's day will be spent individually searching through information using telecommunications, making meaning of the information is the work of people in interaction. For young children this needs to be face-to-face interaction. For older children some of it can be done through communication across networks. For all, it needs to be a social, highly interactive process (M. Riel, email communication , 2 January,1993). The teacher using telecommunications can help

learners interpret, evaluate and use information through meaningful online activities. The teachers' role will concentrate more on developing skills, and particularly the skills of navigating knowledge sources, and of processing and analyzing information (Bates, 1993). Telecommunications can provide the catalyst for these kinds of changes.

Linking Teachers

Across the world teachers spend most of their time in classrooms isolated from one another (Hargreaves, 1992; Kimmel, Kerr & O'Shea, 1988; Little, 1987; Lortie, 1975). This isolation may protect the classroom of blame and criticism but it also shuts out possible sources of praise and support. In this culture of individualism, teachers receive little feedback on their value, worth and competence (Hargreaves & Dawe, 1990). Teachers may plan and consult with each other but will rarely cooperate on issues which threaten their classroom autonomy and which opens up their practice to intrusive scrutiny (Hargreaves, 1992). This means that serious contemplation of alternative practices and purposes is unlikely. Writers on educational change have suggested that we look for ways in which this "privatism" can be changed (Fullan, 1991).

Research on educational change has shown that if schools are to improve or be improved they must somehow be connected to new knowledge from the outside and that conditions within schools have to be such that teachers can share this new knowledge among themselves (Tye & Tye, 1984). In their Study of Schooling, Tye & Tye, (1984) demonstrate that knowledge flows to schools unevenly, without focus or plan. They suggest that researchers need to concentrate on finding effective ways of linking schools and teachers to new knowledge. Telecommunications offers such an opportunity.

Teachers can be effective sources of instructional improvement because peers respect the judgements of those who have previously implemented a skill or

set of ideas in the classroom (Kimmel, Kerr & O'Shea, 1988). Unfortunately, opportunities to continuously share instructional resources among teachers are limited. Due to the time constraints of their daily teaching schedules, teachers need help finding instructional resources and are usually limited to those available in their department or school libraries. Teachers are one of the few professionals that have very limited access to telephones or other means of interaction with those outside the classroom. Telecommunications offers possibilities of professional contact for teachers from their classrooms in a way that does not disrupt teaching. Groups of interested participants engaged in problem solving can do much to reduce isolation (Rothberg, 1986).

Kimmel, Kerr and O'Shea (1988) found that computer-mediated communication in an inservice education program was substantially used by teachers and began to reduce the isolation of teachers from their peers by overcoming the limitations of the physical boundaries of the classroom.

Professional Development

The professional development of teachers must be part of the overall strategy for professional and institutional reform. However, it is important to examine the social theory that underlies the mainstream mode of professional development for teachers. According to Aoki (1984) a positivistic or technocratic research model is characteristic of staff development initiatives in education in North America. He refers to this technocratic paradigm as being committed to a systematic rationalized approach to change where implementation means having acquired the skills and knowledge to be competent. The mainstream reality for professional development seems to be based on the belief that:

> ... problems and conflicts in implementation can be managed through purposive rational action based on precise quantification and systematic decision-making. What is damaging in this approach is the fact that the

> emphasis on technical strategy effectively submerges the ideology of socio-cultural values... (Aoki, 1984, p.109).

Hargreaves (1992) supports this view and criticizes mainstream staff development by suggesting that they are characterized by the lack of involvement, commitment and resistance of teachers.

An alternative mode of implementation from that of the mainstream is to foster a deep understanding of the innovation and at the same time allow individuals to transform it, based on the appropriateness to their situation (Hargreaves, 1992). What teachers think and believe is reflected in how they teach and shape learning. The quality of teachers' work is linked with the way they develop as people and professionals. Strategies for developing teachers should be linked to how people evolve and develop as teachers and be grounded in their backgrounds and biographies, their careers and the surrounding environment or culture of teaching. Resources need to be invested in developing a culture where teachers develop in terms of self understanding and, in knowledge and skill development.

Teachers require support to successfully change their practice (Collis, 1992; Fullan, 1991). This can be through inservice training workshops, teachers as researchers, professional reading, mentoring, peer coaching and teacher support groups. They can do this alone by reading up on new ideas or, by simply reflecting on and reformulating what they do in their classrooms. In whatever instance, the teachers' voice or the purposes and concerns that connect the teaching, the person, and the life, should be a primary focus of professional development (Hargreaves, 1992).

Teachers can learn a great deal from many other groups both inside and outside the school. Teachers learn the most, however, from collaboration with other teachers, particularly from colleagues in their own workplace, their own

school (Aust,1991; Hargreaves, 1992). Unfortunately, existing research suggests that this environment of collaboration is difficult to create and sustain because of the context of teachers' work. Factors such as time and curriculum demands limit the possibilities for collaboration.

Computer-mediated Collaboration

"People change by doing new things, in conjunction with others, while obtaining insights and commitments to do better" (Fullan, 1991, p.84). Much of the literature contends that the successful implementation of change across schools requires strategies which build peer collaboration and collegiality while recognizing the efforts of teachers (Aust, 1991; Hunter, 1990; Kimmel et al., 1988; Schrum, 1992). Kimmel et al.(1988), believe that teachers can be effective sources of instructional improvement because peers respect the judgements of those who have implemented a skill in the classroom. Outside of recognition of students in the classroom, there are too few mechanisms for acknowledging a teacher's accomplishments. One of the most rewarding satisfactions for teachers may come from knowing that the teaching ideas they have refined through years of practice are being widely used by other teachers through telecommunications. Peer interaction is critical to teachers' growth, development and change. Such interactions using telecommunications could include peer collaboration, collegial support teams, consulting, peer coaching, mentoring between expert and novice, team teaching and teacher-researcher teams. Schools that promote a culture of teachers interacting and developing expertise together will be successful in effecting lasting changes. While there is no doubt that these interactions have very positive effects on teachers, they are limited to increasing contact with one another outside of the classroom context.

Increasingly, teachers and researchers are working cooperatively to develop and evaluate new educational programs in action research. Teachers are included

in all phases of the research and at the conclusion of the project often find it difficult to return to the isolation of the classroom (Riel, 1992a). In many cases, teachers leave teaching to continue developing their interests in research as part of a higher degree program or to pursue other careers at the district or national level. This approach for developing teachers does not serve the schooling system well if the result of this interaction is to cause dissatisfaction in teachers. Computer-mediated collaboration is a way to continue these collaborative interactions while remaining in the classroom.

Similarly, team teaching has been used to facilitate teachers working together more. In some cases teachers combine their classes. However, the difficulties of working with 60 children in the same space makes team teaching a difficult solution for teachers who want to work collaboratively in the same classroom. More often, team teaching arrangements refer to a system in which teachers from two or more classrooms share the responsibility for teaching different topics. The students exchange classrooms but the teachers remain isolated in their classrooms.

Telecommunications can facilitate these interactions from within the classroom. Findings from the literature show that teachers who cooperated in learning networks benefited as much as their students from the opportunity to collaborate with their peers. Computer-mediated communication provided a vehicle for the professional development of teachers (Riel, 1992a). Teachers acquired knowledge, developed new instructional strategies, increased their self-esteem and developed professional and personal relationships with their peers.

Changes in Relationships

In learning networks, teachers work closely with their students to plan activities and respond to the projects of their peers. This causes a shift in the power relationships in the classroom. The teacher is a member of the team -

learning and problem solving with the students. A teacher's honest participation in the search for answers models good learning strategies. The teachers' excitement over the discovery of new information demonstrates the high value he or she places on learning. Teacher enthusiasm motivates students learning (Riel, 1992a).

Planning and participating in a learning network involves collaboration among teachers within a school and with teachers from distant schools. Partnerships often evolve from the planning and completion of a project which allow sharing of content knowledge, ways of teaching, approaches to assessment, resources and information. Teachers support and encourage one another to give presentations, conduct workshops or write research papers - fostering professional development. The professional development of teachers and the intellectual development of students are closely tied (Riel, 1992a). Computer-mediated communications can provide a way for teachers to learn from one another at the same time as they are working within the curriculum to create learning contexts for their students. Physical walls, special needs, socioeconomic barriers and geographic distances are not absolute boundaries. Computer networking offers the possibility of changing the social and institutional relationships within schools and between schools and other sectors of society and, as such, may have an effect on improving these relationships in schools.

Many schools have the technology to make the creation of educational networks possible. However, building a community of educators and students is not simply a technical matter of installing hardware and software and connecting computers with modems. Even the most informal network exchange, like any classroom lesson, takes many hours of teacher preparation time and this time is a valuable educational resource (Riel, 1991). The creation and maintenance of local, national and international electronic communities is not easily realized but requires

attention to group organization, group dynamics and educational leadership (Riel, 1989; Riel & Levin, 1990).

The literature suggests that the most important factor leading to successful learning networks is that the network should meet the needs of the teachers and students that are involved in the system (Riel & Levin, 1990). However, the implementation of telecommunications systems are too often done in a mandatory fashion and students' and teachers' perceptions of how the technology should meet their needs are not examined.

Changes to Organizational Structure

Several researchers have pointed out that it is the structure of the organization of schools that is a major barrier in the implementation of mandated change (Bates, 1993; Collins, 1991; Cuban, 1986; Fullan, 1991; Goodlad, 1984; Leiberman, Saxl, & Miles, 1990; Little, 1987; Lortie, 1975). Little (1987), considers the organizational structure and working environment to be a most important influence on teachers' commitment and willingness to change. When you introduce a substantial change like a new communication medium into a complicated system like the educational system, it is important to consider the assumptions underlying the way things are currently done. Linking microcomputers through the telephone system into long-distance networks allows us to consider other forms of instructional interaction (Levin et al., 1987). However, this suggests that some fundamental organizational changes are going to be needed in educational systems. Particularly, the classroom, where learners are taught in large groups at set times and place by a single teacher, will be challenged by computer-mediated communication.

Cuban (1986) effectively argues that computer technologies are unlikely to have any effect on schools. Throughout the history of technological innovation, Cuban (1986) found that teachers were often blamed for resisting change and

refusing to modify their teaching practices to accommodate technological innovations. He maintains that to the degree that technology is flexible, it will be bent to fit existing practice and that, to the degree it cannot be bent to fit existing practice, it will not be used. On the other hand, Bates (1993) believes that we need to carefully examine the purpose and function of educational institutions in the 21st century, and use electronic technologies to build new institutions to meet new educational needs. He believes that the possibility exists of a networked society with equal access to knowledge and information; communities and individuals in charge of their learning environments; government, educators and the private sector working in partnership; and an education system that delivers the skills and knowledge needed for a prosperous society. An overview of the literature on technology use in classrooms reveals that these are extreme viewpoints on how technology will impact schools. It is important to bear in mind that the focus should not be on how to use the technology, for the technology's sake, but rather, how can this technology be used to involve students in making meaning of their learning (M. Riel, email communication, 2 January, 1993). This will require a balance between face-to-face contact at the local level, inter-personal contact through telecommunications and, interaction between an individual and the technology. In other words, the relationship between classroom organization and technology use is better characterized as a mutually influential one (Riel, 1989). Any effort to change education cannot ignore the institutional arrangements of schools, the social dimensions of classroom life and especially the position of teachers in these settings as critical factors affecting educational innovation. (Cuban,1986; Sarason, 1976).

Summary

It would be difficult for any single innovation to address all of the problems of education simultaneously. To do so, the innovation would have to affect

students' attitudes about learning, students' relationships with each other and their teachers, teachers' relationships with each other and other professions, and the relationships of schools to society. Communication technology cannot solve any of these problems, but it can be a vehicle for developing new collaborative relationships among students and teachers and between schools and other institutions (Riel, 1992a). These connections may offer some hope of change.

Practical applications of telecommunications have developed rapidly with some successes and failures. Little is known about the theoretical factors that have contributed towards these experiences. There is a critical need for research to guide and inform future developments in the field in order to make the promise of telecommunications a viable and useful reality (Harasim, 1990).

