



Two frameworks for preparing teachers for the shift from local to global educational environments

Barbara Craig, Victoria University of Wellington

Ken Stevens, Memorial University of Newfoundland

Abstract

The research outlined in this paper is based on the convergence of two conceptual frameworks that guide the transfer of knowledge and skills from traditional teacher education, which focused on teaching in single classrooms, to open networked learning environments that include both inter-institutional teaching and learning and local and global community engagement. Through these frameworks, schools can be extended in terms of time, space, organisation, and capacity. This will be demonstrated on the basis of New Zealand research in inner-city urban environments and Canadian research in rural Newfoundland and Labrador. There are implications for the professional education of teachers from schools that have the capacity to engage with global learning environments, including new ways of relating to learners, learners' parents, networks, and communities. Several of these implications will be analysed in the conclusion of the paper and should generate discussion that will inform current and future research.

Keywords: open learning networks, virtual environments, professional development, collaboration, new technologies

Introduction

The introduction of e-learning and an expanding range of communication technologies have changed classrooms from local to global educational environments. The rapid growth and educational application of the internet has challenged traditional ways of teaching and learning at a distance (Ben-Jacob, Levin, & Ben-Jacob, 2000) that were based on paper and the postal system. 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—as seen in rural Atlantic Canada and in urban New Zealand. Despite being geographically far apart, e-learning in these two regional contexts shares a common history of having developed from the innovative vision and experience of teachers in the first rural network of schools (Cantatech) in New Zealand in the late 1990s. Cantatech was a local bottom-up initiative that used audiographic technologies to create a virtual classroom across a group of very small rural high schools in the South Island of New Zealand (Langley, 2003). These early developments were driven by falling rolls in rural communities and the resultant challenge of providing sufficient curriculum choices for senior students. The challenge to teachers and learners is learning to work in this new environment, where the place of learning may be some distance from the source of learning.

Rural Atlantic Canadian schools

The province of Newfoundland and Labrador has a population of approximately 500,000 people, of whom fewer than 30,000 live in Labrador. In Newfoundland, the island portion of the province, almost all of the population lives in coastal settlements which include the capital, St John's. Approximately two-thirds of schools in the province are located in rural communities. The decline of traditional rural education in Newfoundland and Labrador coincided with a national initiative to prepare people across the country for the information age (Information Highway Advisory Council, 1997; Ertl & Plante, 2004), and this initiative provided impetus to apply emerging technologies in the classroom. In rural Newfoundland and Labrador, the introduction of the internet and internet-based technologies has transformed the capacity of small schools to deliver programmes (Brown, Sheppard & Stevens, 2000; Healey & Stevens, 2002; Stevens, 1999a; 2001; 2002b). There have also been major changes in the configuration of small schools in isolated communities in other developed countries that have substantial rural populations to be educated. In New Zealand (Stevens, 1999b; 2000), Finland (Tella, 1995), Iceland (Stevens, 2002a), Russia (Stevens, Sandalov, Sukhareva, Barry, & Piper, 1999) and the United States (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 organising and managing knowledge in collaborative electronic structures. These changes have implications for regional economies.

Two e-learning developments have changed the nature of education in rural Newfoundland and Labrador in the last decade: (1) the opportunity to study online from schools located in remote communities, and (2) the possibility of enrolment in Advanced Placement (AP) courses from rural schools.¹ Both developments have implications for the professional education of teachers.

The development of collaborative Canadian schools

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 intranets within which virtual classes have been organised. Several challenges have been met in the process of developing e-teaching within school district intranets. Electronically linking eight sites within the former Vista school district to collaborate in teaching AP Biology, Chemistry, Mathematics, and Physics has created a series of open classes in rural Newfoundland that are now known as the Vista School District Intranet. The Vista School District Intranet aimed to use information and communication technologies to provide geographically isolated students with extended educational and, indirectly, vocational opportunities. The development of the intranet within a single school district involved the introduction of an open teaching and learning structure to a closed one. Accordingly, administrative and academic adjustments had to be made in each participating site so that AP classes could be taught. The Vista 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 could interact with each other through audio, video, and electronic whiteboards. Around the time the Vista intranet was being established in Canada, virtual networks were emerging in other parts of the world, including the United States (for example, the Florida Virtual School), Finland (Tella, 1995), New Zealand (Roberts, 2009), and Iceland (Stefansdottir, 1993).

