THE DEVELOPMENT OF VIRTUAL EDUCATIONAL ENVIRONMENTS TO SUPPORT INTER-SCHOOL COLLABORATION

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ABSTRACT

The introduction of inter-school electronic networks has added a new dimension to education in Canada that has many implications for students who attend schools in rural communities. Collaborative internet-based teaching and learning and the creation of virtual classes within regional intranets now complement traditional on-site instruction in many schools that are located beyond major centres of population. Five stages in the advent of virtual educational environments can be identified starting with the introduction of computers in schools as a foundation for the development of collaborative teaching and learning environments. Inter-school collaboration in rural Canada and the extension of curriculum options for senior students has, in turn, provided a basis for the integration of virtual classes and traditional face to face instruction. Instruction in classes that are electronically-linked to other classes requires different skills from traditional face to face teaching and the development of new strategies and protocols. The implications of open and flexible teaching and learning for the future organization of classes, the preparation of teachers, articulation with higher education and in particular, regional economic development are now significant educational policy issues. The linking of virtual and face to face classes through cybercells is a possible next step in the development of virtual educational environments.

Keywords: Collaboration, Cybercells, Integration, Intranet, Rural, Virtual

INTRODUCTION

Traditionally, senior students from small rural communities have been encouraged to complete their secondary education in larger schools, most of which are located in urban areas. The urban relocation of the most senior high school students is often a loss for rural communities, initially for the small schools they leave, and, in the longer term, for the communities from which they depart, in many cases never to return. As rural schools decline in size their viability is often questioned by educational policy makers and in many parts of the world they have been closed permanently. Against this trend, e-learning has been introduced in a growing number of rural Canadian schools, on the basis of which new, virtual, educational environments have been created to support and extend traditional classrooms by developing inter-school collaboration.

The internet and an expanding range of technologies have enabled small schools in rural communities to collaborate in addressing the problem faced by senior students of lack of access to advanced areas of the curriculum through the creation of virtual teaching and learning spaces to complement traditional classrooms (Stevens, 2005a). In Atlantic Canada an increasing number of rural schools are being academically and administratively linked to one another, based on the internet, so that teaching and learning can be shared across dispersed sites.

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For the last decade small schools in rural communities have been particularly active in Canada (Healey and Stevens, 2002; Stevens, 2001; 1999a), New Zealand (Stevens, 1999b), Finland (Tella, 1995), Iceland (Stevens, 2002), Russia (Stevens et al, 1999) and other developed countries in adapting emerging technologies to promote educational opportunities for students and more efficient ways of organizing and managing knowledge within interactive electronic structures. Newfoundland and Labrador is characterized by its many small, almost exclusively coastal communities, rural lifestyles and a distinctive history and culture. Approximately two thirds of schools in the province are located in rural communities, far from major centres of population. In rural Newfoundland and Labrador an open model is challenging the traditional closed model of schooling. Classrooms that are linked to other classrooms through the internet on a regular, scheduled basis, are considered to be "open classes." These are different in structure, organization and the teaching and learning processes within them from traditional "closed" classes that have a single teacher and are not linked to other sites. The development of open classes through which teaching and learning can be shared within a school district has led to the creation of digital intranets. School district digital intranets provide integration between participating sites and new academic pathways for rural students as they access an expanding range of subjects online, taught by e-teachers.

FROM CLOSED TO OPEN TEACHING AND LEARNING

The introduction of computers and the Internet to schools in Newfoundland and Labrador took place gradually, in closed teaching and learning environments which gradually became more open. Three stages can be identified in the development of virtual learning to support dispersed communities in Atlantic Canada:

> ➢ learning about the potential of computers for use in classrooms;
> ➢ collaborative learning between schools through the creation of school district digital intranets and
> ➢ the integration of virtual learning across schools at a provincial level.

A question now faces rural teachers and principals: can the successful horizontal integration of schools across rural Canada be complemented by vertical integration whereby community schools bring increased learning opportunities to local homes and businesses?

ONE: LEARNING ABOUT THE POTENTIAL OF COMPUTERS FOR USE IN CLASSROOMS

Five phases can be identified in the introduction of computers in classrooms over the last two decades in Newfoundland and Labrador's schools as teachers and learners gradually realized their educational potential.

Computers as a Subject of Study
In the late 1980's and early 1990's computer technology was introduced to classes with little of no formal training of the teachers who used it. Teachers frequently learnt how computers worked though their own study of them with little help from outside sources. In this phase of e-learning, computers were a subject of study. Some teachers studied computers to find out how they worked and how they could be programmed while, to most of the profession, this technology was not considered to be directly relevant to classroom life. There was little thought given to the integration of computers to teaching and learning.