Computers and telecommunications technology are potentially very powerful tools to aid in educational reform. However, classroom reality often inhibits this potential (Lehman & Campbell, 1991). The wide-spread implementation of telecommunications in classrooms depends on a number of factors. People interested in school reform need to understand the various kinds of resistance to change, some of which are specific to technology and some of which are general, in order to identify the major obstacles to use of technology in the classroom. Effective implementation is the key to the successful infusion of this innovation in the classroom. We must better understand the implementation of innovation if we are to successfully realise the promise inherent in this new technology.

Educational Change and Technological Innovation

Understanding and describing the process of change in educational institutions, while at the same time maintaining sight of the individuals in the process, is a challenging task for managers and researchers of the change process.

In recent years, research on the management of change has held a prominent place in the literature. Early attempts at introducing computer technology into classroom practice were largely based around efforts to streamline existing pedagogical practices, however, such efforts rarely bore fruit (Goodson, Mangan & Rhea, 1991). Educators began to realize that effective computer use required changes in classroom practices in order to get the most from the technology. At the same time there were those who began to realize that information technologies offered opportunities to do a whole range of things that had never been done before.

The Change Process

Educational change consists of learning new ways of thinking and doing, new skills, knowledge, attitudes and beliefs (Fullan, 1991). Once considered to be a straightforward process of research, development and dissemination, researchers now agree that educational change is complex. This change is both highly personal, and yet, imbedded within the context in which the change occurs (Fullan, 1991). According to Fullan (1991), implementation is successful when a new program or innovation becomes part of the fabric of a school and change has occurred not only in the use of new materials but also in fundamental changes in teachers' beliefs and practices. Huberman & Miles (1984), use success to mean "stable, built-in, widespread use of a well-designed innovation that had a positive impact on students and teachers" (p.253).

Fullan and Miles (1992) state that time has surfaced as a key issue in the change process in all the research of the past decade. Research on educational change and innovation has shown that change happens slowly. Educational change is a long and tedious process that does not end with adopting a new technology or approach to teaching. The decision to change is only the beginning. Change occurs developmentally and in general, it takes at least three or more years for teachers to make substantial changes in their teaching (Ellis, 1990). This amount

of time is needed for teachers to acquire new skills, to interact with the innovation and adopt it into their practice. With the implementation of technology there is the component of first learning to use the tools and then trying to radically alter teaching and classroom practice. Teachers are not simply conservative and resistant to change but have a philosophy of teaching, based on their own experience as students, their professional training, their personal lives and work experiences, which guides their classroom practice (Goodson et al., 1991).

Personal Meaning

Research has shown that the most serious bottleneck to the introduction of telecommunications in universities is not the technology itself or its costs, nor the adaptability of students; it is the training and adaptability of faculty (Turoff, 1990). It is the individual teacher who must make the connections between the new idea or innovation and their reality as they perceive it. It is the daily subjective reality of teachers "that are powerful constraints to change" (Fullan, 1991, p.36). Efforts to effectively implement a technological innovation, that will have a lasting impact to improve education, require deep seated changes in teachers' beliefs, values and attitudes (Fullan, 1991; Maddux, 1990). Such changes occur slowly. Each teacher within each school has to make personal meaning of the new program if it is to be successfully implemented by that individual. The values and beliefs that the individual holds determines whether or not a change is supported.

Teachers must be convinced of the importance of a new set of skills and competencies to be integrated into their instruction, if they are to in turn convince their students of the importance of the new skills and competencies. Substantive and lasting changes in teacher behavior can only occur if teachers perceive the changes as meeting their needs (Fullan, 1991; Kimmel, Kerr & O'Shea, 1988). Teachers will alter classroom behavior selectively to the degree that certain technologies help them solve the problems they define as important and avoid

eroding their classroom authority (Cuban, 1986). They will either resist or be indifferent to changes that they see as irrelevant to their practice, that increase their burdens without adding to their students' learning, or that weaken their control of the classroom.

Culture

It is now recognized that schools operate as socio-cultural systems (Hargreaves, 1992; Leiberman et al.,1990; Riecken, 1990; Sirotnik & Oakes, 1986). School culture consists of a set of shared values and beliefs that are held in common by the individuals of that school. Each school involved in the implementation of a new program or technology is a microsystem with a unique set of beliefs, culture and history of relationships. Any change effort must start with an understanding of the social context of the school; the student population, the community's expectations, the organizational structure of the school day, the staff and how they are supported.

To a great degree the literature on teacher change addresses the question of why efforts to implement change are so often unsuccessful. The initial disappointment with the lack of success of various implementation efforts led to a view of teachers as resistant to change (Cuban, 1986). However, a recurring feature of the literature on teacher change is that change mandated and initiated by others from outside the classroom, in a top-down implementation model, may provide an explanation for this resistance (Fullan, 1991). The changes suggested by outside experts, such as educational scholars and administrators trained in scientific thought, may not fit in with the individual teacher's intuitive and non-scientific beliefs about what is appropriate and necessary classroom practice (Feinman-Nemser & Floden, 1986).

The power of the classroom and school culture in establishing and shaping teachers' practices explain a great deal of teachers responses to classroom

innovations in general and technological ones in particular (Cuban, 1986). The literature suggests that individual teacher change should be viewed within the culture and norms of their school if an innovation or change is to successfully become part of the fabric of the school. Educational change therefore is multidimensional, involving changes in beliefs, skills, approaches and uses of materials. These dimensions are interrelated, each guiding, informing and in some cases driving the others.

Clear Goals

An important factor in the implementation of an innovation in a school is having a clearly defined and articulated reason for the innovation. The solution of technical problems alone does not produce the reformed classrooms and schools that policy makers are hoping for (Goodson et al., 1991). Policy makers must have a clear vision of the goals and purposes for educational technology use. The process of policy development is always a political process which must seek to reconcile conflicting interests between stakeholders and develop the broadest possible concensus.

One of the best ways to generate sound educational policy is to involve the teachers in its development. Teachers need to be shown and convinced that schools need to be restructured in order to meet the challenges of the future. The reasons for the implementation of a new technology must be made clear to teachers who are expected to transform their practice. They must be convinced that the goals of the school with regards to the innovation are consistent with their own concerns.

Leadership and Support

Implementation is complex and involves all the people who have a stake in education. Leadership from the school principal is important in overcoming negative attitudes and fears towards a new technology. Without the commitment

and support of the principal to provide organizational arrangements that encourage the use of the innovation, opportunities for teacher training and on-going consultation, there is little change in the classroom (Kimmel, Kerr & O'Shea, 1988).

Support from a leadership team which may include the principal, lead teachers, the technology coordinator and computer aides, to provide resources, technical coaching, arrange training and reinforce attempts to change is essential if teachers are going to use new technologies in their teaching. Several studies support the importance to teachers of having readily available assistance with solving problems associated with implementing the innovation (Ellis, 1990; Goodson et al., 1991; Riecken, 1990; Woodrow, 1991)

Curriculum Integration

Implementation of a new technology into a school is often not considered complete until teachers not only use the technology in their practices but have integrated the technology into the curriculum. The majority of supporters of this goal for implementation suggest that the proper way to bring a new technology into education is for the teachers to use the technology as a tool in the study of various subjects (Maddux, 1990). However, a serious obstacle to effective integration of computer technology into the curriculum is the difficulty of access to computers through lack of sufficient hardware. The OTA report (1988), revealed that on average most schools do not have enough computers per student to make them a central element of instruction. Farragher et al. (1990), have also identified lack of facilities as an obstacle to teacher integration of computers into their instruction. The majority of school computers are located in labs which often makes them difficult to access by classroom teachers. The labs are booked in advance requiring long term planning by teachers and are often only available at certain times in the

school day. These factors are hindrances to teachers as they work to integrate computers into their instruction.

Inservice Training

Comprehensive inservice programs that help practicing teachers develop the knowledge and skills they need to use new technologies and that support them as they implement information technologies into their classrooms are an essential part of implementing an innovation (Ellis, 1990). A critical factor in inservice training is the participation of teachers in the planning and implementation of staff development efforts (Werner, 1988). However, too frequently, inservice experiences exist in the form of hastily contrived programs with few planned links to teaching practices and infrequent follow-up (Kimmel et al., 1988). Teachers need to be valued partners in the process of change, professionals who have important craft knowledge to inform what should happen in schools.

The most common approach to teacher inservice training has been to offer a workshop on special topics, such as, using telecommunications in the classroom (Ellis, 1990). While this approach can be a very good way to deliver information to many teachers at one time they represent only the beginning and are often inadequate for a number of reasons: Inservice experiences exist in the form of hastily contrived programs with few planned links to teaching practices (Kimmel et al., 1988); they are offered too infrequently, for too short a duration of time with inadequate provision for on-going support and follow-up sessions.

Reports on implementation often detail the amount of time teachers need for learning to use innovations. Learning to use a new technology and its application in teaching and learning often takes a prolonged period of time (Werner, 1988). This has implications for planners and administrators of inservice workshops. Typically such sessions are planned on a fixed time schedule that presupposes all participants' needs will be similar and that difficulties with use and implementation

of the technology arise in the same sequence for all (Werner, 1988). It cannot be assumed that all teachers will be at the same place in learning to use a new technology or have the same concerns at the same time. Considerable flexibility with regard to timing, content, format and follow-up must be considered when planning inservice workshops.

Any change involves the close examination of people's competencies and belief systems. Researchers interested in the problems and satisfactions of teachers have observed that many teachers have concerns when confronted by the prospect of curriculum wide computer utilization (Cicchelli & Baecher, 1989; Hall et al.,1979; Wedman & Heller, 1984). Cambre and Cook (1984) reported that teachers often exhibit higher levels of anxiety regarding the use of computers than do their students. The way we perceive things is dependent on the unique and multifaceted person that each of us is as well as the characteristics of the issue that is the center of attention. Our past history, experiences and knowledge, interacting with our personalities, motivations, needs, feelings, and in fact our entire being, shape how we perceive any issue at hand. Each person's reality will be different from the next person. In working with people involved with change, Hall et al. (1979), have found that concerns about the change that is occurring, or about to occur, is an important indication of how the process is proceeding. Concerns will vary depending on the amount of knowledge about, and experience with, the innovation. Use and non-use of the innovation make a difference to the perception of an innovation. Changing concerns cannot be engineered by an outside agent, it is a dynamic of the individual. Although interventions can facilitate change, in the end, each individual determines whether or not change will occur. Attending to concerns is in no way a manipulation of the person, rather, it is recognizing the inevitable presence of concerns and helping to resolve them (Hall et al., 1979).

The extensive literature of inservice training for computer use in education shows that teachers need specific training geared to their concerns and needs as well as on-going support in order to effectively use telecommunications, or any computer related innovation, in the classroom (Collis, 1992). The general finding from the literature is that as teachers begin to use computer-related activities in their classroom, they do so in the context of fitting those activities into their current practices and beliefs (Canning, 1989; Collis, 1992; Shepard & Wiske, 1989). Therefore the focus of inservice training should first be on the practical benefits of computer-mediated communication and online access of telecommunications mediated resources to teachers themselves. Teachers can then develop their own skills and opinions about telecommunications use to a certain level before they have to think about concerns relating to student use of telecommunications in learning. Inservice training that is structured around these principles will meet the perceived needs and concerns of teachers and assist the developmental process of implementing a new technology.

As teachers come to understand and experience the broad range of useful educational applications of telecommunications, their concerns decrease and cease to be a barrier to the implementation of the new technology in their school. Assessment of where individual members of an organization are in relation to the adoption of an innovation is essential in order for their concerns to be addressed. However, the removal of the concerns is not enough to guarantee the success of the new program or innovation. The innovation also requires the active support and participation of teachers if they are to succeed.

Summary

The success of any new educational program or technology depends strongly upon the support and attitudes of the teachers involved. If teachers regard computers in their school negatively or with suspicion, the educational utilization

will be limited (Randhawa & Hunt, 1984; Woodrow, 1991). Similarly, if they perceive the proposed technology program as fulfilling neither their own nor their students' needs and expectations, they are likely to resist not only the introduction of the technology in their schools but also all attempts to meet the challenges that the introduction of the technology would present (Woodrow, 1991).

