RURAL SCHOOLS AND TECHNOLOGY: CONNECTING FOR INNOVATION

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ABSTRACT

Placed within the context of rural teaching and learning and the use of new technologies, this paper presents a comparative study of three technological approaches to the presentation of curriculum in schools. Supported by three different research projects in one Canadian province, it highlights three areas of e-learning: the use of video conferencing to deliver curriculum to children in five rural schools (Barter, 2004), web-based distance education implemented by the Ministry of Education to deliver academic courses to students in rural and remote areas (Barter, 2011), and a lap top computer-based project with a class of intermediate students (Barter, Murphy, Hardy, Norman & Pack, 2004). Including a literature review, the paper provides a brief background of each project, outlines the results, and then discusses the impact such projects can have on education. Two projects (video conferencing and Ministry of Education delivered distance education) are described and then discussed through the responses of practicing teachers, while the third (lap tops for learning) is explored through the reflections of participating teachers as well as those from consenting junior high students.

Accepting that the three projects represent a largely localized instance of curriculum research, they are used as a 'stepping off point' that serves to highlight the challenges and successes in implementing curriculum through multiple forms of technology that can be expanded to a wider audience. The paper does not delve into the effects of different technology applications. Rather, it focuses on the effects of implementation in general. The intent is to present the successes and challenges of the three projects as examples that may help educators to identify and define theoretical aspects of technology leadership and lead to further understandings about how users may experience its implementation and use. The three projects and an extant literature indicate that innovations involving technology are process driven. They bring opportunity as well as challenges that stretch the limits of teaching and learning. As a result, the effective use of distance education, in any form, requires consistent, extensive support for both students and teachers.

INTRODUCTION

There is an interesting video by SMARTEduEMEA that traces the advancement of technology over time (www.youtube.com/watch?v=UFwWWsz_X9s). The video begins with cave drawings from 30,000 B.C.E. and moves on to Pythagoras Academy, 510 B.C.E.; paper made in China, 105; manuscript transcripts, 1382; Gutenberg printing press, 1450; and so on up to the audiovisual age of the first half of the 20th century, to the information age of the latter half of that century and finally to the computer age of the 21st century. The video demonstrates Ursula Franklin's (1990) point in a CBC Massey Lecture Series on the world of technology that, "Technology has built the house in which we all live" (p. 35). According to Franklin, people's lives are framed within a technological story and there is "hardly any human activity that does not occur" within it. It has changed our reality of time, personal and social space, and place. It has enfolded businesses, schools, governments, and others in a technological web. It includes "activities as well as a body of knowledge, structures as well as the act of structuring" (p. 14). Franklin (1990) reminds us that North America has one of the most extensive technological infrastructures in the world, an infrastructure that is re-shaping the educational landscape for both teachers and students, especially those in rural regions. Newfoundland and Labrador, Canada, is certainly one example of a rural province that has demonstrated its leadership in virtual learning (Clover & Harris, 2005; Barbour, 2007; Barter, 2011).

LITERATURE REVIEW

There is a growing expectation that the education system should be equipping students for life in what has been termed the knowledge society. Many (i.e. Denkyirah, [2009] on technology and special education; McGovern, Laird, Bowman, & Williams [2009] on rural medicine) point to technology as one of the greatest change agents to exist today both within the realm of education and within the work force. According to Franklin (1990), technology is a system involving "organization, procedures, symbols, new words, equations, and … a mindset" (p. 12). In 1996, Johnson noted that "the potential of the World-Wide-Web (WWW) as an educational resource becomes apparent as the amount of resource material on the internet continues to grow" (p. 2). It is seen as a new approach to learning that takes classes to the students and encourages students to be self-directed learners. True to Johnson's observations, the world-wide-web in conjunction with other forms of technology have advanced in leaps and bounds. By 2006, Jacobsen was arguing that globally, the world-wide-web has become a mainstay, in varying degrees, in such areas as communications, business, health care, and education. Despite its widespread application, technology, at least in education, still has its challenges, creating issues for those responsible for its infrastructure and for program delivery as well as for its recipients. For some, it provides services that otherwise would not be provided, for others it is met with mistrust and frustration. As Clover and Harris (2005) discuss in their research involving coastal communities, "the digital revolution" (p. 22) brings dream and nightmare, advantage as well as challenge.

