

Collaborative Professional Education for e-Teaching in Networked Schools

Ken Stevens

Abstract—Networked schools have become a feature of education systems in countries that seek to provide learning opportunities in schools located beyond major centres of population. The internet and e-learning have facilitated the development of virtual educational structures that complement traditional schools, encouraging collaborative teaching and learning to proceed. In rural New Zealand and in the Atlantic Canadian province of Newfoundland and Labrador, e-learning is able to provide new ways of organizing teaching, learning and the management of educational opportunities. However, the future of e-teaching and e-learning in networked schools depends on the development of professional education programs that prepare teachers for collaborative teaching and learning environments in which both virtual and traditional face to face instruction co-exist.

Keywords—Advanced Placement, Cybercells, Extranet, Intranet.

I. INTRODUCTION

IT is often difficult for governments to justify spending public funds providing full high school education in small schools in rural communities where there are usually too few senior students to justify the appointment of specialist teachers. It has therefore been common for senior rural high school students to travel long distances to attend larger urban schools on a daily basis. Alternatively, some senior rural students are encouraged by governments to live beyond their home communities to attend boarding schools, where they are educated in larger, usually urban, institutions in which a full curriculum is available to prepare them for entry to post-secondary education. With the advent of the internet and e-learning a different approach has been implemented in some societies whereby classes in geographically-dispersed schools are electronically networked within intranets to facilitate the sharing of teaching and learning resources.

II. NETWORKED SCHOOL BEGINNINGS IN RURAL NEW ZEALAND

In the early 1990s rural schools in New Zealand faced a crisis common to small schools in geographically-isolated communities in many parts of the world. They were declining in size as parents removed their sons and daughters to send them to larger, urban schools in the expectation that they

The author is with the Faculty of Education, Memorial University of Newfoundland, St John's, NL, Canada, A1B 3X8 (phone +1-709-737-4460; fax: +1-709-737-2345 e-mail: stevensk@mun.ca).

would receive enhanced learning opportunities. The result was that all rural schools in the Canterbury area of the South Island of New Zealand (N=12) were declining in size and competing with one another for students in a struggle to survive. At a meeting of Canterbury rural school principals at the time of the crisis a new approach was considered. Instead of competing with one another for students, a collaborative and co-operative alternative was outlined by one of the rural school principals. From this pre-internet suggestion, initially based on audiographic technology, the first New Zealand network of schools was initiated and became known as the Canterbury Area Schools Technology Project (CantaTech). At the time there was little research to guide the networking of rural schools other than early developments in Iceland [1] and Finland [2].

Following the creation of rural school networks in New Zealand the author had the opportunity to assist in similar developments in rural Atlantic Canada [3]. Research in networks of schools in New Zealand and Canada suggest that, increasingly, rural teachers of senior classes engage with students in both traditional and virtual educational spaces. Unfortunately, few teachers are professionally prepared for teaching beyond their traditional classrooms and are not aware that they will be expected to engage students not only in schools but also in the space between schools that are networked with one another.

III. E-TEACHING IN NETWORKED SCHOOLS – NEW ZEALAND AND CANADA

New Zealand is possibly the most physically-isolated country in the world, while the Canadian province of Newfoundland and Labrador, which is the eastern-most part of North America, is one of the most isolated regions of that continent. Newfoundlanders and New Zealanders have different rural lifestyles. New Zealand has always had a largely agricultural economy in which farming and forestry have traditionally been important. Although many New Zealanders live in rural areas, most communities have easy access to major towns and cities. In Newfoundland and Labrador, fishing has been the basis of the economy until recently when this industry was halted by a government moratorium because of severely-depleted fish stocks. In spite of this, approximately two thirds of schools in Newfoundland and Labrador are still located in coastal, former fishing villages known as “outports”, but many of these are now very small and decreasing in size as people leave the province to seek employment in other parts of Canada.

In both New Zealand and Newfoundland and Labrador there is recognition by policy-makers that a viable rural economy depends to a large extent on schools that are perceived to be at least as good as those in cities. In both countries creative solutions have had to be found to achieve this ideal. Newfoundlanders and New Zealanders have adopted e-learning to provide increased educational opportunities for rural students. In both rural New Zealand and rural Newfoundland and Labrador, e-learning has been introduced to students at the most senior levels of high schools. To support these initiatives the professional education of teachers is now focusing on the need to teach not just in schools but between schools that are electronically networked.