Knowing teachers' perceptions and concerns about the implementation, use and effects of telecommunications can assist administrators, lead teachers and decision makers in making sound computer curriculum decisions as well as meeting the needs and expectations of the teachers and generating support for the technology. Schools that introduce telecommunications by virtue of providing teachers with the hardware and software are bound to experience problems in the implementation. Knowing what teachers regard as priorities in inservice training can assist administrators and educational leaders in making effective decisions about the technology and generate support from the teachers. As Winner (1983) stated: "If the initial training is irrelevant, too complex, or technical, educators will shy away from mastery (p.155). The attitudes of all the teachers and students may become more positive towards telecommunications if they are perceived as addressing their concerns and achieving relevant useful objectives. When expectations match reality, the outcome should be useful for all concerned. When teachers conclude that the use of telecommunications really can assist in meeting the learning needs of their students most of them will welcome the new technology with enthusiasm.

Computer-mediated communication networks have the potential to provide professional growth for teachers through teacher learning and teacher development and reduce the isolation that many teachers experience. However, just placing the technology into the hands of teachers is not the best strategy for establishing a network (Riel & Levin, 1990). Attempts to develop networks of teachers that

focus on the technology and technical expertise rather than on teachers needs usually fail (Riel & Levin, 1990). Teachers' beliefs and values, expectations, previous experiences and stage in the learning cycle all affect how they will view this new technology. There is a need for research that focuses specifically on teachers and their role in the introduction of telecommunications at the middle school level (Atwater et al., 1993; Woodrow, 1991).

CHAPTER 3: RESEARCH METHODOLOGY

Research Questions

A great deal of the current literature on telecommunications in education centers on reports of experiences with telecommunications in various subject areas and school settings. In this study the principles of both quantitative and qualitative analysis were applied to support discoveries about the qualities of, and responses to the use of telecommunications in teaching and learning.

The study addressed three major questions:

1. What are teachers' perceptions of the uses and effects of telecommunications in teaching and learning?
2. To what extent do the factors of teacher gender, age, subject area, teaching experience, and training and experience in telecommunications influence teachers' perceptions of telecommunications?
3. What are teachers' roles in the implementation of telecommunications in middle schools?

The survey in this study was designed to examine the perceptions of teachers towards the implementation, uses and effects of telecommunications. Such information can be used for the evaluation and improvement of the implementation and development of telecommunications both at the school level and the inservice training level. The findings from this study will have implications not only for the schools involved but also for other schools that will be expanding their technologies programs to include telecommunications in the future. What are teachers' beliefs and the sources of their beliefs about the usefulness of telecommunications in teaching and learning? What factors influence teachers to use or not use telecommunications in their classrooms? What are teachers'

perceptions of the relationship between telecommunications and the curriculum? What are teachers' expectations for this technology? What are teachers' perceptions of and attitudes towards how telecommunications may change their teaching style and roles and relationships within the school? Do teachers perceive the potential of telecommunications for reducing the professional isolation that many teachers experience? What type of implementation and inservice program would fit the needs of the majority of teachers seeking to meet the challenges of the new technology? The answers to these types of questions are vital if schools are to take maximum advantage of telecommunications.

Research Design

The study used both quantitative and qualitative research techniques. Ianni & Orr (1979), introduced the term of "methodological layering", where multiple methods are used to explore a single problem or issue resulting in the whole becoming greater than the sum of its parts. This methodology is supported by Sirotnik & Oakes (1986) and has been used in studies done by Huberman & Miles (1984), and Yore (1991). In addition, Borg and Gall (1989) emphasize this methodology as useful when there is only one researcher as it helps to correct for researcher bias.

The quantitative component employed firstly, the compilation and analysis of the telecommunications system's user logs over a nine month period from October, 1993 to June, 1994 and secondly, a cross sectional survey to obtain standardized information from the teachers of two rural middle schools in Western Canada. Eighty teachers at the two schools were asked to complete a questionnaire to assess their perceptions of the implementation, uses and effects of telecommunications in their teaching and in their students' learning. While the survey could not establish causal relationships it could be used to explore a variety

of relationships, such as, between the demographic information of teachers and their perceptions of telecommunications. This was followed by a qualitative component which collected data from semi-structured interviews with teachers.

General Characteristics of the Study Population

The two schools took a lead role in developing and piloting a new learning network in which electronically accessed tools and resources can complement and in many cases replace the more traditional learning resources (Hart & Henman, 1992). The participants from these schools were testing some of the prototype software materials on the use of email, including exchanging mail with off site users via UNIX systems and computer conferencing. The goal of the initiative was to stimulate the use of telecommunications as an educational tool within the subject areas and integrate the technology in these schools. All classroom teachers and their students at the schools had the opportunity to become involved but only a few were considered experienced or expert users of telecommunications at the time when the program was initiated.

The two schools involved in testing the telecommunications system were similar in size, location, staff composition and student background. The schools each had about 40 teaching staff and 600 students registered in Grades 6-8. While the descriptive data of the teachers at the two schools correspond in terms of gender, age and teaching experience, the staff at School 1 occupy a new building with state-of-the-art technology and have had preparation for becoming a lighthouse school in the area of technology through inservice training. There are few other schools in the province that have these services available to their students and teachers. In terms of technology and staff development initiatives, School 2 would be more representative of middle schools in this area. This second school therefore acted as a control to check whether the perceptions of teachers in the

lighthouse school were significantly different from those of a school more representative of schools in this area. If there were no significant differences then the results of the study could be generalized to a wider population with some degree of confidence in their validity and applicability and provide guidelines for other schools wishing to widen their computer use to include telecommunications.

Quantitative Component

Instrument

The study of telecommunications in education is a relatively new area of research and no scale has been developed to measure the perceptions of inservice teachers towards the innovation of telecommunications, to date. The literature was searched for a suitable scale which could be modified to perform this task. The questionnaire developed for the survey in this study was adapted, in part, from The Stages of Concern Questionnaire (Hall et al.,1979). The Stages of Concern Questionnaire, which consisted of 35 items, was developed by Hall et al. (1979) to assess the concerns of individuals about an innovation according to how the test taker perceives the items at the time. Fourteen items from Hall et al. (1979) were modified to specify perceptions of telecommunications in education, where appropriate. The remaining eight items were developed by the researcher to provide data specific to this study. The resulting questionnaire contained 22 items to measure perceptions and nine items to provide demographic data on teachers (see Appendix C). The teachers were asked to assess 22 items of their perceptions of the implementation of telecommunications along a five-point Likert scale. Rather than have teachers agree or disagree with statements, teachers were asked to rate the degree to which a statement reflected a concern they might have towards the use of telecommunications in education. Low scores, coded with one or two, indicated that the statements were not true of the teacher at that time while scores

of four or five indicated levels of concern which were very true of the teacher at that time. Teachers could also indicate which items they felt were irrelevant or about which they were undecided which were coded with a score of zero. The items were randomly organized in the questionnaire to minimize inter-item influences (Yore, 1991). A demographic description of the teaching staff was included on the questionnaire in order to assess to what extent the factors of teacher age, gender, subject area of specialization, teaching experience and training in telecommunications influence teachers' perceptions towards telecommunications (Woodrow, 1989).

The Pilot Study

Instruments to measure perceptions, attitudes and beliefs are frequently criticized for not clearly describing their development and verification (Yore, 1991). In May, 1994, a pilot study was conducted. The purpose of doing this preliminary study was to test the reliability of the questionnaire and the efficacy of its administration. The questionnaire was delivered to the two schools of the study and placed in each teachers' mailbox. Teachers were asked to complete the questionnaire within two weeks and return these to a box in the staff room. Eighteen questionnaires were returned. The questionnaires were anonymous and therefore no follow up letter could be sent to individual teachers. Numerous requests from the school secretary had little effect on stimulating additional responses. A reliability analysis using Cronbach's alpha to measure the reliability coefficient was computed to provide information on the reliability of the subscales on the questionnaire. The questionnaire was then revised to improve the reliability of the subscales, improve item clarity, sensitivity and appropriateness to the research questions and included the comments and suggestions made by the respondents. In addition, changes were made in the procedures for administering the questionnaire.

Data Collection

To maximize the return rate the revised questionnaire was administered in February, 1995, which was a time of the year more convenient to the teachers. The questionnaires, bearing the teacher's name were delivered personally by the researcher to each teacher. To improve the confidentiality of their responses they were requested to return their completed questionnaires to a sealed box, marked clearly for their attention in the staffroom, by the date specified on the covering letter. Two weeks later a follow-up of the questionnaire and a different covering letter was sent to outstanding teachers to stimulate additional responses. The final response rate was 68%.

Data Processing and Analysis Procedures

The completed questionnaires were coded and the coded data entered in the computer using Microsoft's EXCEL program. The data were then analyzed by using the SPSS program. Means, reliabilities, t-tests and analysis of variance were calculated. Where appropriate, Scheffe post hoc tests were performed.

A preliminary investigation of possible bias in the data was conducted. Firstly, a t-test was done to see if the responses to the questionnaire items by the teachers from the two schools were significantly different. Secondly, to check for any effect attributable to levels of telecommunications expertise, the teachers were divided into two groups: Users (novices, intermediates and old hands), and Non-users (non-user, past-user). A t-test was done to check for significant differences between these Users and Non-users (Woodrow, 1991).

Means scores for each of the items on the perceptions portion (Questions 1-22) of the questionnaire were calculated, by School, Users and Non-users and, Total scores. One way analyses of variance using the factors of teacher age, gender, subject area of specialization, teaching experience and experience and training in telecommunications as the independent variables provided further

exploration of what effect these factors have on teachers' perceptions of the usefulness of telecommunications in teaching and learning.

Qualitative Component

Interviews

Teachers were asked to indicate their willingness to be interviewed on the questionnaire. The 17 teachers that volunteered became the non-random subsample that were interviewed. It was judged that this limited selection procedure did not weaken the study since patterns and trends from the interview data were to be used to enrich the data from the questionnaire and to provide illustrative examples for specific survey items.

One way to assess an educational innovation is firstly, to look at the effect of the system on the participating teachers' attitudes about the educational benefits of their participation and secondly, to examine the perceptions of non-users to determine reasons for their non-participation . Fourteen of the teachers interviewed were active users of telecommunications: Four teachers reported that they were novices, six teachers were intermediate and four teachers were expert users of telecommunications in teaching and learning. Three teachers who were non-users of telecommunications were interviewed. The interviews were conducted by a single interviewer two to three weeks after the questionnaire had been returned and utilized a semi-structured interview protocol. Seventeen questions and several associated clarifying or prompting questions were developed to explore and compare expert, intermediate, novice and non-user teachers' perceptions of the uses and effects of telecommunications in their teaching and their students learning. The questions were grouped into categories: Attitudes to uses and effects of telecommunications; Time concerns; Support; Working with others; Role changes; Concerns about students; Concerns about ability, Concerns

about Implementation and Decision making. The interview protocol was reviewed by an experienced qualitative and quantitative researcher and then refined by incorporating their suggestions. Interviews were negotiated separately with each teacher and provided independent assessments and further insights into teachers' opinions about telecommunications and the way it was being implemented in their school. Teachers signed a letter of consent, the interviews were tape-recorded, and later transcribed and summarized.

CHAPTER 4: RESEARCH FINDINGS AND DISCUSSION

Quantitative Component

User Logs

One way to assess participation is by how many times participants logged on to the telecommunications system. The staff usage (teaching staff and other staff) was measured in the initial period of implementation, from when the telecommunications system was installed in the schools in October, 1993 until 24 June, 1994. The usage patterns for this time period are described in terms of volume at the respective sites, and show: Number of staff users; number of staff logons to the system and, average logons to the system (see Table 1).

In total, there were more female than male staff at the two schools combined. This was reflected by more female staff (67) having accounts on the system than male staff (38) at both schools combined. However, the male staff (3,407 logons) used the system twice as much as the female staff (1,737 logons). The average logons of male (113) and female (31) staff at School 1 showed that they used the system more than male (75) and female (19) staff at School 2.

