Rural schools as regional centres of e-learning and the management of digital knowledge: The case of Newfoundland and Labrador

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ABSTRACT

Small schools in rural Canadian communities have had a special role in the development of e-learning and the management of digital knowledge within customized electronic educational structures. In the provision of education to learners in dispersed sites, particularly for those in small schools in rural communities, the school district digital intranet provides a new educational environment that complements and extends traditional schools. Within this digital structure, new processes, including pedagogical considerations that shape e-teaching, have to be considered. The school district digital intranet challenges the traditional educational practice of teachers and learners interacting in closed learning environments and encourages them to consider the possibilities of engaging in open classrooms that are compatible with a knowledge-based economy.

Keywords: Newfoundland and Labrador; Canada; rural education; e-learning;

INTRODUCTION

It could be argued that a new rural education has developed in Canada over the last decade, based on acceptance of e-learning and virtual classrooms (Stevens and Stewart, 2005). Within the new rural education schools have become regional centres for the management of digital knowledge through which they challenge notions of distance, isolation and rurality. It could be further argued that small schools in rural communities have become templates for other schools through their acceptance of modern educational technologies, collaborative teaching and learning and the integration of onsite and online instruction. Schools that have traditionally been considered small in size, based on the number of students that attend, in person, on a daily basis, have, become, to an increasing extent, large educational institutions when the number of students who attend classes virtually is considered.

Over the last decade the introduction of inter-school electronic networks has added a new dimension to education in Canada that is challenging teachers, learners and administrators. Schools in geographically-isolated communities that have traditionally faced difficulty providing instruction to small numbers of senior students, particularly in specialized areas of the curriculum such as science and foreign languages, can now complement on-site classes with specialized on-line teaching and learning. Many rural Canadian schools have been transformed as virtual classes are integrated with traditional, physical learning spaces.

EDUCATION IN NEWFOUNDLAND AND LABRADOR

With the decline in the provincial fishing industry that has always been the main economic activity in Newfoundland and Labrador's coastal communities, rural schools have become steadily smaller in size as shown in the following table.
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Table 1: *Number of Schools By School District 2000-01to 2005-06* *

School District	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Labrador	19	19	19	16	16	16
Western	92	89	85	82	82	79
Nova Central	80	79	79	75	75	70
Eastern	140	134	129	127	125	124
Conseil scolaire francophone provincial	6	5	5	5	5	5
Total	337	326	317	305	303	294

* Department of Education of Newfoundland and Labrador (2006) *Education Statistics – Elementary - Secondary 2005-2006 School Information*

A Decade of E-Learning in Small Schools in Rural Communities

During the last decade a pan-Canadian initiative to prepare people across the country for the Information Age (Information Highway Advisory Council,1997; Ertl and Plante, 2004) has provided impetus for the classroom application of emerging technologies. In rural Atlantic Canada the introduction of the internet and internet-based technologies has had a transforming effect on the capacity of small schools to deliver programs (Healey and Stevens, 2002; Stevens, 2001; 1999a). In other developed countries with substantial rural populations to be educated there have also been major changes in the configuration of small schools in isolated communities. In New Zealand (Stevens, 2000; 1999b), Finland (Tella, 1995), Iceland (Stevens, 2002), Russia (Stevens et al, 1999) and the USA (Dorniden, 2005; Glick, 2005; Schrum, 2005) a variety of communication technologies have been engaged to promote educational opportunities for students and more efficient ways of organizing and managing knowledge in collaborative electronic structures that have implications for regional economies.

The rapid growth and educational application of the Internet has led to a challenge to traditional ways of teaching and learning at a distance (Ben-Jacob et al, 2000) that were based on paper and the postal system. E-Learning is Internet-based and does not require the degree of central control that distance educators have traditionally employed within dedicated institutions. The growth of e-learning in schools has led to pedagogical considerations and to the development of new ways of managing knowledge that enable these institutions to assume extended roles in the regions they serve.

In the last decade two e-learning developments have changed the nature of education in rural Newfoundland and Labrador: (i) the introduction of the opportunity to study online from schools located in remote communities and (ii) the possibility of enrolment in Advanced Placement (AP) courses from rural schools.

Change One: The Opportunity to Study Online in Rural Canadian Schools

As rural schools decline in physical size their viability is often questioned by educational policy makers. The introduction of e-Learning in schools in Canada, as in other developed countries, has been particularly noticeable in rural communities and has been influenced by declining enrolments. The Department of Education of Newfoundland and Labrador (2006) distinguishes between urban and rural on the criterion that cities, towns and metropolitan areas with a population of over 5000 are urban and all other settlements are rural. Table 2 shows a large

proportion of schools in three of the five provincial school districts of Newfoundland and Labrador are classified as rural.