IV. NETWORKED SCHOOL BEGINNINGS IN NEW ZEALAND

In the Canterbury region of the South Island of New Zealand small rural schools have formed virtual classes to collaboratively teach senior students in a range of specialized High School subjects. Both teachers and students in a growing number of rural schools in New Zealand now have tele-presences in multiple sites during the course of a school day. The development of the inter-school network that became known as Cantatech brought twelve rural schools together to consider ways in which teaching and learning resources could be shared. Each school was able to provide its students with instruction in the core subjects on-site: English, Mathematics and Science, as well as instruction in one or two specialized subjects (eg, French, Japanese, Economics, Agriculture). By collaborating in the teaching of specialist subjects between the schools in this part of rural New Zealand, senior students who wished to receive instruction in courses not locally available have been able to access them from a participating site in the Cantatech network. By mutual consent, designated schools in the Cantatech network accepted responsibility for a particular area of the curriculum in which they had a qualified teacher. In return, schools that provided specialized expertise on-line in a designated area of the curriculum could expect to receive other subjects for the benefit of their own students. The Cantatech network encouraged the development of extranets (external networks) to polytechnics and other educational organizations, as appropriate to local needs, to extend educational opportunities for senior students.

Through collaboration in the appointment of specialist teachers on each Cantatech site to avoid duplication of human resources within the network and to encourage the development of the widest-possible range of specialist teaching appointments, each school was able to provide its senior students with access to an extended range of learning opportunities [4, 5]. Teachers appointed to any of the Cantatech schools were expected to be able to provide courses in both traditional (face-to-face) mode, on site, as well as instruction on-line, as required. The development of the Cantatech network brought about many changes in the administrative and academic life of each school. Each school in the network had to academically and administratively interface with each of the other schools in the region and thereby work collaboratively in the interests of a much broader community than its originally-designated local one

[6]. E-learning in the rural Canterbury region of New Zealand demonstrated the value of a collaborative, integrated virtual organization for senior students. The Cantatech network empowered twelve small and geographically isolated schools to deliver an extended range of subjects to senior students. Because of the necessity of finding new solutions to the delivery of education to geographically isolated senior students, each school in the network had to consider the role of information technology in its curriculum. For teachers, students, administrators and people in each of the participating communities, information technology became a means to extend local educational, and indirectly, vocational, opportunities.

V. REPLICATION OF THE NEW ZEALAND SCHOOL NETWORK IN RURAL CANADA

In Newfoundland and Labrador, as in New Zealand, educational policy makers have been challenged to find new ways of providing learning opportunities for students whose homes are located in rural and remote areas, at a time when many such communities have declining populations.

The province of Newfoundland and Labrador has a population of approximately 500,000 people, of whom less than 30,000 live in Labrador. In Newfoundland, the island portion of the province, almost all of the population lives in coastal settlements, including the capital, St John's. Approximately two thirds of schools in the province are located in rural communities. With continuing out-migration most small schools in Newfoundland and Labrador are decreasing in size and during the last decade many have closed and local students have had to travel to larger centres to continue their education. Until recently there has been a category of school in this part of Canada officially known as "small necessarily-existent schools," meaning they are too geographically isolated from all other schools to be closed. Since 1998 there has been consolidation of school boards in Newfoundland and Labrador from ten to four reflecting the reduction in both the size and number of schools in the province. The changes that have taken place in the organization and administration of education in rural Newfoundland and Labrador have influenced classroom structures and processes. In 1998 the first digital intranet was established in which 8 schools in the same rural district were academically and administratively integrated, through the local school board, so that teaching and learning could be shared between the dispersed rural sites. The eight participating schools had to coordinate senior classes in those areas of the curriculum that were taught across multiple sites. Some schools received instruction for senior classes from teachers located on other sites (schools) within the network. Collaboration between schools, teachers and students in the initial teaching and learning network was essential. Classrooms that had previously been closed to one another began to open to classes located in other parts of the district network for both teaching and learning. The autonomy of teachers within their own classrooms as well as their isolation from other members of the profession was challenged by this initiative. Students struggled with the concept of discussing