Table 1

Volume of Staff Telecommunications Use

	School1			School2			Both		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Total Numbers	15	39	54	23	28	51	38	67	105
Total Logons	1688	1195	2883	1719	542	2261	3407	1737	5144
Average Logons	113	31	53	75	19	44	90	26	49

Questionnaire Subscales

For convenience in interpreting the results the 22 items of the perceptions portion of the questionnaire were categorized into eleven subscales. The subscales were defined as: Attitudes (Questions 1, 2, 9, 13, 18, 19); Time to integrate (Question 3); Time on problems (Q 21); Support (Questions 4, 11, 15, 20); Other staff (Questions 5, 6, 7); Role changes (Questions 8, 17); Student access (Question10); Effect on students (Question 14); Ability (Question 16); Decision making (Question 22) and Implementation (Question 12).

Reliability of the Questionnaire

The data were collected using a reasonably reliable instrument for research into teachers' perceptions of telecommunications. The reliabilities of the subscales which were made up of more than one question were: Attitudes (alpha= 0.82); Support (alpha= 0.56); Other staff (alpha= 0.76); Role changes (alpha= 0.58). Due to the varied and independent nature of the items, a total score would have virtually no meaning, therefore, the overall reliability of the perceptions portion of the questionnaire was not calculated.

Demographics of the Sample

Completed questionnaires were received from 27 teachers at School 1 (63% of the teaching staff) and from 28 teachers at School 2 (74% of the teacher staff) yielding a 68% response rate for the study. The total sample consisted of 55 teachers with 27 males and 27 females and one respondent that responded anonymously. The teachers ranged from 20 years to over 50 years of age with the largest single grouping aged between 40 and 49 years of age. The majority of the teachers had over 17 years of teaching experience (43%). Nineteen percent of the teachers had under five years teaching experience. At the middle school level most teachers are trained as generalists and they teach the core subjects. On the questionnaire teachers were asked which subject area their training had

emphasized. The teachers' responses to this question were divided into two categories; those that fell in the area of math, science or technology (26%) and all other areas of expertise, which comprised 74%.

Teachers were asked how long they had been using telecommunications in their instruction. Thirty-five percent indicated that they had never used telecommunications in their instruction. Thirty percent indicated that they had been using telecommunications in their instruction for two to five years. Thirty-nine percent of the teachers felt that they were intermediate users of telecommunications in their teaching, while 26% indicated that they were non-users. Twenty-eight percent of the teachers considered themselves novice users while only seven percent felt they could be called experts. A large proportion of the teachers in the study used telecommunications daily for professional purposes (40%) while 22% did not use telecommunications at all. Fifty-four percent of teachers had received some training to use telecommunications, however the interviews revealed that generally, training was limited to one workshop which was arranged by the technology coordinator and informal help from colleagues. The findings from the demographic data collected on the teachers are summarized in Table 2.

Table 2

Demographic Data (%)

Gender	**Male**	**Female**		
	50	50		
Age group	**20-29 years**	**30-39 years**	**40-49 years**	**>50 years**
	13	22	54	11
Years teaching experience	**1-5 years**	**6-11 years**	**12-16 years**	**17-34 years**
	19	17	21	43
Subject area	**Math/Sc/Tech**	**Other**		
	26	74		

Table 2 continued

Demographic Data (%)

Years using telecommunications	**Never**	**1 year**	**2-5 years**	**>5 years**
	35	15	30	20
Level of telecommunications	**Non-user**	**Novice**	**Intermediate**	**Old Hand**
	26	28	39	7
How often used	**Not at all**	**Daily**	**Weekly**	**Monthly**
	22	40	28	7
Training	**No**	**Yes**		
	46	54		

Teachers' Ratings of Questions 1-22

Teachers were asked to rate the 22 perception statements in terms of their feelings and concerns about their use of telecommunications in their instruction (see Table 3). The attitude of the majority of teachers was that telecommunications would improve the technology program in their school (72%). The teachers saw telecommunications as a valid tool in learning (67%) and wanted to improve their use of telecommunications in their instruction (65%). A small number of teachers (15%) were not interested in learning about telecommunications and did not see it as a valuable tool in learning (7%). More than half the teachers wanted to know what other staff were doing in the area of integrating telecommunications into teaching (54%), and wanted to coordinate their efforts with others (57%). Forty-five percent of teachers believed that telecommunications would require a change in their teaching style and 49% that their role would change to that of a facilitator. Teachers were concerned about not having enough time to learn how to use the technology in their teaching (62%) and felt that technical support (74%) and inservice training (84%) was essential to their use of telecommunications in their

instruction. Only 39% of teachers were satisfied with the overall operation of telecommunications in their school and felt that they had been adequately prepared to use the technology (27%). Forty-two percent felt that they had not been adequately prepared to use the technology. However, surprisingly only 23% of the teachers were concerned about who made the decisions regarding the implementation of telecommunications in the school. This would suggest that while many teachers were interested in using telecommunications they were not ready to take the initiative in preparing themselves to do so. These findings are summarized in Table 3.

Table 3

Teachers ratings of Questions 1-22 of the Questionnaire (N=55)

	Questions	% not true	% some-what true	% very true
1	Given thought to telecommunications in instruction	24	17	59
2	Like to interest students in using telecommunications	11	29	60
3	Concerned about lack of time to integrate	15	23	62
4	Technical support essential	4	22	74
5	Would like to coordinate effort with others	15	28	57
6	Important to know what other staff are doing	13	33	54
7	Telecommunications may reduce isolation	24	30	46
8	Role will change to that of facilitator	20	31	49
9	Telecommunications will improve technology program	13	15	72
10	Concerned about student access to computers	18	32	50
11	Support of principal essential	8	20	72
12	Concerned about implementation	75	10	15
13	Would like to improve use of telecommunications	15	20	65

Table 3 continued

Teachers ratings of Questions 1-22 of the Questionnaire (N=55)

Questions	% not true	% some-what true	% very true
14 Concerned about effects on students	33	31	36
15 Inservice training essential	7	9	84
16 Concerned about ability to manage	23	30	47
17 Believe teaching style is supposed to change	23	32	45
18 Telecommunications is a valid tool	7	26	67
19 Satisfied with operation of telecommunications	20	41	39
20 Adequately prepared for using technology	42	31	27
21 Concerned about time spent on non-academic problems	31	20	49
22 Concerned about decision making	45	32	23

t-tests

To investigate whether the responses of the teachers from School 1 and School 2 for each of the subscales were significantly different, mean scores were compared using a two-tailed t-test. As not all subjects completed all items the N on specific questions varied.

The results indicated that there were significant differences in two of the subscales; Attitudes, and Student access. The mean for the Attitude subscale for School 1 was 3.94 and 3.50 for School 2 showing a difference of 0.44 which was significant at the $p < .05$ level (see Table 4). These data show that the teachers at School 1 were interested in integrating this technology into their instruction and had more positive attitudes towards the use and effects of telecommunications on teaching and learning than the teachers at School 2.

Table 4 also shows that the mean for the subscale Student access was 2.96 for School 1 and 4.14 for School 2, showing a difference of 1.18 which was significant at the $p < .001$ level. These data show that the teachers at School 2 were more concerned about their students' access to computers for use in telecommunications than the teachers at School 1.

Table 4

t-test for subscales comparing School 1 and School 2.

	school 1		school 2				
variable	M	SD	M	SD	df	t-value	P
Attitudes	3.94	0.66	3.50	0.74	53	2.33	0.024*
Time to integrate	3.68	1.28	3.88	1.28	50	0.59	0.560
Time on problems	3.50	1.30	2.91	1.41	47	1.51	0.137
Support	3.73	0.76	3.80	0.72	53	0.38	0.707
Other staff	3.54	1.03	3.40	0.98	53	0.49	0.628
Role changes	3.40	0.92	3.20	1.13	50	0.68	0.498
Student access	2.96	1.15	4.14	1.11	52	3.84	0.000**
Effects on students	2.77	1.21	3.16	1.31	49	1.11	0.274
Ability	3.58	1.10	3.22	1.55	51	0.96	0.344
Implementation	1.75	1.03	2.13	1.23	46	1.15	0.258
Decision making	2.52	1.05	2.82	1.40	45	0.83	0.409

*$p < .05$. **$p < .001$.

To determine the effects of the teachers' level of telecommunications expertise, the teachers were divided into two groups: Users (novices, intermediates and old hands) and Non-users (non-users and past users). The mean scores for each of the subscales of Users and Non-users were compared using a two-tailed t-test. The results indicated that there were significant differences in three of the subscales: Attitudes, Other staff and Effect on students.

The mean for the Attitude subscale for Users was 3.92 and 3.08 for Non-users showing a difference of 0.84 which was significant at the $p < .001$ level (see Table 5). These data show that teachers who use telecommunications have more positive attitudes towards the uses and effects of telecommunications on teaching and learning than non-users. The teacher users see telecommunications as a valid tool in learning and would like to interest their students in using telecommunications in their learning. They would also like to improve their own use of telecommunications in their instruction.

The mean for the subscale Other staff was 3.68 for Users and 2.92 for Non-users showing a difference of 0.76 which was significant at the $p < .05$ level (see Table 5). These data show that users of telecommunications have greater needs to know what other staff are doing in this area and to coordinate their efforts with other staff than teachers who do not use telecommunications in their instruction.

The mean for the subscale Effect on students was 3.22 for Users and 2.23 for Non-users showing a difference of 0.99 which was significant at the $p < .05$ level. These data show that teachers who use telecommunications are more concerned about how telecommunications affects the students' total school experience than the teachers that do not use telecommunications.

Table 5

t-test for subscales comparing Users and Non-users.

	Users		Non-users				
variable	M	SD	M	SD	df	t-value	P
Attitudes	3.92	0.67	3.08	0.55	52	4.26	0.000**
Time to integrate	3.92	1.22	3.46	1.45	49	1.12	0.268
Time on problems	3.25	1.40	3.08	1.34	46	0.36	0.722
Support	3.84	0.77	3.58	0.63	52	1.16	0.251
Other staff	3.68	0.92	2.92	1.03	52	2.59	0.012*
Role changes	3.41	0.94	2.83	1.21	49	1.74	0.089
Student access	3.72	1.23	3.21	1.37	51	1.27	0.209
Effect on students	3.22	1.18	2.23	1.30	48	2.52	0.015*
Ability	3.31	1.32	3.69	1.49	50	0.88	0.383
Implementation	1.74	0.95	2.50	1.51	45	2.03	0.125
Decision making	2.79	1.20	2.25	1.29	44	1.33	0.192

*p<.05. **p<.001.

Analysis of Variance by Demographics.

Analysis of variance was performed on the subscale scores by the demographic data (Age group, Gender, Years of teaching, Subject area, Years using telecommunications, Telecommunications level, How often telecommunications was used and Training in telecommunications). The results indicated that there were significant differences in eight of the possible 88 combinations. These are reported here.

The analysis of variance performed on the **Ability** scores by **Gender** showed a significant difference in the concerns about Ability at the p<.05 level (see Table 6). The mean scores for female teachers was 3.96 and 2.75 for male teachers. Inspection of the means revealed that female teachers felt significantly more concerned about their inability to manage all that is required to use

telecommunications in their instruction than male teachers. This finding is supported by data from the user logs (see Table 1) that reveal that female teachers use telecommunications far less than their male counterparts. According to Hall et al. (1979), perceptions are related to participation and achievement. The finding that female teachers are concerned about their ability to manage all that telecommunications will require is important as there is little evidence in the literature as to what factors influence teachers' decisions about using computer technology in the classroom. Cicchelli & Baecher (1985) and McCoy & Haggard (1989) found that gender had no effect on teachers' computer use. This issue should be studied further.

Table 6

ANOVA of Ability by Gender

Variable	df	MS	F	P
Gender	1	14.988	9.989	0.003*

*$p < .05$.

The analysis of variance performed on the **Ability** scores by **Subject** area showed a significant difference in the concerns about Ability scores at the $p<.05$ level (see Table 7). The mean scores were 2.85 for the Subject area of science, math and technology and 3.63 for the Other subject areas. Inspection of the means revealed that teachers whose subject area did not fall into the category of math, science or technology were significantly more concerned about their inability to manage all that is required to use telecommunications in their instruction than teachers who have a science, math or technology background. These data have implications for inservice training workshops that can be designed to meet the specific needs of the different subgroups of teachers.

Table 7

ANOVA of Ability by Subject

Variable	df	MS	F	P
Subject	1	8.384	5.324	0.026*

*p < .05.