Table 2: *Urban and Rural Enrolment and Schools by School District 2005-06 **

Social District	Urban				Rural				Total Schools	Total Enrolment
	Schools	% Schools	Enrolment	% Enrolment	Schools	% Schools	Enrolment	% Enrolment		
Labrador	6	37.5	2,968	68.7	10	62.5	1,351	31.3	16	4,319
Western	15	19.0	5,685	39.7	64	81.0	8,624	60.3	79	14,309
Nova Central	12	17.1	4,766	34.0	58	82.9	9,246	66.0	70	14.012
Eastern	66	53.2	30,789	70.1	58	46.8	13,131	29.9	124	43,920
Conseil scolaire francophone provincial	3	60.0	83	40.9	2	40.0	120	59.1	6	203
Province	102	34.7	44,291	57.7	192	65.3	32,472	42.3	294	76,763

* Department of Education of Newfoundland and Labrador (2006) *Education Statistics – Elementary - Secondary 2005-2006 School Information*

The search for appropriate new educational structures for the delivery of education to students in rural Newfoundland and Labrador has led to the development of school district digital intranets, within which virtual classes have been organized. In the process of developing e-teaching within school district digital Intranets, several challenges have had to be met. The electronic linking of eight sites within the Vista school district (now part of the Western School District) to collaborate in the teaching of AP Biology, Chemistry, Mathematics and Physics created a series of open classes in rural Newfoundland that became known as the Vista School District Digital Intranet. The creation of the Vista School District Digital Intranet was an attempt to use information and communication technologies to provide geographically-isolated students with extended educational and, indirectly, vocational opportunities. The development of the digital intranet within a single school district involved the introduction of an open teaching and learning structure to a closed one. Accordingly, adjustments had to be made in each participating site so that administratively and academically, AP classes could be taught. The Vista school district initiative challenged the notion that senior students in small schools have to leave home to complete their education at larger schools in urban areas. By participating in open classes in real (synchronous) time, combined with a measure of independent (asynchronous) learning, senior students were able to interact with one another through audio, video and electronic whiteboards. From time to time they met for social occasions and to engage with their science teachers in person.

Change Two: Advanced Placement Courses for E-Learners in Rural Canadian Schools

Advanced Placement (AP) courses enable senior students to begin undergraduate degrees with part of their program completed from high school if their AP courses are passed at grade levels specified by the universities of their choice. The development of Advanced Placement web-based courses in Biology, Chemistry, Mathematics and Physics took place within a team in each subject area. A lead science teacher in each discipline was paired with a recent graduate in each of the

disciplines of Biology, Chemistry, Mathematics and Physics who possessed advanced computer skills including web page design, Java and HTML. The lead teacher and the graduate assistant were advised from time to time by Faculty of Education specialists at Memorial University of Newfoundland in each curriculum area and, where possible, scientists from the Faculty of Science. The extent to which each web-based course was developed by a team of four people varied. Most course development took place through interaction between lead teachers and the recent graduates. Although at times professors had different opinions as to the most appropriate approach to the design of the courses, this model enabled the four courses to be developed over a sixteen-week summer recess period in time for the new school year. Minimum specifications were adopted for computer hardware and network connectivity. All schools involved in the project had DirecPC satellite dishes installed to provide a high- speed down-link. In most rural communities in this part of Canada, digital telecommunications infrastructures do not enable schools to have a high-speed up-link to the internet. Appropriate software had to be identified and evaluated for both the development of the resources and the delivery of instruction within the Intranet. Front Page 98 was selected as the software package. Additional software was used for the development of images, animated gifs and other dimensions of course development. These included Snagit32, Gif Construction Set, Real Video, and similar packages. Many software packages were evaluated and finally WebCT was selected. This package enabled the instructor to track student progress, it contained online testing and evaluation, private E-mail, a calendar feature, public bulletin board for use by both instructor and student, a link to lessons and chat rooms for communication between teacher and student. For real - time instruction, Meeting Point and Microsoft NetMeeting were selected. This combination of software enabled a teacher to present real-time interactive instruction to multiple sites. An orientation session was provided for students in June, prior to the implementation of this project in September. Students had to learn how to communicate with each other and with their instructor using these new technologies before classes could begin.

In eight schools within the rural Vista school district of Newfoundland and Labrador, 55 students were enrolled in AP Biology, Chemistry, Mathematics and Physics courses. While AP courses are a well-established feature of senior secondary education in the United States and Canada, it was unusual for students to be able to enrol for instruction at this level in small schools in remote communities. The advanced nature of these courses requires highly qualified and experienced teachers who are often difficult to attract and retain in small schools in rural communities. Furthermore, small rural schools, because of their size, have few students who are able to undertake instruction at this level. This initiative was significant for rural Canadian education in that it was, as far as can be ascertained, the first time courses at this level were delivered to students who would otherwise not have had access to them because of the size and location of their schools. By introducing AP subjects to small schools in a remote region of Canada, a step was taken toward inclusion of rural people in the emerging knowledge economy. Several graduates of this program were subsequently able to enrol in science and engineering faculties at the local university with a small part of their post-secondary program already completed. Perhaps, more importantly, they entered universities with the knowledge that they could successfully compete academically with students anywhere in North America.