¹ Advanced Placement (AP) courses enable senior students to begin undergraduate degrees with part of their programme already completed at high school if they have passed courses at grade levels specified by the university of their choice. Before this initiative, AP courses had not been taught online or in rural schools in Canada or the United States.

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. Although 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 before the intranet was established. 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, because of their size, small rural schools have few students able to undertake instruction at this level. This initiative was significant for rural Canadian education because 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. Introducing AP subjects to small schools in a remote region of Canada was a step toward including rural people in the emerging knowledge economy. Several graduates of this programme were subsequently able to enrol in science and engineering faculties at the local university, having already completed a small part of their post-secondary programme. More importantly, perhaps, they entered universities knowing that they could successfully compete academically with students anywhere in North America.

From closed to open teaching and learning environments

The major change for students in the first 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 intranet were frequently subject to scrutiny by their peers as they responded to each other through chat rooms, audio, and video as well as with their AP online teacher. The intranet provided students with access to multiple sites simultaneously, and the opportunity to work independently of a teacher for part of the day. The need to prepare for classes before going online became increasingly apparent to both teachers and students if the open, synchronous, science classes were to succeed.

The changes that took place in the closed learning spaces of traditional rural schools led to a ministerial inquiry into the implications of these developments for the future of rural education in the province. After the inquiry, the provincial government expanded the links amongst schools by creating the Centre for Distance Learning and Innovation (CDLI)² within the Newfoundland and Labrador Department of Education (Government of Newfoundland and Labrador, 2000). The Centre 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.

Urban New Zealand schools

The physical geography of New Zealand, a long narrow country with sparsely populated and hard-to-access mountainous regions on two islands, makes the task of providing high-speed connectivity to all schools very challenging. Successive governments have implemented policies to connect rural schools and remote communities to provide equal learning opportunities to all students. In 2002 the Labour Government launched Project Probe which, over 3 years, connected almost 900 isolated rural schools with broadband at a speed that could support two-way videoconferencing—but not the Web 2.0 platform. This result was achieved through partnership with local councils to build local MUSH networks (open-access fibre networks) to enhance rural economies. Current government policy³ is to roll out high-speed broadband to urban schools through the Ultra-Fast Broadband Initiative by 2016. At the same time, all but the most remote

² <http://www.cdli.ca/>

³ See <http://www.med.govt.nz/sectors-industries/technology-communication/fast-broadband/education>

rural schools will receive broadband through the Rural Broadband Initiative (New Zealand Ministry of Education, 2012).

In the last 10 years a number of New Zealand inner-city urban school networks have emerged as local solutions to sharing resources and expertise across schools. These inner-city aggregations have drawn on the experience of earlier rural collaborations (such as Cantatech and, later, the Virtual Learning Network) in which small, geographically isolated schools experimented with forming online learning environments. Here, their students could use digital technologies to participate in classes taking place elsewhere in the network (Starkey & Stevens, 2006). Over time, some of the rural clusters connected to the Virtual Learning Network have partnered with urban schools in their regions. One such example is the current resource-sharing arrangement between OtagoNet, which comprises a network of rural schools, and DunedinNet, which connects urban schools (Roberts, 2010). Cantatech is in the process of evolving into the Greater Christchurch Schools Network (GCSN), which will create a community across the region, sharing content between urban and rural schools through a high-speed fibre optic infrastructure (Zwimpfer, 2010).