their work with peers they did not know who participated in shared lessons taught from other locations. The traditional closed, or autonomous, model of the school was challenged by an increasingly open teaching and learning environment. The initial digital intranet 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. The initial electronic linking of eight sites within a school district to collaborate in the teaching of Advanced Placement (AP) Biology, Chemistry, Mathematics and Physics initiated a series of open classes in rural Newfoundland and Labrador. The creation of the first 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 first 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. While technological and administrative changes supported this initiative, adjustments were needed in the professional education of teachers. The structural changes that have taken place in Newfoundland and Labrador since the inception of the first digital intranet, within which initial AP courses were developed and taught, has advanced to become a system that provides online instruction to almost all schools in the province. The provincial government, after a ministerial inquiry [7] 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.

VI. COLLABORATIVE APPROACHES TO THE EDUCATION OF TEACHERS FOR NETWORKED SCHOOLS

Teachers have traditionally been prepared for what have been, in effect, closed, autonomous classrooms in physical schools. It is now necessary to consider the implications of networked, virtual environments that complement traditional schools in the professional education of teachers. Students preparing to become teachers in rural Canadian and New Zealand schools will, to an increasing extent, be expected to contribute instruction to open, networked, virtual learning environments from the schools to which they are appointed. The integration of virtual and actual (face to face) learning spaces provides opportunities to develop collaborative teaching and learning.

Three stages can be identified in the development of teaching and learning in networked virtual environments that have particular application for the provision of education in sparsely-populated regions such as the Canadian province of Newfoundland and Labrador.

Stage One: Development of Awareness of Collaborative Teaching and Learning Structures

Traditionally schools have been established to serve designated communities and in rural areas the school-community relationship is often a very close one. However, schools in any community to a considerable extent duplicate what schools are doing in other communities, with students being taught by teachers assigned to them to teach whole classes face to face, or in small groups and, in some cases, individually. This traditional approach to teaching and learning in rural communities is currently being challenged in both Newfoundland and New Zealand where electronic educational networks have been established.

There are a number of challenges in finding appropriate ways of using technology in a e-learning classroom [8, 9]. A major challenge is that teachers have to learn to teach effectively from one site to another, they have to learn to teach collaboratively with other teachers across dispersed sites, using a range of technologies simultaneously. There is a further challenge in providing e-learning for dependent, non-university bound learners. (Advanced Placement learners are likely to be among the most independent learners in any school - they are engaged in university-level work at this level). There is a challenge is the provision of instruction face to face and on-line simultaneously. Finally, there is the issue of providing effective evaluation in this new educational environment.

Awareness of what is taking place in the delivery of education in the province of Newfoundland and Labrador has to be introduced to pre-service as well as practicing teachers who have traditionally been prepared to teach in autonomous, or closed, teaching and learning environments known as classrooms. 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.

Stage Two: Development of Awareness of Collaborative Teaching and Learning Processes

Students have been prepared to teach in Newfoundland and Labrador schools in which they could expect to have their own classrooms and their own students on a single site. It is likely that many teachers will not now teach exclusively in classrooms but in the spaces between schools, such as digital intranets, as classes are academically and administratively integrated for at least part of the school day. Teachers in rural Newfoundland and Labrador will, to an increasing extent, teach on site as well as online, in virtual as well as in actual classes. This change requires a different way of thinking about teaching and the organization of learning. Future teachers in the province's high schools will require skills that their predecessors of a decade ago did not need. In Memorial University of Newfoundland's secondary teacher program in the Faculty of Education students have been introduced to the concept of learning circles within which they can collaborate by sharing ideas and experiences about their initial observation visits to local schools and, in particular, their semester-long internships. Not all students return from the