From Closed to Open Teaching and Learning Environments at the Regional Level

The major change for students in the first Digital Intranet in Newfoundland and Labrador was the opportunity to study advanced science subjects and mathematics as members of open classes from their small, remote communities. Students in the Vista school district digital intranet were frequently subject to scrutiny by their peers as they responded to one another through chat-rooms, audio and video as well as with their AP on-line teacher. The digital intranet provided students with access to multiple sites simultaneously, as well as the opportunity to work

independently of a teacher for part of the day. The need to prepare for classes before going on-line became increasingly apparent to both teachers and students if the open, synchronous, science classes were to succeed.

The advent of the digital intranet had implications for students who began to interact with teachers and their peers in a variety of new ways. Many students experienced difficulty expressing themselves and, in particular, asking questions in open electronic classes when they did not know their peers from other small communities. The organization of social occasions for students learning science in open classes in the Intranet helped overcome these problems. As students became more comfortable with one another, inhibitions such as asking questions on-line were overcome. In future, interaction will be both synchronous and asynchronous. The e-teachers had little to guide their practice in teaching at this level for the first time. Each of the four AP science subjects was taught in a different way. For example, the physics and mathematics teachers had little need for video in their interactions with students, but access to electronic whiteboards was critical so that the development of equations and calculations could be managed interactively. For the e-teacher of chemistry experimental work posed a problem because of the dispersed locations of the students. Videos of experiments that were to be conducted in person, at designated sites and pre-arranged times, were found to be useful in preparing students for the laboratory component of the AP course.

In an evaluation of the Advanced Placement experiment rural students commented:

> *"I have been introduced to one of the best teachers I have ever had;"*

This is a significant comment, made by a student about an on-line teacher who was only known at a distance. The highly-esteemed teacher would not have been encountered by this student had it not been for the AP online development. This comment illustrates the possibility of providing rural students with expertise from other than local sources.

Students in the first year of online AP courses in the rural Canadian network were critical of the technical and organizational problems that were encountered. One student noted:
> *"I think these courses are valuable, but there was much confusion early in the year;"*

Other members of the class were critical of the delivery of AP courses within the initial network:
> *"The intranet is unreliable when communicating between numerous sites. There are some slow connections;"*
> *"More use of video would help so that we can see the teacher."*

The experience of working at post-secondary school level through Advanced Placement courses was not, until this development, available to students in small, rural high schools. The intellectual challenge for university-bound students was considered to be useful. One student advised:
> *"If you are planning on doing post-secondary education, do one of these (AP) courses;"*

Another student reported at the end of the school year:
> *"This course has exceeded all my expectations - I believe I have passed;"*

In the process of developing e-teaching and e-learning within digital intranets in rural Newfoundland and Labrador, teachers, learners and administrators had to adapt to a new, electronic educational structure. In the open teaching and learning environment of a digital intranet, participating institutions academically and administratively interfaced for that part of the school day during which classes were taught. This was, for teachers and administrators, a very different educational structure from the traditional and, by comparison, closed educational environment of the autonomous school with its own teachers and its own students. There was

potential conflict between the local school as an autonomous educational institution serving a designated area and schools which become, in effect, sites within electronic teaching and learning networks that, in effect, began to serve a region. Principals and teachers appointed to the closed, autonomous learning environments of traditional schools frequently discovered that the administration of knowledge required the development of open structures within which they were increasingly expected to collaborate with their peers located on a range of distant sites. Many discovered that the positions to which they were appointed in traditional (closed) schools became, in effect, locations within new (open) electronic schools.

The need for increased technical support (Asher, 2005) for the new, open structure became increasingly urgent for teachers and students who were using information and communication technologies to teach and learn across dispersed sites. Both had to be provided with expert advice and instruction in the use of new applications. A particular problem that emerged was difficulty in securing and maintaining instructional design expertise in the preparation and upgrading of courses, although this issue is common in the development of on line courses at high school level (Sweeney, 2005). An essential aspect of the development of open electronic classes was the coordination of both hardware and software between schools. Without synchronized technology, schools cannot fully participate in electronic networks. However, the purchase of appropriate hardware and software was initially a matter of confusion for many Principals, teachers and school boards who had to seek expert advice and support. Many rural schools with open electronic classes realized that the successful administration of a network required shared local technical support. Unless adequate technical support systems could be established, electronic networked classes could, potentially, be curtailed by teachers who argued, with justification, that there was insufficient technical support for their investment in e-learning. While there were doubts by some teachers and administrators about the adequacy and robustness of the technology that was available, the solutions that were sought and the infrastructure that was implemented were at the regional rather than local school district level.