The analysis of variance performed on the **Attitudes** scores by **Telecommunications level** showed a significant difference in the Attitudes scores at the p<.001 level (see Table 8). The mean scores were: Non-user (3.14), Novice (4.02), Intermediate (3.74) and Old hand (4.54). Post hoc comparisons between the means revealed that teachers who had experience in using telecommunications at all levels had significantly more positive attitudes towards using this technology in teaching and learning than non-users.

Table 8

ANOVA of Attitudes by Telecommunications level

Variable	df	MS	F	P
Telecommunications level	3	3.242	8.6300	0.0001*

*p < .001.

The analysis of variance performed on **Support** scores by **Telecommunications level** showed a significant difference in the need for Support scores at the p<.05 level (see Table 9). The mean scores were: Non-user (3.67), Novice (4.07), Intermediate (3.63) and Old hand (4.88). Post hoc comparisons between the means revealed that teachers who had the most experience in using

telecommunications had significantly greater beliefs that support was essential to their use of telecommunications in their instruction than non-users.

Table 9

ANOVA of Support by Telecommunications level

Variable	df	MS	F	P
Telecommunications level	3	2.188	4.951	0.004*

*p < .05

The analysis of variance performed on **Other staff** scores by **Telecommunications level** showed a significant difference in the need to work with Others scores at the p<.05 level (see Table 10). The mean scores were: Non-user (3.03), Novice (3.81), Intermediate (3.61) and Old hand (4.58). Post hoc comparisons between the means revealed that teachers who had the most experience in using telecommunications wanted to work with other staff in maximizing the effects of telecommunications on learning significantly more than non-users.

Table 10

ANOVA of Others by Telecommunications level

Variable	df	MS	F	P
Telecommunications level	3	3.397	3.951	0.013*

*p < .05.

The analysis of variance performed on the subscale **Attitudes** scores by **Training** showed a significant difference in Attitudes towards telecommunications at the p<.05 level (see Table 11). The mean scores for teachers trained in using

telecommunications was 4.00 and 3.45 for untrained teachers. Inspection of the means revealed that the attitudes of teachers trained in telecommunications were significantly more positive than teachers untrained in the use of telecommunications. This indicates that inservice training should be a critical component of implementing a new technology in a school.

Table 11

ANOVA of Attitudes by Training

Variable	df	MS	F	P
Training	1	1.897	4.133	0.047*

*$p < .05$.

The analysis of variance performed on the subscale **Decision Making** scores by **Training** showed a significant difference in concerns about decision making in telecommunications at the $p<.05$ level (see Table 12). The mean scores for teachers trained in using telecommunications was 2.57 and 2.00 for untrained teachers. Inspection of the means revealed that teachers trained in telecommunications were significantly more concerned about their role in making decisions about telecommunications than teachers untrained in the use of telecommunications. This indicates that including teachers in the planning should be a critical component of implementing a new technology in a school.

Table 12

ANOVA of Decision Making by Training

Variable	df	MS	F	P
Training	1	4.493	4.059	0.05*

*$p < .05$.

The analysis of variance performed on the subscale **Support** scores by **Training** showed a significant difference in concerns about support in telecommunications at the $p<.05$ level (see Table 13). The mean scores for teachers trained in using telecommunications was 4.00 and 3.66 for untrained teachers. Inspection of the means revealed that teachers trained in telecommunications were significantly more concerned about support in using telecommunications than teachers untrained in the use of telecommunications.

Table 13

ANOVA of Support by Training

Variable	df	MS	F	P
Training	1	3.086	6.518	0.014*

*$p < .05$.

Qualitative Component

Interview Data and Analysis

The focus of this research is on the teacher. The questionnaire provided idiosyncratic interpretations of the items by individual teachers. According to Borg and Gall (1989), the interview tends to yield more complete data regarding negative aspects of the self. Therefore, in order to get a clearer understanding of teachers views and perceptions towards telecommunications in teaching and learning, semi-structured interviews with a non-random subsample of 17 teachers were conducted. The interview probed for reasons for their views and checked their understanding of words or terms in the questionnaire.

Seventeen teachers indicated their willingness to be interviewed on the questionnaire. Four teachers were identified as expert users of telecommunications, four teachers were novices, six teachers were intermediate

users and three teachers were non-users of telecommunications. There were six females and 11 males, nine teachers from School 1 and eight teachers from School 2. The interviews focused on a number of areas: Attitudes towards the uses and effects of telecommunications; Effects of telecommunications on students; Changes in relationships and roles; Concerns about access to computers for use in telecommunications, time to learn how to use the technology and integrate it into their teaching and support; Implementation; Decision making and Teacher development and training.

Attitudes towards the Uses and Effects of Telecommunications

The teachers who were novice, intermediate and expert users at both schools reported that they used telecommunications (email) predominantly for personal communications. Some teachers were using it to a small extent to help students with their communications, but generally, the majority of teachers were not using telecommunications very much, if at all as a tool in their teaching. Communications were made to: students, other teachers, friends, relatives and the community at large. Telecommunications was also used for getting information by accessing bulletins and subscribing to email conferences. Most of the expert and intermediate users had telecommunications at home as well and found this very useful for communicating with teachers in their absence from school.

For teachers, the use within the school was mostly for staff to communicate to each other about professional issues, such as, notification of meetings and to transfer files for sharing between teachers. Teachers were also using telecommunications for back and forth discussions with teachers at other schools. One teacher said that it was easier to contact busy colleagues by email that to try to reach them by telephone. At School 1, the teacher who was the technology coordinator was using the system for giving and receiving assignments to students, in addition to all the other uses mentioned above. At School 2 the goal was to use

telecommunications to disseminate the morning announcements. However, the telecommunications system is machine dependent requiring a Macintosh Classic with System 7. Therefore, the school first had to have an email capable machine on every teachers' desk so that all the teachers would be networked from any classroom in the school.

Teachers felt that telecommunications would develop globalmindedness in students and teachers giving them a new perspective of how accessible the world really is. It would enable discussion, forums, sending and receiving news and current information from all over the world. The teachers found that they could send and receive information from the Internet for use in their teaching. For example, one teacher downloaded Nelson Mandela's inauguration speech the day after the inauguration for her social studies class, to discuss issues of democracy:

> You can just pull it off and it's on the spot and current. That's nice because some of the resources I have are so old! I used the speech with the grade eights and we talked about democracy and how someone had gone from prisoner to president. It was interesting to the kids because they knew the name but by reading the speech they could understand more about how they got there and where South Africa is going.

The three Non-users that were interviewed all felt that telecommunications was a valuable tool for use in teaching and learning. However, none of the three teachers had computers available for their personal use in their classroom. Two of the three teachers were hesitantly open to learning how to use telecommunications in their instruction. The hindrances to telecommunications use described by these teachers concerned fears about their ability to succeed in learning to use the technology; access to computers to practice their skills; and making the time to learn to use the technology.

> I feel like I won't catch on, it's not as easy as flipping through a book.
> I don't have a computer in my classroom and it's just not worth the effort.
> I don't know how it's going to help me and I don't want to invest the time.

These teachers acknowledged that there was support and expertise in the school that they could draw on to help them learn to use the technology but expressed that:

> It's difficult to get at the expertise here.
> We have been invited to become part of the process but ... I suppose that if it were important enough to me I would be there.

They felt that in order to get to the level of expertise and confidence to use the technology in their teaching they would need small group work with hands-on experience that was reviewed regularly in the year. While teachers felt that the school had implemented telecommunications well, they personally needed more leadership and direction, a focus in the school that would force them into using the technology: "One of their goals should be to make us more willing to participate". These teachers did not perceive that telecommunications had changed the school in any way and had not noticed any differences in the students attitudes to school or learning. However, one teacher commented that: "If I was more comfortable with using it I would probably use it occasionally".

Effects on Students

The teachers at both schools believed that the primary educational benefit of telecommunications was to improve students' language arts skills and writing skills. Through this medium of communication students were getting practice at expressing themselves in the written form. In their opinion it would be the teacher's responsibility to oversee the process and instill a sense of pride, for example, in using the correct grammar that would be reflected in students' work. A teacher at School 2 remarked that: "It returns us to the era of the written word and away from the primacy of the visual medium".

The teachers believed that telecommunications had the potential to broaden the scope of communication between students in their school, in other schools and

schools in different parts of the world. They expected that this tool would supplement the traditional school library by providing students and teachers with quick references to libraries all over the world.

> The kids three years ago are very different from the kids here today, they know they can access information and they do it. Now when you give them a research project they don't go to the library, they go to the computer.

One teacher who was an experienced user of telecommunications had reservations about whether the students were ready for this kind of access. This supports the findings summarized in Table 14 which show that the more experienced users are concerned about the effects of telecommunications on students:

> I have mixed feelings about doing this too rapidly. I think sometimes the communication moves forward before we're ready to deal with it in terms of behavior and ethics. Although I see it coming, I feel cautious about how it is implemented in schools because I don't think that open access to the Internet is necessary until we can find ways of their (the students) using it ethically.

Teachers also believed that telecommunications provided the opportunity for students to break down barriers of culture, race, age and gender and reach out and communicate world wide.

Teachers perceived that telecommunications was facilitating student access to them, which they saw as vital. Many teachers had experienced more personal contact with some of their students through telecommunications.

> There was one boy who was going to stop band, but after I had written back to him he wanted to carry on. He's a quiet, shy kid and that personal contact was what he needed. Now he's making progress.

Many teachers were concerned about the quantities of irrelevant mail they were receiving from students but felt that in the busy school day the advantage of students being able to leave a message or an assignment for a teacher outweighed the inconvenience of having to delete "junk mail" from students sending general

messages of "write me", or messages with inappropriate language. They acknowledged that their role was not only to facilitate the use of the software but also to teach "netiquette". Many of the teachers interviewed found that communicating by email was very different from talking face-to-face. A feature of not talking face-to-face is that you lose the tone of voice and emotion that comes from body language, which could create misunderstandings and make it easier to offend. This finding is supported by the literature (Collis, 1992). Some teachers felt that when you remove this component of communication the boundaries are extended and that students did not always know what was appropriate and ethical behavior. "We've got a lot of work to do - to make them respect it". The teachers expressed the view that if students were to have the freedom to message anybody then they need to be taught when, how and what to message. Teachers believed that clear guidelines for use of telecommunications needed to be set and that trivial messaging should be discouraged. Communication should be focused, and serve a valuable purpose. These perceptions are supported by the literature which shows that this new form of communication has definite educational implications. Students need to be taught different patterns of questioning and answering from those usually experienced by the student in written communication - new conventions have to identified and adopted before computer-mediated communication becomes a comfortable medium for communication (Collis, 1992).

Many of the teachers had the perception that telecommunications had improved their students' relationships with students and teachers and enhanced their roles in the school. "I think there is more interaction and mutual respect". They had noticed that communicating via email was liberating for students in that it took away gender, age, and the pressures of teenage interaction. Telecommunications had also provided variety for students searching for different interests - even to the extent of opening up future career choices. The teachers reported that in general,

telecommunications had built up the students' self-confidence. This perception is consistent with the trends reported in the research literature regarding the positive effects of computer use on the self-confidence of students (Jackson, Meadows & Scoates, 1992).

Changes: Relationships and Roles.

Most of the expert and intermediate users interviewed had been using telecommunications for a while from their homes, however, they all agreed that it was an improvement for them to be able to communicate with other educators in their school.

> It has allowed me to communicate with people that I haven't talked to personally for a long time so that I feel I'm still linked - I don't feel like I'm so isolated down here.

Teachers also felt that telecommunications had reduced the sense of professional isolation that many teachers experience, and that it had allowed them to reach out to other educators that they would not normally have been in contact with.

> I'm not only isolated physically but also by attitudes towards this subject (music). This is a highly specialized area and I can now talk to someone who has similar frustrations and brick walls.