Inner-city school collaborations have an advantage over their rural counterparts simply because they are located in centres where broadband is faster and more reliable. Most recently, high-speed urban school networks have emerged as regional fibre loops. A loop is formed in a community in which a provider of ultra-fast broadband (URF) is willing to forge a partnership with the schools to create a high-speed aggregated learning network. The concept began with the Nelson Loop, a network that connects large urban high schools and small, remote, rural primary schools in a shared online environment (Newton, 2007). The Nelson Loop has been a model for other urban regions, as other groups of schools have set about developing local aggregations or loops. In addition to The Loop (Nelson), there is the Wellington Loop, the North Shore Education and Access Loop (NEAL) in Auckland, and GCSN. These loops have participated in the ongoing development of the proposed New Zealand National Education Network (NEN) (Gould & Wenmoth, 2009).

High-speed networks

Teaching and learning across a network of schools requires a higher speed of connectivity than most schools in New Zealand currently have. The current National Government is therefore rolling out ultra-fast broadband to rural and urban communities. This network will provide speeds that allow teachers and students to upload multimedia projects and participate in services such as high-definition videoconferencing or streaming live broadcasts (New Zealand Ministry of Education, 2011). Such services allow students to access a much wider network of expertise and opportunities than is offered within the four walls of their physical school (Roberts, 2009). The New Zealand Wellington Loop project demonstrates how high-speed, uncapped, reliable fibre-optic internet access to schools in an inner-city community—a “fat, fast and free” (Newton, 2007)—will encourage teachers to use new technologies in their classrooms. It offers professionally managed and supported digital resources and services that would otherwise be too costly for individual schools to provide for their own teachers and learners. It is almost impossible for any individual school to manage these services except by collaborating with other schools.

This online learning community is enabled by using several Web 2.0 technologies that facilitate networking and collaboration. This project aspires to demonstrate the potential of sharing resources, services, and Web 2.0 applications and to provide some evidence of authentic benefits for both the teacher and the learner when aggregating expertise across a group of schools that are working in partnership rather than in competition. The experiences of teachers and learners participating in these fibre loops will pave the way for the government’s commitment to roll out

fibre to 97% schools (all but the most remote) by the year 2016. The success of the project depends on showing that the benefits of aggregation include savings associated with collective buying power, economies of scale to ensure access to advanced services (as well as the social aspect of networking such as peer-to-peer assistance between schools with technical expertise), and professional development (Craig & Stevens, 2011).

The Wellington Loop

The Wellington Loop initiative broke new ground in that it was set up in one of the few areas in New Zealand that could immediately offer the ultra-fast connectivity required for Web 2.0 applications. Researchers were able to investigate the potential of uncapped high-speed access. As one of the defining purposes of the Loop is “establishing, maintaining and promoting a high speed fibre optic learning network” (Chapman Tripp, 2007), lessons learned will provide protocols for other regional networks. Schools in inner-city Wellington had the advantage of partnering with Citylink, an open, high-bandwidth fibre network that uses the trolley-bus network in downtown Wellington to provide high-speed internet access to inner-city businesses. (Citylink was established in 1995 as one of many strategies initiated by the City Council to build Wellington as an InfoCity2). These schools are also physically close to two national universities and are therefore able to connect the loop to one of the nodes on the Kiwi Advanced Research Network (KAREN), which supports international research collaborations through 1Gb/sec connections to Sydney (Australia) and California (United States). The speed of KAREN has allowed schools to use high-definition videoconferencing with instant responses and interactions, and its capacity allows a whole class to have simultaneous access to applications such as Google Earth and e-portfolios—without any delays in uploading data.

Initially six Wellington Loop schools were connected to each other through the Citylink high-speed infrastructure, and were able to receive shared services. Connectivity through the KAREN network made it possible to work on global collaborative projects. Unlimited internet traffic was particularly attractive to schools. Under previous arrangements, schools paid for usage on a pay-for-data system, but the Loop contract was a fixed monthly cost with no cap on the amount of data they used, both nationally and internationally. Because the Loop provides the infrastructure that enables access to the applications and services, the technical team has been challenged with synchronising the implementation of pedagogical initiatives with their ICT systems so that one did not impede the development of the other. Teachers needed assurance that, when they clicked on any application icon, the services would work. Today, five of the foundation member schools continue to work collaboratively through this network and a further four schools, including two primary schools, have joined the project.