Computers and Course Re-Development
In the early 1990's the Lighthouse Schools Project (computer networks in schools) was introduced and some teachers began to realize the potential of computers for both teaching and student learning.

Local Area Networks (LANs) were introduced in Newfoundland and Labrador. While there was awareness of the Internet it was not used in Newfoundland and Labrador schools at this time. However, computers were used to capture data for science experiments using Vernier hardware and software. Students were shown how to use word processing, spreadsheets and graphing software in completing their assignments and some entire courses were re-developed around such uses of computer technology.

Internet Access

In 1993 the introduction of Internet access to selected teachers in Newfoundland and Labrador led to the formation of STEM~Net, the provincial arm of SchoolNet, based at Memorial University of Newfoundland. Within a two year period more than five thousand teachers were provided with access to the Internet through STEM~Net. Training sessions were provided in the use of E-mail and the development of web-pages (HTML). Subject area web pages began to appear, initially designed for the assistance of teachers rather than for students. Soon, however, some teachers began to ask for student access to the Internet and from this, the STELLAR Schools project was initiated as a partnership between STEM~Net and Cable Atlantic. STELLAR schools projects facilitated the development of student Internet resources.

Integrating Technologies

By 1996-97 Newfoundland and Labrador schools had a high level of connectivity, per capita. The development of web-pages by students in schools was accompanied by the introduction of other areas of school life to the web such as homework exercises, answers to questions, school policies and schedules of events. Early attempts to bring information technologies into teaching and learning were in the form of text on line and links to other sites (mostly Universities). Internet resources and CD-ROMs became increasingly available to both teachers and learners, facilitating interaction between dispersed sites.

The First Digital Intranet

In eight schools within the rural Vista school district of Newfoundland and Labrador, 55 students were enrolled in Advanced Placement (AP) Biology, Chemistry, Mathematics and Physics courses. Advanced Placement High School courses administered from Baltimore, Maryland and are of post-high school curriculum standard. Many North American universities provide credit towards first year courses depending on the standard of pass obtained. While AP courses are a well-established feature of senior secondary education in the United States and Canada, it is unusual for students to be able to enrol for instruction at this level in small schools in remote communities.

The development of Advanced Placement (AP) 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.

The electronic linking of eight sites within the Vista 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 intranet was an attempt to use information and communication technologies to provide geographically-isolated students with extended educational and, indirectly, vocational opportunities. This was part of a broader pan-Canadian initiative to prepare people in Canada for the Information Age (Information Highway Advisory Council, 1997). 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 had 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 on social occasions and to spend some time with their science teachers in person.

TWO: INTER-SCHOOL COLLABORATION

An essential aspect of the development of open electronic classes was the coordination of both hardware and software between schools. Without coordinated technology, schools cannot fully participate in electronic networks. The purchase of appropriate hardware and software was initially a matter of confusion for many principals, teachers and school boards. Many rural schools with open electronic classes realized that the successful administration of a network required local technical support. Unless adequate technical support systems were established, electronic networked classes could be curtailed by teachers who could argue, with justification, that there is insufficient back-up to justify their investment in e-learning. 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. The need for technical support within it became urgent for teachers and students using information and communication technologies to teach and learn across dispersed sites and both required expert advice and instruction in the use of the new applications.

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 intranet were frequently subject to scrutiny by their peers as they responded through chat-rooms, audio, video and 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. As they became more comfortable with one another, inhibitions such as asking questions on-line were overcome. In the open teaching and learning environment of a digital intranet, participating institutions academically and administratively interface for that part of the school day during which classes are being taught. This is a 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 is a potential conflict between a school as an autonomous educational institution serving a designated district and schools which become, in effect, sites within electronic teaching and learning networks. Principals and teachers appointed to the closed, autonomous learning environments of traditional schools frequently discovered that the administration of knowledge requires the development of open structures within which they are increasingly expected to collaborate with their peers located on a range of distant sites. Many now find that the positions to which they were appointed in traditional (closed) schools have become, in effect, locations within new (open) electronic schools.

Technological changes provide potential new ways for schools and people in the communities within which they are located to engage with one another. When the horizontal integration of learning between schools in digital intranets is accompanied by vertical integration of links between schools and homes within their communities, local and non-local learning is facilitated. For example, small schools in rural communities could provide local people with access to printing and website development (Joyce, 2003).