Some of the novice users felt that while telecommunications was useful they were more comfortable with face-to-face communication. None of the teachers at either school believed that telecommunications had created divisions between Users and Non-users, although some felt inconvenienced by the fact that they could not email the entire staff but had to send written memoranda to the non-users of telecommunications. The teachers who were expert users perceived that they were looked up to by the other teachers for help, guidance and direction and as a model of how to implement this tool in the classroom. These teacher users felt that an important goal was to get all the staff using telecommunications at some level. "We've got a lot of work to do to bring the other staff on and build up their

confidence". This supports the finding that teachers who had the most experience in using telecommunications wanted to work with other staff to maximize the effects of telecommunications on learning (see Table 12). Many of the novice teachers were waiting to be invited to do team work in using telecommunications in teaching and hoped that there would be time for the collective knowledge in the school to be passed around.

The teachers who were active users did not feel that their role as a teacher was threatened by telecommunications in the classroom. One teacher commented:

> Staff need to realise that there are Grade eight kids out there that are better than you are and there's nothing to be ashamed of.

Although students had access to experts and would therefore have access to knowledge that the teachers themselves might not know, they did not believe they were expected to know everything and felt that their role was changing to become that of a facilitator rather than a dispenser of knowledge. However, for the teachers not using the technology, they saw an increasing problem with students that were forging ahead with this technology and wanting their teachers to keep up with them.

> Some teachers are feeling challenged that the students are ahead of them, especially when they are having problems and the students know more than they do.

The challenge was to get those teachers to catch up with the rest of the school.

Telecommunications had not made a lot of difference in most teachers' classrooms. The fact that not all teachers had computers in their classrooms contributed to this at School 2. Although all the teachers at School 1 had computers and access to telecommunications, their routines in the classroom had not yet changed. Teachers were becoming comfortable with the software and were beginning to see ways to use telecommunications in the classroom. They believed

that these changes would occur slowly as this technology was integrated into the curriculum. This is supported by the literature (Fullan, 1991). Many teachers felt that while telecommunications had saved them some time by simplifying some tasks it had created many other tasks not the least of which was learning how to use and integrate this technology into their teaching. However, overall, the teachers were excited about the integration of telecommunications into their classrooms and viewed the technology as a very valuable tool for teaching and learning.

Access

The concerns and hindrances to use of telecommunications expressed by teachers at School 2 were mainly concerned with the deficiency of hardware. These teachers believed that once the necessary hardware had been acquired, telecommunications would provide teachers and students with simultaneous, easy and rapid access to information. At School 1, teachers felt that while there were enough computers available in the computer laboratories (there are over 275 computers in the school), it would be a lot easier to use telecommunications if their students had classroom access to it. One teacher commented:

> For me to use this (telecommunications) to it's full potential I would want to have a technology classroom setup where I could use this during lessons in a more spontaneous way with small groups and other things going on at the same time. Ideally you need several computers per class to really do anything.

Time

Time to learn to use and integrate telecommunications into the curriculum was a major concern for many teachers. "There is very little time for anything around here - rarely do I get a chance to just explore". Many of the teachers interviewed could see the potential for telecommunications in the curriculum but felt that there was no scheduled time to learn how to use and integrate it into their instruction. However, most teachers admitted that they were not prioritizing the

time to learn to use the technology. "Some of my colleagues are finding the time, but I'm too busy trying to stay up with my class - there is only so much energy".

Support

Teachers at both schools emphasized the importance of support from the principal, administration and parents, to release the funds for the necessary hardware and the time for inservice training for the teachers. The technology coordinator at School 2 commented that:

> Even with a keen and aware staff, if you don't have this support you're lost. The principal can encourage people to use it. If he uses it himself and sends people messages on email then they can't argue with him. But if he doesn't do that then there's less encouragement to use it".

It was interesting to note that the principal of School 1 did not use telecommunications to any extent. The teachers found that to be an inconvenience, but when questioned further said that it was his way of protecting himself against a deluge of communications from students and teachers. The research literature reveals that the leadership provided by the school principal and technology coordinator in directing the development was a critical element in successful implementation (Muir, 1991; Scrogan, 1989).

The role of the administrator of the telecommunications system was also a crucial factor, at both schools, in whether people used the system or not. They provided the technical support and the link between the changing software and the teachers. While many teachers felt that this support was available, their schedules did not allow them the opportunity to get together with the technology coordinator, and that was a great hindrance to their using the system. Many teachers felt that the support needed to be more proactive:

> It would be a lot better if someone could feed me information on things from the Internet that would be useful. We need a support system that is really supportive and not just waiting for you to ask them something.

> No-one has shown me how to do it. I could probably do it but I'm afraid of wasting time and losing stuff. Other staff have made it their priority and have gone for help and received it, but the foremost thing in my mind is to use the computer for report cards and keep up with my class.

Many teachers believed that the school should have a common goal and purpose for learning to integrate telecommunications in teaching and learning. "We should be learning as a school community and not each doing our own little thing. Be involved with each other".

A summary of the factors which teachers felt had hindered them from realizing the potential of the system were:

* Limited hardware."Our school is high tech and we have a core of computer people that are always striving to get more out of technology and we still find that a problem."
* Not understanding the software and being comfortable with it.
* Not knowing the applications and what the system can do.
* Time constraints and curricula demands. "We are asked to do a lot of things in the school these days".
* Organization; where the computers are is a big concern because they're not that easily accessible to classroom teachers.
* Different levels of experience of teachers and students.
* Attitudes of teachers who don't see a personal application of telecommunications in the school system (they are in the minority, approximately 7%).
* Convenience, sometimes it's easier to write a note.
* Not knowing whether people are reading their mail and not answering.
* Too much junk mail.

Implementation

School 1 and School 2 differed in how they made telecommunications available to their students. At School 1 the teachers went into the computer laboratories to use computers and in some cases, telecommunications, in their teaching. They were assisted in the technical area by the full-time computer support staff person. Supervised telecommunications use was available to students in the form of a computer club. Students could join the club if they had previously arranged a project in consultation with their teacher. The educational focus was on global projects with long term goals. Other than that, students accessed the system during lunch, and before and after school. At School 2, all the students were exposed to telecommunications during a course called Unified Arts, which was part of the enrichment program. The teachers of this course believed that they were providing students with essential exposure to information technologies and the focus was on sparking students' interest in technology. At School 1 the teachers are trained to use computers and are encouraged to use computers in their instruction, whereas at School 2, teaching students to use computer technology is kept separate from the main curriculum, although teachers are encouraged to use them in their teaching.

The teachers found that being part of the development of the telecommunications software project had its ups and downs. An important reason why teachers had not used telecommunications for projects in their classrooms was because the system had not been totally reliable. "The software needs to be flawless if we're going to integrate it into our school day because unreliability is worse than not having it at all". While the teachers understood that they were assisting in developing the software, nonetheless, they felt that an administrative type of manual would have improved the implementation process. The administrator at School 2 advocated an evolving manual that would have saved

having to phone for support repeatedly. It would have also lightened the administrator's load with regard to helping teachers use the system. Although help was available through online lessons teachers could not access the lessons until they knew how to use the system. For some teachers changes were being made too rapidly, sometimes daily. This was especially true for the system administrators. "When there are twelve hard drives it's an hour-long job to upgrade them all - daily! When do I have the time to do that?"

Teachers felt that the introduction and implementation of the system in the schools could have been done more formally and that communication could have been better between the developers and themselves, the testers. It took a while for teachers and students to hear about and catch on to what telecommunications was all about. The students found out about using telecommunications from their friends and the teachers felt that they would have liked to have been formally introduced to telecommunications and invited to use the software. The teachers suggested that inservices should have been formally planned to show teachers firstly, how to use the system and secondly, how to implement telecommunications into their curriculum areas. They suggested that at the beginning of the year the classroom teachers should spend a few days demonstrating how to use telecommunications to their students - what it's uses are, how not to use it, and it's benefits. They believed that the school should have had a common goal and a plan for how the system could be used in the various curricular areas. Some teachers suggested that the next step could be for them to volunteer their classrooms to pilot curriculum uses, ethics, and behavior requirements.

The opinions of the teachers, regarding the implementation of telecommunications in their schools, are supported by the literature that indicates one needs to support implementation over a long period of time (Fullan, 1991). To

be really effective the implementation plan needs to consider and cater to the individual teachers' needs.

Decision Making

School 1 and 2 differed in the decision making processes with regard to implementing telecommunications. At School 1, a group of lead technology teachers made the decisions regarding the technology in conjunction with the administration. Some of these expert users perceived that: "We have got a lot of technical support and the administration is really good about getting us what we want". There was a very different response from some of the novice users. In their experience:

"Certain people in the school have got the biggest slice of the pie - they've got the hardware, software, expertise and are hogging all of this, not sharing it". One teacher was resentful of having to put pressure on the administration for over a year to get the minimum of technology that she needed, while other people had more clout and were getting the technology they requested. The majority of the teachers ranged from being novice, intermediate and non-users of telecommunications. The expert teachers formed a smaller group and worked independently of each other in the area of telecommunications. At School 2 the decision making process was more collaborative. All the teachers, including the non-users, felt that they had been invited to become part of the implementation process. Nevertheless, some teachers believed that their needs were being neglected in favour of people who were able to articulate their demands more forcefully.

The teachers who did not use telecommunications felt that they would need the opportunity to spend a lot of time familiarizing themselves with telecommunications in order to be able to use this technology in their instruction. Since this time was not being scheduled for them, they did not feel that they were

able to make learning to use telecommunications a priority. These teachers felt that they needed a focus to force them to see what was there. "I haven't been forced or nudged to get online and increase my own knowledge. I've wanted to, but I need guidance and someone to push me". The literature supports this need for leadership (Fullan, 1991).

Teacher Development and Training

"It's sometimes hard to define what you want in professional development when you don't know what's available or what you need". The technology coordinator at both schools had provided a voluntary workshop and one-on-one training to help teachers to use the system. However, they saw that regular sessions of staff development would be necessary to show the teachers the full uses of the software. They suggested that at the beginning of each year the teachers spend two or three days getting to know the system and then regularly review how it can be used in the classroom throughout the rest of the year. This would also help new staff members, who had possibly not been exposed to the level of computer technology that was available at the two schools, to get the training they needed. Many teachers were in agreement with this and felt that one training workshop was not enough and that they would get better use of the system through on-going inservices. One teacher felt: "I need frequent immersion in order to get it". Another teacher commented:

> I think the technology was placed in the school rather quickly and a lot of teachers got bogged down or even turned off because there's too much happening too fast and we need a few days of inservice so that people can get more comfortable with what's available and see the potential value of using it.

The teachers at both schools believed that they needed a demonstration by the lead teachers of exactly how telecommunications could be used in the classroom, and in their subject area of the curriculum. They felt that a technical

manual that used language that everybody could understand was critical if this technology was to be used in their teaching. One teacher suggested that they, the teachers, should have an opportunity to criticize the wording, presentation and style of this manual.

Training programs are most successful when they target specific participants. By knowing the perceptions of the different sub groups of teachers, designers of inservice courses can meet the specific needs of teachers (Woodrow, 1989). The schools needed an operational plan as a whole, both for individual teachers in the school and those coming into the school over a period of years. All the teachers were at different levels of expertise, interest and acceptance of the new technology. "I need consolidation of what I know now and then to go on specially for me and my needs". In addition the teacher pool was dynamic, with staff coming and going, removing expertise and support in some cases, and adding needs in others.

Summary

Attitudes

Many of the key issues identified in the research in educational change literature were mirrored in the responses of the teachers in this study. According to Fullan (1991), and Maddux (1990), implementation is successful when a new program or innovation becomes part of the fabric of a school and change has occurred not only in the use of new materials but also in fundamental changes in teachers' beliefs, values and attitudes. In these terms, the implementation of telecommunications at both schools was reasonably successful. The technology had become part of the daily lives of the teachers with about 75% of the teachers using telecommunications at some level (see Table 2). In addition, the majority of teachers had positive attitudes (67%) and wanted to improve their use of

telecommunications in teaching and learning (65%) (see Table 3). This is in contrast to the analysis of the trends in the literature that Collis (1992) completed, which suggest that despite strong enthusiasm for telecommunications-related activities among the students and teachers who become active in the area, the majority of teachers in a school make no use of telecommunications (Collis, 1992).

Users and Non-users of telecommunications formed two distinct groups. Users had significantly more positive attitudes towards the uses and effects of telecommunications on teaching and learning than Non-users. They were concerned about the effects of this technology on students and wanted to work with other staff in integrating the new technology into their instruction (see Table 5).