intern experience to the university aware of the changes that are taking place in the delivery of education in the province, particularly if they spent their time in urban schools. However, it is accepted that learning circles provide a collaborative process that complements the structural changes that have been introduced in the organization of schools over the last decade in Newfoundland and Labrador. To be professionally prepared for the reality of new, virtual educational structures and processes in Newfoundland and Labrador it is necessary to introduce pre-service teachers to institutional as well as professional collaboration. The contradiction of teaching in closed learning spaces (or traditional classrooms) located in collaborative networks of schools challenges students to re-examine the changed nature of education in the province. Pre-service teachers are asked to consider research on the use of computers in education [10, 11] and their potential for collaborative teaching as well as shared learning between dispersed sites [8, 12, 13, 14, 15]. A first step is to organize students into learning circles within which they can share recent classroom experiences from their internships and from which they often discover common problems. Students are placed in learning circles that are heterogeneous in that they comprise many different curriculum teaching areas. Mathematics, language, social science, visual art, science and physical education teachers are encouraged to discuss common issues in teaching and learning within learning circles. A second step is to encourage students to project themselves from their university learning circles into the near future when they are appointed to schools across Newfoundland and Labrador (most of which are located in rural communities) or in other Canadian provinces, with a view to continuing to work collaboratively across disciplines by sharing common educational problems. The purpose is to encourage the development of awareness in pre-service teachers that members of their profession have traditionally been isolated from one another in their classroom spaces but that this is not always appropriate in an internet-based network of schools. Students may be physically-isolated from other teachers within digital intranets spanning schools in rural communities, but they do not need to be professionally-isolated in ways they organize teaching and learning if collaboration is fostered.

Stage Three: Cybercells – The Integration of Virtual and Actual Structures and Processes

A challenge for teacher educators engaging new members of the profession is linking the practice of teaching and learning in schools to educational theory. In learning circles students are asked to bring to their discussions appropriate reading from academic journals and books that complement their discussions about recent teaching practice as interns. How can the literature support (or refute) ideas that are under discussion, drawn from recent classroom experience? Learning circles, schools, digital intranets and the provincial educational system are all social structures. Students are encouraged to consider the sociological implications of classroom issues they encountered and, if possible, to locate them within an appropriate theoretical perspective. Discourse about shared experience between students and between

teachers facilitates the creation of new realities as participants discover common perceptions, experiences and problems. The development of shared realities through cybercells (face-to-face groups whose members extend their discussion to include virtual visitors) challenge teacher and student isolation in a way that is similar to how intranets challenged the physical isolation of rural schools in Newfoundland and Labrador over the last decade. In a cybercell teachers who collaborate on an actual site (or school) can share their discussions with virtual colleagues from other sites located within their internet-based network and beyond [16]. Cybercells enable shared realities to be created both on site, for example, in a particular school, as well as virtually, by enabling participants at a distance to engage in discourse with those in a given, physical location.

VII. CONCLUSION

The application of telecommunications technologies to education is an area in which small rural schools have acquired positions of leadership in both New Zealand and Canada. A feature of the advent of telecommunications technologies in rural schools in both Newfoundland and New Zealand is the encouragement it has given school administrators and teachers to find new ways of teaching students. The ability to teach students across multiple sites simultaneously demands particularly careful preparation for managing virtual classes.

In both rural Newfoundland and rural New Zealand, e-learning has created new, electronic educational structures within which senior high school students have been provided with extended learning opportunities. As small rural schools become smaller in many parts of the developed world, it is possible that virtual classes, located in intranets, can provide a basis for a new approach to the provision of educational opportunities for those whose homes are located beyond major centres of population.

The advent of e-learning in rural Newfoundland and New Zealand schools has taken place in two developed societies. Although many problems still have to be resolved, the application of information and communication technologies is being extended in both countries. Almost two decades ago [17] pointed out that

“It is easy to wax rhapsodic about the future of educational media, predicting that there will be a workstation or hypermedia system in every den and that a plethora of telecommunications carrier systems will make possible virtually instantaneous audio, video and computer communication around the world. The problem with such a rosy scenario is that only a small portion of the world’s population will be able to afford such services.”

The ultimate challenge for sociologists, educators and economists is to extend the advantages young rural New Zealanders and Newfoundlanders now enjoy through e-learning, to less developed parts of the world.

ACKNOWLEDGMENT

The author acknowledges research support from the Community University Research Alliance (CURA) and the Social Sciences and Humanities Research Council of Canada.