If senior high school students are encouraged to share their skills with adult members of their local communities in the way they share them with other students within intranets, digital knowledge can be extended to the Canadian adult population. Conversely, the local retired population's knowledge and experience, often an untapped education resource, becomes available to students and can be made available to their peers in other communities through digital intranets. Developments in information technology including cell phones, broadband, wireless technology and, of course, the Internet, assist the expansion of teaching and learning between schools and from schools to local communities. Inter-school collaboration within intranets, particularly if enhanced by school-community learning, significantly extends the educational environment of senior rural students.

THREE: THE INTEGRATION OF VIRTUAL LEARNING

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 (Ertl and Plante, 2004). It is often difficult to coordinate the timetables of networked schools and a considerable measure of inter institutional and intra institutional cooperation is required to develop detailed and effective plans for collaboration (Cavanaugh, 2001).

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 develops and administers online learning that complements traditional classes in schools throughout the province. While many members of the profession will continue to provide instruction in traditional closed environments, an increasing number will teach in open, collaborative, internet-based learning spaces. 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 engage 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 judgements have to be defended on the basis of sound pedagogy—defined by Van Manen (2002) as "the complexity of relational, personal, moral, emotional, aspects of teachers' everyday acting with children or young people they teach."

Teaching in classrooms that are electronically linked to other sites requires different lesson preparation and delivery skills from teaching face to face (Hawkes and Halverson, 2002). For teacher – student interaction in a new electronic structure to be effective, the strengths and weaknesses of the new environment have to be understood by everyone who participates (Mathiasen, 2004). 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 do not suit the needs of all students, particularly those at junior levels, they provide rural schools with choice in the way they can access educational and, in particular, curriculum opportunities for senior classes. Students often have more independence in managing their learning in open electronic classes, particularly if they own their own laptop computers (Lowther, et.al., 2003), 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.

A THREE-STEP PROCESS FOR THE DEVELOPMENT OF COLLABORATION THROUGH CYBERCELLS

One of the strategies online teachers and students may consider is the development of cybercells. A cybercell is a face-to-face group whose members extend their discussion to include virtual visitors (Stevens and Stewart, 2005b). This recent addition to the lexicon of e-learning describes the integration of actual and virtual discussions, meetings and classes and has particular application in internet-based networks of schools. Cybercells provide teachers with opportunities to discuss their respective work with other teachers on-site and on-line, for students to similarly discuss their work with other students and for teachers to engage students in both actual and virtual environments.

The first step in the introduction of cybercells for international collaboration between teachers is the development of awareness of recent changes in school organization in which teachers are increasingly expected to provide instruction between schools as well as in traditional classrooms. The second step in the creation of cybercells for high school teachers is an introduction to the need for professional collaboration for effective integration of actual (face to face) and virtual instruction in classrooms.

Traditionally teachers have been professionally prepared to teach in face-to-face classroom environments that have not been open to other classes. In opening traditional on-site classes to classes internationally for part of the school day, using the Internet, collaboration between teachers becomes essential. A third step in the development of cybercells for the integration of virtual and actual teaching and learning, based on step one (open learning structures) and step two (collaboration), is the building of shared realities within which understandings can be negotiated.

CONCLUSION

The introduction of inter school electronic networks has added a new dimension to education in Canada and is bringing challenges for teachers and rural communities as they move from regional to national to, ultimately, global teaching and learning networks. There are important questions that shape open learning at the high school level in a globalized world: How will increasingly global networks share teaching staff? Will the notion of a school year disappear as schools move from regional to national to international instruction? How will globally-networked secondary school programs, using cybercells, articulate with higher education programs in universities and polytechnics nationally and internationally? Finally, what are the implications for the preparation of high school teachers of increasingly global teaching and learning environments? The educational challenges presented by institutional size and location have opened new possibilities for teaching and learning in Atlantic Canada, challenging the notion of rurality and, ultimately, conventional notions of school structures and processes. Open, flexible learning has provided new opportunities for communities at regional and national levels. The challenge now is to consider the global implications of recent provincial educational policies for the twenty first century (Ben-Jacob et al, 2000). In rural Newfoundland and Labrador the open model challenges the closed model of schooling by questioning the need for appointing all teachers to schools, rather than, in appropriate cases, some teachers being appointed to networks of schools. It questions the appropriateness of learners engaging solely with their peers within their own, physical classrooms, and, it questions the very notion of the school.

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