For rural schools and communities, it is a dream to those seeking ways to: (a) meet the needs of non-traditional students, (Barter, 2011) (b) support geographical out-reach, (c) increase course capacity often inaccessible to rural students (Barter, 2011), (d) foster economic competitiveness (Russo & Campbell, 2004), and (e) enhance one's "ability to create and distribute resources to personalize and individualize learning" (Kopp & Crichton, 2007, p. 2). It becomes a nightmare when it represents challenges. Three, the pace of change, struggles around access, and the lack of discussion on its limitations are described by Clover and Harris (2005). First, changes occur so quickly that many people are never able to catch up either technologically or financially. Second, there are those who believe that technological change does not serve all groups of people equally, that conflicts and power struggles exist around access that are often excluded from the research. Third, there has not been much discussion on the limitations of technology and the challenges people have owing to those limitations. As Barker and Hall (1994) suggested almost two decades ago, research on the "use and availability of educational technologies in rural schools, is lacking" (p. 126). Similarly, for Clover and Harris (2005) it is evident that as implementers of education, we sometimes do not pay attention to the context and need of technology. They believe that people's needs are secondary to the technology implying that research on the technology itself takes precedence over what it is that people get from it. According to Bereiter (2003), "… much of the literature on learning technology … trumpets a revolution that is assumed to derive solely from the potentialities of the technology and its radiating effects on practice" (p. 61). Hence, as already indicated, there seems to be little research discussing these challenges, while the literature (Jacobsen, 2006) indicates that we, as educators, regard E-learning and technology to be a critical component of education.

To summarize, although there has been considerable progress as described in journals and other literature there is much that is unknown about the practice of implementing technology into schools. Technology, despite its images of success, also carries with it challenges that sometimes stretch both the strengths and limits of teaching and learning. This paper focuses on the limited setting of technology in schools, placed within the context of rural teaching and learning and the coming of new technologies to demonstrate that innovations involving technology come "primarily through processes rather than patented products" (Harasim & Calvert, 2002, p. 1). One project involves the use of video conferencing to connect five schools in one remote region of Newfoundland and Labrador (NL), Canada. The second involves research with rural teachers who report on their experience with Ministry of Education (henceforth referred to as the Ministry) led distance education and the third describes the implementation of lap tops into one intermediate classroom – one class of Grade 8 students in one school. The remainder of the paper provides a brief background of each project/research study, a summary of the successes and challenges, with future considerations.

BACKGROUND OF THE THREE PROJECTS

Video Conferencing

As principal of a local high school in eastern Canada in the late 1990s, I was looking for alternate ways to provide educational programming for students that they could not avail in the regular system. In small communities, schools are challenged with low student populations and not enough trained teachers to cover the wide range of course offerings accessible to larger schools. Courses such as advanced mathematics, multiple sciences (chemistry, biology, and physics), and foreign language are often either set aside or offered every second or third year in order to ensure the provision of a core program required for student graduation that prepares them for future levels of training and education.

The solution for our school was to partner with several agencies to bring high speed Internet and video conferencing (VC) to five coastal communities in our region that could be used to 'teacher share', which means having teachers in different communities share their teaching workload across schools using VC. As an example, instead of having two teachers in two different communities teaching two streams (basic, which ensures graduation and academic, which ensures university entry) of students at the same time (i.e. multi-coursing), one teacher could teach the basic course to students in both communities while the other teacher teaches the academic course to both schools. This decreases the workload for both teachers.

Our school, with approximately 300 students (grades 7-12), was the largest of five schools on the coast and the staff of 12-14 teachers struggled to meet both the basic and academic needs of students. We were a rural high school which, at the time, was too big to be allocated and funded distant education equipment through the Ministry, but yet too small to be able to offer enough courses to meet student needs and demands. Much staff time was put into three-year plans of course offerings and scheduling to provide the courses required for school graduation as well as to provide courses which many students would need to experience success at the university and college levels.

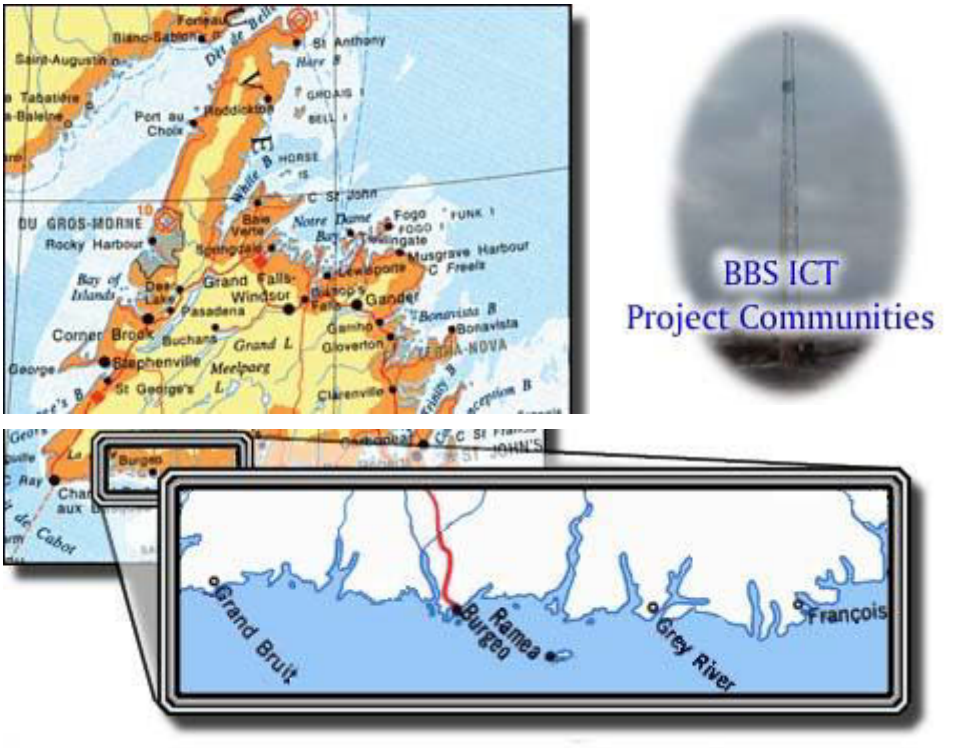
With a government formula in place to determine teacher allocations and increasing demands on the school, one of the few avenues the school viewed as an option for enhancing curriculum offerings and delivery was technology. At that time, around 1995, the school had only a few computers, and a dial-up Internet system that was slow and unreliable. We began seeking ways to provide more for students through government funding and community partnerships. By the year 2000 the school had a partnership with several agencies, the four other remote communities in the region, and a local broadcasting station. From the partnership, the broadcasting company was seeking a cable upgrade for its local community while the schools and other agencies were looking for up-to-date computer equipment which included high speed Internet and VC.