REFERENCES

- [1] Stefansdottir, L. (1993). The Icelandic Educational Network – Ismennt, In: Davies, G. and Samways, B. (eds) *Teleteaching – Proceedings of the IFIP TC3 Third Teleteaching Conference*, Amsterdam, Elsevier Science Publishers, pp: 829-835.
- [2] Tella S (1995) *Virtual School in a Networking Learning Environment*, Helsinki, University of Helsinki, Department of Teacher Education.
- [3] Stevens, K.J. (2003a) Open Learning to Sustain Rural Schools: The Replication of a Three-Stage Model, *New Zealand Annual Review of Education - Te Arotake a Tau o te ao o te Matauranga i Aotearoa*, No 12, pp:173-186.
- [4] Stevens, KJ (1995a) Geographic Isolation and Technological Change: A New Vision of Teaching and Learning in Rural Schools in New Zealand, *The Journal of Distance Learning* Vol. 1, No. 1.
- [5] Stevens KJ (1995b) The Technological Challenge to the Notion of Rurality in New Zealand Education Repositioning the Small School, In: Ian Livingstone (ed) *New Zealand Annual Review of Education* No 5, pp: 93 –102.
- [6] Stevens, K (1999) Telecommunications Technologies, E-learning and the Development of Virtual Classes for Rural New Zealanders *Open Praxis* Vol. 1, pp: 12 – 14.
- [7] Government of Newfoundland and Labrador (2000) *Supporting Learning: Report on the Ministerial Panel on Educational Delivery in the Classroom*, St John's, NL, Department of Education.
- [8] Cavanaugh, C. (2001) The Effectiveness of Interactive Distance Education Technologies in K-12 Learning: A Meta-Analysis, *International Journal of Educational Telecommunications*, 7, (1), 73-88.
- [9] Hobbs V. M and Christianson J.S (1997) *Virtual Classrooms*, Basel, Switzerland & Lancaster, Pennsylvania, Technomic Publishing.
- [10] Lowther, D., Ross, S. & Morrison, G. (2003). When Each Has One: The Influences on Teaching Strategies and Student Achievement of Using Laptops in the Classroom, *Educational Technology Research and Development* 51 (3), 23-44.
- [11] Mathiasen, H. (2004). Expectations of Technology: When the Intensive Application of IT in Teaching Becomes a Possibility, *Journal of Research on Technology in Education*, 36, (3), 273-294.
- [12] Collis B (1996). *Tele-learning in a Digital World - The Future of Distance Learning*, London and Boston, Thompson Computer Press.
- [13] Ertl, H. and Plante, J. (2004). *Connectivity and Learning in Canada's Schools*, Ottawa, Statistics Canada, Government of Canada.
- [14] Hawkes, M. and Halverson, P. (2002). Technology Facilitation in the Rural School: An Analysis of Options, *Journal of Research in Rural Education*, 17 (3), 162-170.
- [15] Stevens, K.J. (2003b) E-Learning and the Development of Open Classes for Rural Students in Atlantic Canada, In: *The Open Classroom – Distance Learning In and Out of Schools*, Jo Bradley (ed) London and Sterling, VA., Kogan Page, 149-157.
- [16] Stevens, K.J. and Stewart, D (2005) *Cybercells – Learning in Actual and Virtual Groups*, Melbourne, Thomson-Dunmore Press.
- [17] Verduin J. R. and Clark T.A (1991) *Distance Education The Foundations of Effective Practice*, San Francisco, Josey-Bass.

Ken Stevens is a New Zealander and a Professor of Education at Memorial University of Newfoundland where he was appointed to a chair in e-learning, funded by Industry Canada. His previous appointments were at James Cook University in Queensland, Australia, and at Victoria University of Wellington in New Zealand. In Australia, New Zealand and Canada he has specialized in the provision of education in rural communities and the application of information technologies for teaching and learning in and between schools in sparsely-populated areas. He recently co-authored with David Stewart *Cybercells – Learning in Actual and Virtual Groups*, Thomson-Dunmore Press, Melbourne, 2005. Currently he is cross-appointed from Memorial University of Newfoundland as Adjunct Professor of Education at Victoria University of Wellington. He lives in Canada and New Zealand.