The teachers at School 1 had more positive attitudes towards telecommunications than the teachers at School 2 (see Table 4). They had given thought to integrating telecommunications into their instruction and were satisfied with the overall operation of telecommunications in the school. Teachers at School 2 however, were significantly more concerned about their students access to computers for use in telecommunications than the teachers at School 1 (see Table 4). The fact that School 1 was a lighthouse school in the area of technology with four computer laboratories equipped with state-of-the-art computer hardware and software, clearly gave them an advantage over School 2 which was not equipped with the same level of technology. This difference between the schools was not fully taken into account by the developers of the telecommunications system. School 2 was expected to achieve the same level of implementation, with the comparatively little they had in terms of hardware, compared with School 1. These findings are supported by the literature which suggest that a major hindrance in implementation of technology is the underfunding of projects (Collis, 1992; Fullan, 1991; Pink, 1989).

Decision Making

The literature shows that concerns about integrating a new technology into the curriculum are reduced when the majority of the teachers are involved in the process and committed to the program (Fullan, 1991; Wedman and Heller, 1984). Concerns about the decision making process was not a big issue for the teachers at both schools. Only 23% of the teachers had concerns about the decision making process for the implementation of telecommunications. By being included in the implementation process and having some control over the implementation of the program these teachers could ensure their own and their students' needs as been properly addressed. Under these conditions, teachers attitudes towards the program and commitment to its success were positive.

Leadership

Leadership from school administrators remains essential (Fullan, 1991; Muir, 1991). From this study it was evident that leadership provided by the schools' technology coordinators in directing the development was a critical element in the success that was achieved. The interviewees gave recognition of the unusual level of support they received from the coordinating teacher at both schools. They were seen as being able to solve any problem regarding the technology as well as supporting the teachers and facilitating the successful implementation of the new technology. However, this leadership would have benefited from the active and enthusiastic support of the schools' principals. This might have improved the participation level of the teachers integrating this technology into their instruction.

Concerns of Time and Access

The implementation of telecommunications in the schools was linked to how individuals made significant changes in their practice. Fullan (1991), and Fullan & Miles (1992), stress the importance of attaching personal meaning to the innovation

to the success of change. The interview data revealed that teachers evaluated the technology as individuals and assessed whether it was worth the investment of time, energy and personal commitment. They made their assessments based on the practical aspects of their experience. At School 2 the teachers were concerned about access to resources such as computer hardware. Teachers at both schools were concerned about access to the technology coordinator's time; time to learn how to use the technology and integrate it into their classrooms and the amount and level of inservice that was offered in support of learning to use the technology. These findings are supported by the trends from the research literature that show that time problems, particularly relative to the rigid scheduling typical in schools, in the area of adequate preparation and adequate student access, were major concerns (Collis, 1992). These two problems - time and access - continued to hinder most of the use of telecommunications in the schools, no matter what the level of teacher support or software design. For telecommunications to be implemented successfully attention must be given to the personal concerns and involvement of individuals, for change only occurs as individuals change (Cicchelli & Baecher, 1989; Fullan, 1991; Hall et al., 1979).

Peer Collaboration

The findings from this study showed that the most experienced users of telecommunications needed to work with other staff in maximizing the effects of the technology on learning, more than the other groups (see Table 12). Writers on educational change have suggested that we look for ways in which the privatism of teachers can be changed (Fullan, 1991). However, in reality factors such as time, access to computers and curriculum demands limited the possibilities for collaboration. While these constraints persist, serious contemplation of peer collaboration using telecommunications is unlikely. Little (1987), has focused on the importance of collegiality to motivate staff towards their own improvement and

development. She considers the organizational structure and working environment to be a most important influence on teachers' commitment and willingness to change.

Teachers may plan and consult with each other but will rarely cooperate on issues which threaten their classroom autonomy and which opens up their practice to intrusive scrutiny (Hargreaves, 1992). This could explain why non-users and less experienced users of telecommunications had less need to work with other staff than their more experienced counterparts. An environment or culture that supports collegiality, risktaking, sharing goals and expertise will support growth and change and so facilitate the implementation of a new technology.

Inservice Training

Training programs are most successful when they target specific participants (Woodrow, 1991). By knowing the perceptions of the different subgroups of teachers, the managers of the implementation process and the designers of teacher inservice courses can meet the specific needs of teachers. Eighty-four percent of the teachers in this study rated inservice training as essential to the integration of telecommunications into their instruction. In the interviews, novice users expressed the need for individualized inservice training that involved regular, hands-on workshops, with small groups of their colleagues who were at the same level of expertise. These teachers were not interested in different workshops but wanted time to learn the basics of how to use telecommunications and then progress to how to use this technology in their teaching. Other teachers who were intermediate users wanted time on their own: "Some of the best inservice was time to just sit and work through it yourself". This is supported by the research literature that reveals that as with computers in education, the importance of providing appropriate and affordable teacher training and support emerges as a critical issue. Teachers need specific training as well as on-going support in order

to effectively use telecommunications in the classroom (Collis, 1992). Little has been written about teacher inservice courses specifically for use of telecommunications in middle schools. Schrum (1988) described a teacher training institute that focused on educational telecommunications use that did attempt to blend technical skills with the application of the technology to the curriculum, through the production of model lessons. Observations were made that teachers differed in their preference for help, some preferring help in written form and others through group discussions. Learning style differences among teachers were important, some wanted to be left on their own to experiment, others preferred working in small cooperative groups where they could continually turn to each other for support. This study showed that the concerns of teachers can be used as clues to determine where teachers are in the process of change, and subsequently, what inservice activities are appropriate to meet their specific needs.

Goals and Support

Strong enthusiasm for telecommunications-related educational activity was found among the teachers who became active in using the technology. According to Riel and Levin (1990), and Collis (1992), although people are excited by the experience of telecommunications in itself, the majority of users need support and some external motivation. The initial enthusiasm that people have shown and the potential of this technology in enhancing teaching and learning does not in any way lessen the urgency of these needs. The most important factor leading to successful networks is the shared meaningful function that the network serves for the participants. In other words, the focus or goal of the network must meet the particular needs of the teachers and students that are involved in the system (Riel, 1992a). A crowd of people who share an opportunity to communicate is not a group; it lacks organization and a shared purpose. Group organization is as important in electronic settings as they are in face-to-face settings (Riel, 1992a).

At both schools, attention needed to be focused on the structure of the social groups using the telecommunications system, the coordination of activities in, and between the schools, and the definition of the educational outcomes of these efforts. Network designers must carefully consider the group structure and participants' common goals before they will be able to design an electronic structure that helps people achieve their goals.

CHAPTER 5: CONCLUSION

This study sought to examine the perceptions and roles of teachers towards implementing telecommunications in middle schools through a review of the literature, and using quantitative and qualitative research. While the quantitative and qualitative results were separately interesting, the combination of the two did indeed reveal a clearer picture of the perceptions and roles of teachers in implementing telecommunications in the two middle schools. The findings from the study show how the teachers in this study view telecommunications, the uses and effects they have experienced, the challenges they face and the needs they have in the implementation of this technology.

Implications for Schools

The general attitude of the majority of teachers in this study was positive towards telecommunications in teaching and learning. However, the findings from this study and the literature reveal that there are a number of obstacles to telecommunications use in schools. Certain problems are repeatedly present and relate to difficulties in getting equipment, setting up reliable connections with networks, establishing good partnerships in the case of computer-mediated communication and dealing with cost. Until these tangible problems are overcome little more can be achieved in terms of integration of telecommunications into the curriculum. Less tangible factors can also critically affect the educational use of telecommunications. These factors relate to pedagogical, managerial and inservice challenges associated with the use of computer-mediated communication and online data bases in the school setting. Until the affective needs and concerns of teachers when planning computer related inservice activities are addressed,

teachers will not be able to fully integrate telecommunications into their classrooms.

Limitations of the Research

Researchers always go into a study with their own ideas about what they will find. Studies where there is one researcher are particularly in danger of exhibiting researcher bias. Methodological layering was used in this study to reduce researcher bias, nonetheless the study must reflect the personal biases of the researcher.

The demographic portion of the questionnaire was reviewed by a number of people but did not have any reliability analysis done on it. The reliability analysis done on the perceptions portion of the questionnaire revealed only a moderate reliability of the subscales. The quantitative component would have been improved by further development and refining of the questionnaire.

It should be noted that the sample came from only the two schools that were studied and was relatively small ($N = 55$). Significant differences were found between the schools. They are distinct and cannot be representative of schools in general. These results therefore cannot be generalizable to middle schools but can only provide trends that may validate the patterns found in the literature.

The qualitative component of the research was limited to the attitudes and perceptions of the respondents at the point in time that they answered the questionnaire. The more ethnographic approach of multiple interviews conducted over a longer period of time would have improved this component of the study. Developing this theme would also involve classroom observations to find out actual teaching practices to compare with the reported practices.

The non-random selection procedure of the interviewees weakened the study. The opinions of people who volunteered to be interviewed were likely to be

more positive towards telecommunications than those who did not volunteer, and therefore could not be representative of the whole population.

Consequently, the results of the study may not be generalized to a wider population with any great degree of confidence in their validity and reliability. This study may provide insights for other schools wishing to widen their technology program to include telecommunications and at the very minimum the results should serve as a guide for future work that could be generalized more definitively to larger populations.

Recommendations based on Research

Schools wishing to broaden their technology program to include telecommunications should address three areas to ensure successful implementation:

1. **Technical** - overcoming technical and logistical difficulties. Providing access and time to implement.
2. **Social** - thoughtful management and facilitation of group processes on the system. One of the factors for success is the amount of attention paid to the human, non-technical aspect of the messaging system.
3. **Curriculum** - a purpose, or focus of the system, within the different curricular areas, to stimulate and structure the participants' attention and contributions to the system. There needs to be a match between the participants' interests and the learning network purposes.

This study revealed that there were a number of hindrances to the implementation of telecommunications at schools. These aspects should be considered when implementing a new technology, such as, telecommunications:

1. The telecommunications software was developed with the whole school and many people were put off the technology by the teething problems. It would

have been advisable to use the lead technology teachers in the school to work through the developmental stage and then present it to the school for implementation.

2. It is essential to provide ample and easy access to computers for both teachers and students. This includes organizing the computer lab schedule so that it is available to teachers when they need it.
3. Time must be provided for teachers to learn to use the technology through formal inservice training and regular on-going sessions with the technology coordinator.
4. Regular, formal access to a technology coordinator, who preferably should be in a full-time or part-time capacity, must be possible as well as informal contacts with experts in the school.
5. Classroom teachers should be encouraged to use the technology and not delegate the computer learning experiences using telecommunications to the computer teachers or aides.
6. Enthusiastic leadership from the principal who cultivates a supportive environment, makes resources available and offers incentives is a key component to successful implementation.
7. The negative perceptions that some teachers have towards the technology must be considered and training provided to meet their individual needs.

The literature supports the view that a major reason for failure to implement innovation has been the inattention accorded the individual user involved in the change process (Cicchelli & Baecher, 1989). The inservice training for teachers who are implementing a new technology, such as telecommunications, should be matched to their individual levels of concern about the new initiative. Features of successful inservice training would include:

1. Clearly defined goals for the technology both at the school level and individual teacher level. A teacher who has been personally productive will want to empower students in the use of telecommunications.
2. Hands-on development of the teachers' knowledge and skills at the individual level of expertise and at the pace required by individuals, possibly through small group sessions.
3. Support with integrating telecommunications into the different curriculum areas. This would include materials designed to use telecommunications and provision of documents that provide working models for curriculum development.
4. On-going review of telecommunications use and support that meets the changing needs of teachers, preferably by a fulltime technology coordinator for the school. This study found that the technology coordinators were teaching full-time with little time available for helping teachers.
5. The teachers who used telecommunications at home had an easier time integrating this tool into their teaching. Educator purchase programs or computer loan programs to encourage teachers to use this technology should be explored.