At the time that our school was experimenting with these alternative forms of curriculum delivery, it also became part of a newly consolidated school district whose mandate was to provide education services for 5100 students in 27 communities situated within a diverse 18,000 square kilometre geographic area. Under the consolidation, I became Assistant Superintendent of Programs - responsible for curriculum delivery. For the District, the geographic remoteness of some of its communities coupled with the sparse population provided opportunities to continue addressing the challenges for the delivery of quality and equitable curriculum choices for students that I had experienced as a former principal in one school.

One of the modes of delivery for many schools in the District included the web-based distance education developed by the Center for Distance Learning and Innovation (CDLI – Provincial Ministry of Education). Our District also continued the VC initiated by our coastal region as a means of enhanced curriculum delivery, and embraced the partnership between the Local Broadcasting System and the five coastal schools, with VC being used to provide support in curriculum areas (i.e. French, music, language arts) not covered by CDLI.

The five communities that began this project are situated on the south west coast of NL, Canada (as shown on the map below). Populations range from approximately 25 to 2000 with access from the

four smallest communities to the outside world by ferry or helicopter. The community of 2000 (Burgeo) is connected to the provincial highway system by a 148 kilometre secondary highway.



(http://www.bbsict.com) BBS ICT Project

Starting as a cooperative community project, satellite systems were set up in the five remote communities to enable them to access high speed Internet and video conferencing services. The school in each community received a pro-share VC system called Polycom (www.polycom.com) for visual connection with peripherals (microphones for vocal communication, webcams, and network components such as email). The larger school coordinated the process and housed the lead or base teacher. Through coordinated schedules, the teacher from the base community logged on to a school in another location. Programmed cameras and microphones were connected between the receiving school and the delivery school and both the teacher delivering the course as well as the students, stood or sat before the cameras for each lesson. In some instances the teacher taught a class at the base school and students from the distant school connected to the class to participate in the lesson. For courses such as music, a teacher sat in an empty room, linked by camera to the distant receiving school.

Center for Distance Learning and Innovation

Although forms of distance education began in the province of NL, Canada in 1988, the Center for Distance Learning and Innovation (CDLI) was officially founded by the Ministry in December, 2000. Primarily, the model is Internet Protocol based in that it is delivered to schools through the use of computers, networks, and the Internet (www.cdli.ca). It is a mode of education delivery in which teachers and students are in different places geographically, virtual to each other, and communicate with each other through electronic forms of correspondence (i.e. whiteboards, email).

This form of E-learning provides students in remote areas with courses that are required for high school graduation as well as entry into post-secondary education. The primary technological resource of CDLI is the Internet which facilitates its other aspects and currently include: headsets for vocal communication; webcams for visual teaching; tablets for writing; Desire2learn, a course management software program that includes discussion forums, shared calendar, internal e-mail, and course web pages, for asynchronous communication; and Elluminate live, a voice over Internet software, for synchronous communication and Polycoms for visual monitoring of students. According to Barbour (2007), through this system "teachers regularly utilize the course calendar to

post upcoming work and assignments, deadlines, and a notification for quizzes and tests. Teachers also regularly use the internet e-mail system and discussion forums to communicate with their students outside their synchronous class time" (p. 4). At the time of the research, telephone and faxes were also used for communication and information transmission. Virtual teachers deliver curriculum in such subject areas as mathematics, language arts, and science to students from several communities across the province.