The changes that took place in the closed learning spaces of traditional rural schools in Newfoundland and Labrador with the introduction of a digital intranet and AP instruction online led to a ministerial inquiry into the implications of these developments for the future of rural education in the province. The provincial government, after a ministerial inquiry (Government of Newfoundland and Labrador, 2000) expanded the linking of schools through the creation of the Centre for Distance Learning and Innovation (CDLI) within the Newfoundland and Labrador Department of Education. CDLI (http://www.cdli.ca/) develops and administers online learning that complements traditional classes in schools throughout the province. Since its inception it has considerably extended e-learning throughout Newfoundland and Labrador.

PEDAGOGY FOR E-LEARNING

Pedagogy includes "the complexity of relational, personal, moral and emotional, aspects of teachers' everyday acting with children or young people they teach." (Van Manen, 2002). Teaching in classrooms that are electronically linked to other sites requires different lesson preparation and delivery skills from teaching face to face. For teacher – student interaction in a new electronic structure to be effective, the strengths and weaknesses of the new regional environment have to be understood by everyone who participates. Audio-graphic networking has in the recent past provided schools participating in regional electronic networks with a simple and flexible way of accommodating the diverse needs of learners. Although open Internet-based classrooms may not suit the needs of all students, they provide rural schools with choice in the way they can access educational and, in particular, curriculum opportunities. The student's need to concentrate on the audio lesson to fully participate in it when conducted in an open electronic class between several sites was noted by several participating schools in earlier research in New

Zealand (Stevens, 1994). Students cannot anticipate when they will be asked a question over the audio network, something that encourages preparation for classes conducted with teachers and peers who are not physically present (Stevens, 1998).

Students often have more independence in managing their learning in open electronic classes but most have to be assisted by teachers in the setting of goals, the meeting of deadlines and in evaluating their progress. Teachers are effective in open electronic classes if they can be flexible in ways they enable students to participate in on-line lessons. Strategies and protocols for on-line teaching have to be developed between participating schools if all students are to be able to fully participate. The introduction of a rural school to an open electronic network considerably improves its resource base for both teachers and learners but does not solve all of its problems. A considerable measure of inter-institutional and intra-institutional cooperation is required to develop detailed and effective plans for collaboration. Two new educational professionals have emerged in Newfoundland and Labrador since the Ministerial Inquiry (Government of Newfoundland and Labrador, 2000): e-teachers and m-teachers. E-teachers teach classes across a growing range of dispersed sites through the internet, administered by CDLI. These teachers were initially supported on the sites (or rural schools) within which they provided instruction from a distance by mediating teachers (m-teachers). M-teachers were usually traditional classroom teachers, providing instruction face to face in small schools in rural parts of the province. They liaised with e-teachers about issues on-site that e-learners faced in their courses. Subsequently m-teachers were replaced by m-teams through which on-site technical, pedagogical and personal support was provided. In some rural Newfoundland and Labrador high schools that receive e-learning through CDLI, the Principal and all teachers are the m-team that support both e-teachers and their students.

There are several immediate pedagogical challenges to be considered for effective teaching in a Digital Intranet: Teaching face-to-face and on-line are different skills and teachers have to learn to teach from one site to another. This is fundamental to the success of e-teaching. Teachers have to learn to teach collaboratively with colleagues from multiple sites and have to judge when it is appropriate to teach on-line and when it is appropriate to teach students in traditional face-to-face ways. These judgments have to be defended on the basis of sound pedagogy.

CONCLUSION

The introduction of e-learning at the K-12 level has provided teachers, administrators and, most of all, students with extended teaching and learning options (Dell, 2005; Hawkes and Halverson, 2002). In rural Newfoundland and Labrador a new type of rural education has emerged. An open model now challenges the closed model of schooling by questioning the need for appointing all teachers to schools, rather than to networks of schools. It questions the appropriateness of learners engaging solely with their peers within their own, physical classrooms, and, it questions the notion of the school as an autonomous institution. Awareness that the school is potentially a site within an extended electronic network that can function at the regional rather than local level has economic implications. The school district digital intranet's economic contribution to Atlantic Canada is its demonstration that local intellectual resources can be shared between sites enabling collaborating institutions to provide opportunities for students that would not otherwise be available to them. By developing collaborative pedagogy between electronically integrated learning institutions, small schools in Atlantic Canada have contributed to the regional knowledge economy by providing a template for other sparsely-populated areas of the country, facilitating their participation in a knowledge-based economy.

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