Recommendations based on Literature

Change does not lie with communication technology itself. It is the teachers and the strategies they use to incorporate the technology into their educational practices that make the difference (Teles & Duxbury, 1992). For the teachers and students who have been involved in this experiment in educational telecommunications there has been excitement and enthusiasm which needs to be focused before the momentum is lost. There has also been a component of frustration and confusion that comes with new and undefined social roles, technical

difficulties with the communication system and unstructured educational activities. Riel (1992b) found that:

> Studies of network projects have found an extremely low success rate (1-2%) among projects that are introduced by individuals on open structure, free access networks. Open computer access to people in distant locations does not, in itself, stimulate creative thinking or integration of ideas. Informal and unfocused discussions on networks are time consuming and offer little in terms of lasting educational change. But careful planning has lead to some success in constructing new learning environments for students. (p. 221)

Riel (1992a) proposes four general recommendations to teachers wanting to set up computer networking. Firstly, to avoid matching students one-to-one with students at a distance for the task of exchanging friendly letters in a pen-pal project. The cost to teacher and learning time is far greater than any educational gain that occurs. Secondly, to network with more than one other classroom. The work settings of teachers are highly unpredictable and there may be a change in teaching assignment, or computers are reassigned and are no longer available for the project. The additional schools will enrich the activities and provide the added insurance that the project will continue. Ideally there should be five to ten classes on a networking project which provides maximum diversity and still allows an intimate level of exchange. Thirdly, to have a well-defined project with a beginning and ending date and a written product. This provides structure and goals to which participants can be committed. Fourthly, network projects are most successful when they are part of the larger framework of activities that take place in the classroom. An effective way to integrate networking is to select part of the instructional unit that can be enriched by information from different locations.

Riel (1992a) and Riel and Levin (1990) compared learning networks of people connected by telecommunications that succeeded with those that failed, and isolated some of the important features of network development. The designers

and managers of the implementation of telecommunications technology in a school should consider the following areas before setting up an electronic network:

1. The organization of the learning network group - its size, common knowledge and interests, past experiences, and the physical location of the participants. This is important because if people can meet in hallways and staffrooms then there is less motivation for them to use telecommunications.
2. Network task organization - the types of activities that participants engage in over the network should be structured and focused while allowing teachers the flexibility to teach the curriculum their own way. There should be links between the on-line tasks and the curriculum.
3. Response opportunities - the ease of access, through software and hardware, to the interaction, social, and technical resources.
4. Response obligations - the formal requirements for a response to a message and the quality of the exchanges on the network.
5. Evaluation and coordination - monitoring and assessing the quality and quantity of the exchanges on the network.
6. Support - the amount of time and money spent on the technology in the school should be matched by the amount spent training staff and facilitating successful integration in the classroom. The focus should not be on the technology itself but how to use the technology as a tool in teaching.

Implications for Further Research

Computers and modems have made it possible for the teachers and students at the two schools to participate in educational telecommunications projects with learning partners who are neither seen nor heard. Telecommunications technology has been implemented and has been a vehicle for accessing information and developing new collaborative relationships among the teachers, their students and

between schools and other institutions. The teachers of these schools have the potential to help students acquire a deeper understanding of cultural, historical, political, and geographic knowledge from well structured, educational exchanges via electronic networks. However, one needs to ask what learning had taken place at these schools over this new medium? This study found that very little educational use had been made of telecommunications - it had been used mainly for personal communications and as an auxiliary activity for students. There is potential for these activities to become a major element of the education of students. The focus of the innovation was to make telecommunications available to as many students and teachers as possible in order to test and develop the software. In this context, the two schools were successful in implementing telecommunications. The teachers were now ready to move on to the next phase; that of integrating the technology in their classrooms.

In such a new field, where telecommunications is an innovation within an innovation in education, it is clear that much is required of the teacher. Building a community of educators and students through online education is not simply a technical matter of installing telecommunications in schools. For the teachers involved in the predominantly successful implementation of telecommunications in the two schools, the process was one of balancing a variety of goals, practices, hindrances and needs at a personal level. The findings from this study suggest that the implementation of telecommunications in school classrooms is a complex process, one that focuses on issues well beyond the technology of software and hardware. This study has revealed that there is a wide range of pedagogical, social, cognitive and affective issues that bear on the effective adoption of telecommunications in schools. Further research is necessary to determine which approaches to computer-mediated education will break down the isolation of

schools and facilitate learning and whether these approaches are applicable to other schools.

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APPENDIX A: Letter of informed consent

I am researching teachers' perceptions of the use and effects of telecommunications in teaching and learning. As part of this study I will be conducting individual audio-taped interviews with teachers.

Your participation in this study is voluntary and you may withdraw at any time. The interviews will be kept completely confidential. Audio tapes will be stored in a locked filing cabinet. Your anonymity will be protected in the study through the use of pseudonyms and the audio tapes will be erased after transcription is complete. Your decision to participate or not participate in this study will not affect your employment or advancement.

Your assistance in this research is appreciated. Thank you for your time and cooperation.

Yours truly

Nikki Burger
Graduate Student, Faculty of Education
University of Victoria

I consent to participate in this research study on teachers' perceptions of the use and effects of telecommunications in teaching and learning. I understand that my participation is voluntary and that I may withdraw at any time. I also consent to having my interview session recorded by audio tape and I understand that the information that I give will be kept completely confidential.

Signature:_____

Date:_____

APPENDIX B: Teacher Interview Schedule

Uses and Attitudes.

Establish a common understanding of what "telecommunications" means in this context. My understanding is : Email, bulletins, internet. An extra tool of the computer that will require changes in the organisation of the school.

1) What does telecommunications mean to you?
2) How are you presently using telecommunications? (Probe: %personal, % in teaching)
3) How do you expect telecommunications to be integrated into the curriculum in the future, both at a personal level and in general?
4) How is/will the integration of telecommunications be useful and beneficial to you and your students? For regular instruction, enrichment and /or remediation?)
5) Do you feel you have a positive or negative attitude towards telecommunications in teaching and learning.

Sources of their beliefs

6) What in your past experiences do you think makes you feel this way? (Probe: what positive or negative influences have there been? Do you feel anxiety or intimidation from computer experiences? Unconfident about your ability to use telecommunications? See it as a valuable tool?)

Concerns and support

7) Are you satisfied, overall, with the implementation and operation of telecommunications in this school?
8) What are your concerns/hinderances to use about telecommunications in this school? Comment about:
-access to computers,
-time to learn and integrate,
-support of the principal,
-technical support,
-preparation for use and inservice training in integrating into curriculum,
-your ability or aptitude,
-implementation process and decision making process

-hardware limitations, software failures,

9) What suggestions can you make about these concerns?

10) What professional development would you like to participate in to prepare you to use telecommunications in your teaching?

Role Changes

11) Has telecommunications changed your classroom in any way? (Probe: For non users have there been any oblique impacts. Please comment on:

- changes in being in authority (challenges in discipline and classroom management),

-changes in being an authority (new expertise required where some students are experts),

-teaching style to that of facilitator,

-changes in culture/general feeling of the school.

-change in expectations of students

- change on teacher/student relationship eg allows students to mail teachers

Student concerns

12) Have you seen any changes in your students since telecommunications was introduced to the school? (Probe: attitude towards school, towards learning, teachers, students?)

13) Have students been adequately prepared for using telecommunications, ie in the ethics, rules etc?

Others

14) Do you think it is important to work with other staff to maximise the effects of telecommunications in learning? How might this happen?

15) How has/may telecommunications affect your relationships with other teachers? (Probe: Are there groups of users and non-users, has it put pressure on you?)

16) Do you think that telecommunications may reduce the sense of isolation that many teachers experience?

17) Do you have any other comments you would like to make about electronic messaging?

APPENDIX C: Questionnaire

RETURN TO BOX IN FRONT OFFICE BY: 30 MARCH,1995.

Name:

TEACHER PERCEPTIONS OF THE USES AND EFFECTS OF TELECOMMUNICATIONS IN TEACHING AND LEARNING

Please respond to the following items in terms of your present feelings or concerns about your involvement or potential involvement with the integration of telecommunications into your instruction. Thank you for taking the time to complete this task.

TELECOMMUNICATIONS = EMAIL, INTERNET, BULLETIN BOARDS etc.

0	1 2	3	4	5
irrelevant	not true of me now	somewhat true of me now		very true of me now

1. I have not given any thought to integrating telecommunications into my instruction.
0 1 2 3 4 5

2. I would like to interest my students in using telecommunications in their learning.
0 1 2 3 4 5

3. I am concerned about not having enough time to integrate this technology into my instruction.
0 1 2 3 4 5

4. I believe that technical support is essential to my use of telecommunications in my instruction.
0 1 2 3 4 5

5. I would like to coordinate my effort with others to maximize the effects of telecommunications on learning.
0 1 2 3 4 5

6. I think it is important to know what other staff members are doing in this area.
0 1 2 3 4 5

7. Telecommunications may help to reduce the sense of professional isolation that many teachers experience.
0 1 2 3 4 5

8. My role will change to that of facilitator when I am using telecommunications in my classroom.
0 1 2 3 4 5

9. Telecommunications will not improve this schools' technologies program.
0 1 2 3 4 5

10. I am concerned about student access to computers for use in telecommunications.
0 1 2 3 4 5

11. The support of the principal is essential to the integration of telecommunications in teaching.
0 1 2 3 4 5

12. I am concerned about the way telecommunications was implemented in this school.
0 1 2 3 4 5

13. I would like to improve my use of telecommunications in my instruction.
0 1 2 3 4 5

14. I am concerned about how telecommunications affects the students' total school experience.
0 1 2 3 4 5

15. Inservice training is essential to support me in my integration of telecommunications into my instruction.
0 1 2 3 4 5

16. I am concerned about my inability to manage all that is required to use telecommunications in my instruction.
0 1 2 3 4 5

17. I don't believe that my teaching style is supposed to change as a result of using telecommunications in my instruction.
0 1 2 3 4 5

18. Based on my experience as a teacher, I see telecommunications as a valid tool to assist students' learning.
0 1 2 3 4 5

19. I am satisfied with the overall operation of telecommunications in this school.
0 1 2 3 4 5

20. I am satisfied that I was adequately prepared for using this technology in this school.
0 1 2 3 4 5

21. I am concerned about time spent with non-academic problems (ie. system failures, hardware/software problems, etc.) related to telecommunications.
0 1 2 3 4 5

22. I am concerned about who makes the decisions about the use of telecommunications in this school.
0 1 2 3 4 5

Demographic Self-description

23. Female____ Male____

24. Age: 20-29_____ 30-39_____ 40-49_____ >50 _____

25. Highest degree earned: Bachelor____ Masters ____ Doctorate ____

26. Total years teaching: 1-5_____ 6-11_____ 12-16_____ 17-34_____

27. Subject Area: _____

28. How long have you been involved in integrating telecommunications into your instruction?

never_____ 1 _____ 2-5 _____ >5 _____ years

29. In your use of telecommunications in instruction, do you consider yourself to be a:

nonuser_____ novice_____ intermediate_____ old hand_____ past user_____

30. How often do you use telecommunications for professional purposes?

not at all_____ daily_____ weekly_____ monthly_____ other (specify)_____

31. Have you received any training in using telecommunications in your teaching?

Yes___ No ___ If Yes, state where and with whom_____

WOULD YOU BE WILLING TO GIVE A SHORT INTERVIEW (30 MINUTES) WITH THE RESEARCHER, NIKKI BURGER, TO TALK MORE ABOUT YOUR USE OR NON-USE OF TELECOMMUNICATIONS?

IF YES, PLEASE PRINT YOUR HOME TELEPHONE NUMBER IN THIS SPACE AND SHE WILL CALL YOU TO MAKE AN APPOINTMENT.

HOME TELEPHONE # _____

I require a summary of the results. Yes___ No___

VITA

Surname: Buirski Burger Given Names: Nicolette
Place of Birth: London, England.

Educational Institutions Attended:

Rhodes University	1977 to 1981
Rhodes University	1988

Degrees Awarded:

B.Sc.	Rhodes University	1981
Higher Diploma of Education	Rhodes University	1982
B.Sc. (Honours)	Rhodes University	1989

Honours and Awards:

University of Victoria Scholarship	1993
University of Victoria Fellowship	1994-95

Publications:

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Title of Thesis:

Teachers' Perceptions and Roles in the Implementation of Telecommunications at Middle Schools

Author [redacted]
Nicolette Buirski Burger
August 31, 1995