In 2006, I began research on current issues in rural education where teachers recounted the challenges of teaching. The inquiry design and implementation was grounded in theories of constructivism (Glesne, 2006) and personal practical knowledge (Connelly & Clandinin, 1988) that position teachers as holders and makers of knowledge and focused on teachers' stories of practice (Barter, 2011). These included: a lack of qualified teachers, diversity in student programming, adequate curriculum delivery, teacher workload, bussing, and student access to extra-curricular activities. Teachers called for research to be undertaken and urged that, government departments and other institutions responsible for teacher training need to understand the value of rural education and of small schools. One of the prominent issues identified was the impact the delivery of distance education through CDLI had on schools.

Learning in Technological Environments (LITE)

In 2001 the same School District, which was involved in the VC project and responsible for 27 schools in the southwestern region of NL, began to develop its Strategic Education Plan – a process that involved all employees who identified one of the required strategic directions as technology. Based on the development process of identifying the technological strengths and needs of the District, it was believed that it could not meet educational demands with the existing offerings both in hardware and professional development. Under the guidance of the Director of Education, the District set as its goal to be at least on par with the province, if not above in the use and knowledge of technology. Besides working with the Ministry to progress CDLI as well as with the five remote communities experimenting with VC, one of the District's terms of reference was to explore innovative projects that placed an emphasis on the integration of technology specific to our District. The plan that emerged was to integrate technology within the curriculum that exposed junior high students to teaching and learning that focused on meeting curriculum outcomes through the use of personal lap tops. The initial goal was to create a paperless classroom.

The project, founded on the principles of participatory action research (Kemmis & McTaggart, 2000), began as a pilot scheme to find out: what a digital classroom, where all students and participating teachers used lap tops, would look like; how it would function for both staff and students; and what educational value it might have for students and staff. The administration, staff and students maintained logs and journals to monitor progress and a program specialist from District Office worked closely with them to assess the progress, determine their needs, and provide support. There was also an ongoing dialogue with parents and a three-year commitment (both in infrastructure and personnel) from the School Board in support of the pilot scheme. We wanted to create a total education experience that was of direct educational use for all those involved. School participation and public meetings led by District Office were used to draw on people's knowledge and experiences in technology and enhance learning for all. The method was very much participatory in that the District identified its intent to work in collaboration with teachers, students, parents, and community to create what we hoped would become a long term sustainable learning plan at the pilot school that could be replicated in other schools.

CONSIDERING THE RESULTS

This paper re-presents three different forms of e-learning: the use of VC between regional schools as a way to increase the number of courses accessible to students as well as to decrease teacher workload as it pertains to multi-grading and multi-coursing; web-based distance education implemented by the Ministry as a way to make more courses accessible to students in remote areas; and the use of lap top computers as a means to enhance student and teacher learning. These projects exhibited varying degrees of differences in their implementation processes, while also having common threads. Before

looking at the differences and similarities, challenges and successes, a summary pertaining specifically to each project/study is provided.

VC

The assessment of the VC, over a three year period, included information from two surveys (2003, 2004) that were sent to four of the five schools involved in the project, letters from some of the teachers involved with delivering programs through video conferencing, and that were initially collected for the establishment of a mega District report. Survey questions included: What subject(s) do you teach through VC? What successes have you experienced? What are some of your challenges? What recommendations do you have for future work using this medium for curriculum delivery? Two interdependent concerns surfaced from the information communicated by the teachers. One was technical and the other, pedagogical.

According to the teachers who provided the information, there are several technical factors to consider in the use of VC equipment for teaching purposes including connectivity, reception quality, and sound. They indicated that in order to ensure that teachers and students get optimal service there are operational procedures which need to be kept in mind. One is the compatibility of the equipment used in each community. As an example, sound delays resulted when speakers, microphones, and hard drives were not properly matched. Although with some courses students and staff had learned to ignore it, the delay became a hindrance in courses such as music where sound synchronization is critical for establishing a steady beat to accommodate rhythm patterns. In addition, according to teachers, people need to be cognizant of the respect required to operate and move such expensive, high ended equipment from one class to another. They found that careless handling led to dysfunctional equipment. They recommended that, as much as is physically possible, video conferencing teaching should be scheduled in one room to minimize movement and damage to equipment. A second issue was that the project was completely new and had to progress from a dial-up system to a wireless system that could connect five isolated communities, three of which (one, an island, and two in fjords) were situated to the east of the lead school, and a fourth, situated to the west. It was a technological feat owing to the geography and existing infrastructures that took a decade to see progress towards an effective high speed Internet system. During that time, teachers attempting to deliver programs often found themselves at their 'wits end' trying to work with and around the technology.

Pedagogically, since the District could find no similar teaching via video conferencing that could provide guidance, teachers were left to solve problems by themselves. With no other instruction than their own experience, they relied on the practices they knew, face-to-face traditional classroom teaching. This did not prove to be successful as students on camera in another school often felt left out as teachers tried to cope with the technology (i.e. intrusion of the camera in the class, poor visual and sound reception) and teach two groups of students (in-class and virtual). Although the project began with courses in science and language arts, in the end, only one subject (music) remained a constant offering between the schools as teachers and administrators, frustrated with the lack of support opted out of course and/or teacher sharing. By the time District Office personnel were coming to realize the need for teacher support, the District was being consolidated with two other boards for a second time, resulting in personnel change. According to some of the study participants, the report recommending pedagogical support was never addressed. The fact that music was the only course to survive may be credited to a couple of factors. One, the teacher who had been hired to teach the music program was also hired with the expectation that music would be taught to the communities in that region using VC and the teacher remained in that position for several years. Second, there may have been recognition that in small, remote schools, the chances of being supplied a music teacher for each school is as remote as the schools themselves. Ongoing teacher layoffs and redundant courses were evidence that if some alternative form of delivery such as VC was not used, music would be removed.

Teachers involved in the VC project made it clear that, for them, this mode of delivery was not meant to replace any of the existing face-to-face instruction but rather, was meant to enhance current teaching. It was seen as a way to interconnect communities for curriculum and professional development sharing even though there is evidence that neither curriculum sharing nor professional

development was happening. Teachers described the project as a work-in-progress that required experimentation and problem solving through dialogue and professional development. It should be noted that there was also mistrust among teachers and administrators that more technology in the schools could result in a loss of existing teaching staff, placing their own jobs at risk. These results may help to explain why, at present, VC remains in the initial schools as a way to teach music with no indications of growth or expansion of use among communities or their schools.

CDLI

The data for this research project came from three sources: small group discussions of practicing educators enrolled in a distance education graduate level course, individual discussions of consenting participants, and the instructor's questions and responses arising from the first two. There was an open forum where current issues in rural education were posted and discussed. The responses of 15 consenting educators (See Barter, 2008) were anonymously collated to create 750 pages of dialogue that were further color coded based on the three research questions: (a) What are the current issues of education in the community in which you teach? (b) How do these issues compare to those pointed out in the literature? (c) What do you think supporting agencies such as governments and universities need to be doing to advance rural education?

Participating teachers made clear that technology while it is inevitable in today's world and provides opportunities for student access to more courses, also creates challenges. Participant enthusiasm and support for CDLI stemmed from their concerns that their students receive "an optimal education" (Barter, 2008, p. 36). It "alleviated some of the frustrations for rural educators, students, and parents" (participant response, p. 36). However, their responses also showed four main areas of concern. First, distance education as a medium for learning is not suitable for all students. Some students are comfortable with such a medium, while others are not. Participants from the study indicated that when students have no alternative but to choose courses through distance education, they sometimes make decisions that negatively affect them for future study in that they choose not to enrol in the course. Second, quantity and quality of technology equipment and reception are a challenge in that, communities and schools have varying degrees of suitable infrastructure. Some schools operate on a dial-up service while others have dedicated lines or high speed connection. Attempting to meet the needs of these diverse infrastructures creates delivery challenges for both schools and Ministry. The third issue focuses on teacher workload. Even though virtual teachers are assigned to students, teachers already assigned a full course load in the schools, often assist students by supervising and tutoring when the virtual teacher is unavailable. They also support the virtual teachers by sending and receiving faxes, administering examinations, and so forth. Hence, there was a feeling among participants in the study that, although CDLI is offered province-wide as a solution to programming issues for rural students, there is no consideration given to the fact that it also imposes extra responsibility on teachers within the schools. Depending on the size of the school, rural teachers often find themselves having to multi-grade, multi-course, or multi-subject teach. Many of them do this with very little, if any, preparation time during their regular teaching day. For some of those who have preparation time, they use it to supervise students who are on-line. Thus, for teachers within this kind of teaching and learning environment, CDLI increases their workload. The overall benefits and challenges (Barter, 2011, pp. 40-41) are listed in Tables 1 and 2.

Table 1: Benefits

Benefits of Distance Education (DE)
Alleviates frustrations for rural educators, students, parents
Helps make students independent learners = better prepares students for university
Provides students with courses they are unable to obtain in regular class, i.e. more sciences, advanced math, and fine arts = fills in the gaps & increases selection
Gives students more options, i.e. obtaining requirements for university
Provides alternate ways for educators to talk to each other = professional development
Provides another way for teachers to achieve professional certification

Table 2: Challenges

Challenges of its Implementation
Requires much more commitment from students than regular class
Is not for all students = suited for a particular kind of learner and marginalizes others
The human factor = loss of personal contact with class and instructor = "peers [are] just names and not people"
It discourages some students from doing academic courses
Students waste instructional time i.e. playing internet games rather than logging into a "virtual class"
Requires supervision from someone physically in the building = increased work load for teachers in the schools
School set-up for virtual classes = some are away from regular classes, i.e. in a computer room or some existing room re-structured for distance education (DE) creating an ineffective functioning environment for the learner and/or supervisor
Some students encounter the stresses of DE with those of long distance bussing
Inadequate technology infrastructure
Technology services = big districts & small number of technicians
Volunteer assistance required from teachers within the school when the DE teacher is not available
Boundaries created between regular teaching staff within schools and virtual staff
Problems with coordinating provincial schedules with those of schools, i.e. class start times, lunch, etc.
Insufficient technology training for teachers in the use of DE

Hence, one has to look at the general effects of policies and practice. Distance education is assigned to schools without input from teachers in the receiving schools. Participant responses indicate that their issues were beyond the control of teachers, especially those in the schools, even though they often placed extra workloads on themselves in order to meet the needs of students involved in distance education learning

LITE

Owing to the number of active learning participants in the lap top project, many layers of implementation were experienced. District Office's approach was to set the criteria for schools,

partner with parents, partner with communities to build on existing networks and expertise, and provide support to make it all happen (Barter, Murphy, Hardy, Norman, & Pack, 2004). Drawing from anecdotal reports through student and teacher journals, the project was considered to be quite successful. Students said that coming to school was no longer a chore and assignments were more enjoyable. Teachers, likewise, reported that the change in their teaching had been very rewarding since they now found themselves acting as facilitators in each of their courses. At the district level we learned that, although we provided the tools, the tools could only be maximized if teachers received adequate training and "that they transfer these newly developed skills into interactive and innovative classroom strategies that spark student creativity and interest" (Barter et al., 2004, p. 10). It was very much research-in-action.

Schratz (1993), in reference to Altrichter, emphasises that action research gives "practitioners a voice in educational research by making them reflect on their professional action" (p. 3). Unlike traditional research, in action research the researcher researches his or her own practice. It is characterized by "inserting individual findings into a critical professional discussion" (Altrichter, 1993, p. 51). It lends itself to some sense of risk as the educator is prepared to discuss the experiences outside the walls of the classroom, to share them with colleagues and others. Since it seeks full collaborative inquiry by all participants, it challenges the claims of neutrality and objectivity boasted by the traditional social sciences (Sumara & Carson, 2001). Its field text is that of the experience of the participants as they work through the process of implementing the project. Its participants maintain a commitment to local contexts. That is what happened throughout this project: participant and researcher were as one, as those engaged in the project inquired into their own practice and shared in the experience of the inquiry.

Moving theoretical thoughts into practice usually implies a paradigm shift. For both the District and the School this project required personnel and board trustees to think beyond the norms of curriculum delivery. It moved us out of our comfort zones and challenged the way we did things. The fallout of that shift was positive in that we believed the process changed the way we did things. It encouraged higher-order thinking and embraced the constructivist approach to learning and teaching at all levels. For that to happen, planning was critical. Being able to set goals, meet objectives and develop strategies were critical. Professional development and support were critical.

As is the case with many new initiatives, we learned that there was a time requirement. District Office, teachers, students, and parents had to be willing to invest in the process. Flexibility was a must. There had to be a willingness for those involved being open to suggestions, and being prepared to try new means of delivering curriculum both at the District and School levels. People had to recognize that not everything worked all of the time. It was anticipated that things would break down. Teachers and students learned to define goals that were attainable, for example, developing a curriculum website for the class, using e-mail and video conferencing software, creating tests and sharing them with others, holding a virtual exchange with another class, using an Excel spreadsheet to teach a mathematical concept, using Power Point to do group presentations, and so forth. It was important to reflect on teaching and learning practices and the nature of both. Another thing we learned from this project was that mentorship was important. The success of the program depended, to a great extent, on the ability of those involved to support one another and to build on existing expertise. And, that was what in fact happened. There was an extraordinary principal who initiated the dialogue and established the parameters around which school staff was willing to work. There was also a strong pedagogue at the District level who worked closely with the principal and participating staff. And, there were energetic experienced teachers who were 'open' to doing something different, as well as technicians who maintained a functioning infrastructure.

Some of the findings at the end of Year 1 were that teachers had reacquainted themselves with the joy and challenge of learning something new (one of the teachers was a 30 year veteran). They experienced new ways of thinking, learning, and expressing their knowledge through collaboration with both colleagues and students. Authentic opportunities to learn with/from students emerged. Teachers told us that their sense of professionalism and self-esteem were elevated. We found that thoughtful discussions about the nature of learning and the purpose of school became routine and sometimes passionate. The project provided teachers the ability to collaborate with teachers around the world. They were thinking innovatively as new scheduling, curriculum, and assessment

structures emerged. Moreover, District Office personnel listened, observed, questioned, and moved with the school rather than in opposition. However, by year 2, similar to the VC project, the District was embroiled in a Ministry consolidation plan that merged it with two others. And, although some of the projects proponents saw the project through to the end of its three years (2007), many did not. According to one participant (personal communication, 2013), the project lost some of its momentum as the process of consolidation took precedence. In hind sight, this may have been a valuable research site to observe at least some of the impact on schools from educational reform. On a more positive note, I was recently told (personal communication, 2013) that a new LITE project began in the same school this current school year.

IMPLICATIONS: SUCCESSES AND CHALLENGES

There are several factors to consider when looking at different forms of educational technology and the impact it has on schools. First, these projects are examples of strategic initiatives that support a fundamental shift in direction and/or a change in the way we, as educators, use technology in order to provide services necessary for the best delivery of education that can be provided for children. The literature (Franklin, 1990; Johnson, 1996; Kopp & Crichton, 2007) continues to indicate the embeddedness of technology into society and the need for those responsible for education to access computers using appropriate information, applications, systems, and communications technologies that improve and maximize learning, productivity, and performance on a regular basis. Technology has untapped promise if it is applied meaningfully - providing a medium that enhances education and furthers the implementation of curriculum for both students and teachers. However, in order to do so, those responsible for its implementation have to be aware of what may be required to experience positive change/growth. Current literature (Knowles, 2004; Sclater, Sicoly, & Grenier, 2005) warns that the effective use of distance education requires the presence of consistent, extensive support. That was evident in each of the three projects reported here. Particularly, it is a reminder that technology-based approaches not only need to provide students with courses, consideration must also be given to teachers within the schools who often become the invisible catalysts of student success.

Second, in the three projects discussed in this paper, there were a combination of interdependent technical and curricula challenges; technical issues often impaired curriculum delivery. These were less noticeable in the LITE project where more partners, especially parents, teachers and District Office personnel, became involved and time was provided to allow for a successful process of implementation. When it comes to technology as one of the primary tools of curriculum delivery, the source, capability, and quality of that delivery is key. If the technical glitches that are often encountered can be overcome, teachers delivering the programs, I believe, can overcome the challenges of pedagogy. The data indicated that teachers could not do both at once - address technical difficulties and teach at the same time or teach in such a new environment without adequate support from those responsible for teacher professional development and curriculum delivery. As the Vice-Chancellor of the University of Southern Queensland stated "without a new pedagogy, the technology will fail" (as cited by Hofmann & Dunkling, 2002, p. 2491). Earlier research (Barter, 2008) indicates that teachers are up to the challenge; they simply require support.

Third, as indicated in Table 3, schools in partnership with others formed the basis of the projects but the degree of collaboration and co-operation varied from project to project.

Table 3: Project Partnerships

Video Conferencing	Centre for Distance Learning and Innovation	Learning in Technological Environments
School District 5 schools Local Broadcasting Station Town Council Regional Health Board Provincial Library Board Bell Aliant Phone Company Federal Government funding Provincial Government funding	Provincial Ministry of Education (there may be more partners at this level) School Districts Schools	School District & participating personnel Participating school Consenting teaching staff Consenting students Consenting parents Local Credit Union National computer supplier

In the VC project there were several partnerships, but they were more financial than curricular. Each had its own agenda for being part of the project (i.e. the local broadcasting station wanted upgraded cable, the library board was looking for Internet access for the public, and the health board was exploring VC for health services). Hence, enhancing student education was only a portion of the project intent rather than everyone's focus. From that perspective, the pedagogical support required to grow this project for education was not there. Writers such as Miller (1995) contend that, although economics is interconnected with social and environmental dimensions, we have a tendency to focus on the economics to the detriment of the other two. Clover and Harris (2005) warned that where technology is concerned, people's needs often become secondary. That may indeed be what happened to this project and which, coupled with other invested interests, allowed it, in my view, to stagnate. The infrastructure was purchased, put into place, and built to a standard performance. The communities now have efficient high speed Internet. From what I have observed, VC's use as a means of delivering curriculum to students, providing professional development to teachers, and enhancing communication among communities, has not progressed beyond its initial implementation.

With CDLI, the delivery of curriculum was Ministry led and, therefore, mandated and, from a systems' perspective, has been successful in that it continues a process of implementation that teachers have adhered to with traditional curriculum. And, although there are issues, teachers accept what they referred to as the "inevitability of CDLI" (research study Participant) implementation. Up to the time of the completion of the research (2006), administrators could request to have distance education courses in their schools, but the policies and procedures of the implementation process were external to the school. Similarly, teachers in schools and virtual teachers were viewed as separate providers of education. Virtual teachers were not identified with any particular school or school district, but rather operated somewhere on the periphery. This, to my knowledge, continues to be the case and raises several issues, including: (a) expectations of teacher work (i.e. teachers in schools are responsible for student supervision, extra-curricular facilitations, social and academic connections to space and place); (b) teacher workload (teaching duties, supervisory duties, parent meetings, teacher representation on school councils, etc.); (c) professional development and teacher collaboration and collegiality. These have the potential to create professional learning silos for both teachers within schools and virtual teachers who have no connection to a school. The silos arise from the professional teaching space and place in which teachers find themselves. Regular in-class teachers are in schools, while virtual teachers can be anywhere (i.e. district office, at home, or some other assigned space). If the assumption is made that teaching in traditional face-to-face environments differs pedagogically from teaching in distance education environments and that such differences can create pedagogical gaps in the teaching profession, then the notion that teachers can be physically separated creates another professional divide. In discussing inter-professional

teamwork in health care, Hall (2005) notes that each health care profession has a different culture and that educational experiences as well as a socialization process occurs during professional development and practice that reinforces common values, problem solving approaches, and language of practice. If this is the case for education, this creates gaps between classroom teachers and on-line or virtual teachers that can contribute to the challenges of creating effective professional learning communities. In other words, geographic location of teachers can limit professional interaction and growth. It is possible that each may have little or no knowledge of what the other does. Virtual teachers, for example, may not understand the impact their work has on the workload of teachers in a school. Considering that schools themselves may house multiple areas of specialization and departments – multiple silos under one roof – that can contribute to the fragmentation of academic knowledge and loss of opportunities for interaction with other educators, virtual teaching that is separated from other teaching is open to creating even a greater gap.

In reviewing the data, it was evident that participants in the three projects understood the significance of distance education, but that both technical infrastructure and teaching through technology require attention. The most participatory project from the perspective of curriculum implementation was LITE. School District personnel, school administrators, consenting staff, parents, students, a sponsoring financial institution, and a computer company came together to make the project work. Teaching staff members, who were not interested in participating in the project, were assigned the remaining classes. Invitations were sent to all staff when professional development for the project was scheduled. Non-participating staff had the option to decline the invitation, but some of them attended. The project worked, in that classroom activities shifted from the traditional practices of short, isolated, teacher-centered instruction that focused on basic skills, memorization, and explanation. According to the teachers involved, learning became more lasting, student centered and integrated within the curriculum with real world issues and practices through both synchronous and asynchronous learning. The intent, to meet curriculum outcomes while engaging students and teachers in activities that promoted higher level thinking as they used their lap tops and the Internet to support their learning, was evident in the types of assignments students experienced and the kinds of lesson plans teachers put forth. While engaging in this process they dialogued with each other through email, journal writing and log keeping to observe themselves as they moved through the new learning experience. It was research-in-progress as well as teaching and learning-in-progress. One happened through the other as the teaching/learning action and interaction took place. This affected non-participating staff as some began to take an interest in what was happening in the project classroom. Although the other two projects provided learning opportunities for students, for the most part learning was functional. There were no visible signs of students or teachers being 'hooked on the learning'.

SUMMARY

It can be argued that within the comparative approach of this paper there is no new framework that has been advanced for considering the impact of technology in rural settings. There are no data included that generate a new way of thinking or developing the field of study. Rather, my intent was to raise technical and pedagogical red flags – cautions of the things we, as educators and implementers of technology tend to forget in our desire to advance technology. The use of technology as a means of curriculum delivery has been heralded into our lives enthusiastically by some and with apprehension by others. Naisbitt (1999), similar to Miller (1995) and Clover and Harris (2005), reminds us that the more technology we have at our disposal, the more we need to make sure that the human elements are not overlooked. Naisbitt's work, however, takes us beyond the warning to assure that possibilities exist for a balance between the two. However, to do so, requires a shift in the way we, as implementers of technology, design our learning communities, and view the learning environment around us. As Naisbitt (1999) asserts, there needs to be a responsible balance.

Such a balanced approach, or lack thereof, is evidenced in the three projects discussed in this paper. From a pedagogical perspective the challenges noted are areas of which systems administrators need to be aware, as well as invest more in (i.e., money, time, resources, and training) to ensure the successful implementation of technology. As stated earlier, it requires support and teachers need to be

involved in the process rather than being merely the recipients of implementation. Ministry departments and school districts, in partnership with schools and communities can have a positive educative impact on what happens in schools. Without building strong support and shoring up that support through active policy it is unlikely that projects such as these will have a lasting benefit. As Miller (1995) noted in his work on the role of rural schools in community development, the most successful project is sustained "by ensuring provisions in school district policy that grant them permission and resources to exist" (p. 14). It would be difficult to argue against the notion that technology in its various forms offers great opportunity as a tool for curriculum delivery. However, as indicated by Kuman (2007), the

> *Pervasive usage of Internet technology alone does not guarantee positive gains in instructional objectives. Technology can play only a peripheral role in scaffolding pedagogical processes. The heart of learning lies in effective instructional strategies that efficiently manage diverse educational provisions to optimize students' learning outcomes. (p.35)*

The same can be argued for optimizing teachers' teaching outcomes.

Similar to Norman (2004), I have learned from re-visiting these three projects that social interaction, depth of relationship, professional community building, and trust are not built into technology. For these to happen "instructional design and contact are necessary to enhance the technology" (Jacobsen, 2006, p. viii). With the advancement of modern forms of information technology, educators and Ministry personnel are faced with more complex challenges with initiating and successfully implementing learning through distance education. Paying closer attention to existing research and dialoguing with their staffs (especially teachers) will provide new opportunities for connecting people and creating sustainable e-learning environments - a place where teachers and students get hooked on learning.

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