The Wellington Loop trial has generated experience and models of good practice to disseminate to future aggregations. The Ministry of Education is drawing on research conducted on regional loops (Gould & Wenmoth, 2009) to establish both the pedagogical and system benefits of being connected to a proposed advanced NEN. The lesson learned from the Wellington Loop is that the only way to support Web 2.0 services is through aggregation and collaboration. Individual schools have benefited from sharing costs and expertise. This was particularly true of ICT procurements (such as sharing servers to store resources) but also applies to minimising the risk of making bad technical decisions that could prove costly. Within a loop, smaller schools will be supported by larger schools that have greater experience of hardware and school-level ICT network management, and that have full-time technical support—all of which can be shared across a collaborative network. Schools need to procure services locally to meet their teacher and learner needs, but will need to be connected at the national level to benefit from other shared services (Davis, 2010).

The concept of the networked school

The future of schooling in New Zealand is a vision of complete integration of physical and virtual teaching and learning, where schools are nodes on a national network contributing and using shared resources and expertise (Davis, 2011; Wenmoth, 2010). In this vision all teachers need to be able to use digital technologies alongside their everyday face-to-face teaching in the classroom (New Zealand Ministry of Education, 2012). Learning will take place at a time and place of students' convenience, whether that is within the four walls of the classroom, at home, or in the community—and anywhere in the world, face to face or online (Lee & Finger, 2010). Teachers require new ways to collaborate with these wider communities.

Two conceptual frameworks

For the last two decades in New Zealand, Canada, and in other developed societies, small schools located beyond major centres of population have been academically and administratively linked, initially in school district intranets, and subsequently in more diverse configurations. Schools in inner cities, likewise, responding to demand for greater student choice and personalisation of learning, have aimed to become members of urban clusters or loops, to collaborate and share expertise and resources beyond their physical walls. Two conceptual frameworks provide ways to consider changes in schools and the role of teachers as they move from local to global educational environments.

Framework One: Face-to-face and virtual teaching

Newfoundland and Labrador

Following initiatives in New Zealand, the development of the first school district intranet in Newfoundland and Labrador involved a combination of technological, pedagogical, organisational, and conceptual change (Stevens, 2007). In rural Newfoundland and Labrador this combination supported the creation of a rural school district intranet of four interconnected components as shown in Figure 1.



Figure 1 Development of learning networks

Technologically, the development of the school district intranet was difficult. In many parts of the province the telecommunications infrastructure was barely adequate to link schools within such a structure. 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.

Pedagogically, the integration of schools in a single district meant teaching in ways that were different from traditional classroom practices. Instead of providing instruction exclusively within their own classrooms, teachers had to consider teaching collaboratively from one site to another in what became shared teaching and learning space. The challenge of teaching *between* rather than exclusively *in* schools focused attention on what Van Manen (2002) terms “the pedagogical task of teaching”. Some teachers found it difficult to accept a colleague from another site teaching AP students online in their school from another school in the district intranet. Teachers who taught the initial AP subjects of Chemistry, Mathematics, Physics, and Biology within the new collaborative structure (the school district intranet) had little pedagogy to guide them other than (for one teacher) previous experience as a distance education instructor. The delivery of classes between schools (or sites) raised issues involving the balance of synchronous and asynchronous instruction, motivation (Murphy & Rodriguez-Manzanares, 2009), control, lack of student confidence based on inexperience in learning other than by formal classroom instruction, and assessment. One of the first challenges for students was how to interact online with peers they had not met. In some cases this led to awkwardness and embarrassment that threatened to impede learning. Teachers had to adjust to talking less during lessons, and to prepare questions very carefully so that all students could participate. Judicious questioning by teachers helped students learn from each other as they all considered how to respond.

Organisationally, the integration of schools in a district intranet involved institutional collaboration, beginning with the coordination of senior class timetables so that students located on multiple sites could be taught together online. Unlike earlier initiatives in New Zealand (Stevens & Moffatt, 2003), where self-governing schools do not have assistance and direction from school boards, Newfoundland and Labrador schools were organised in school districts—each of which had a board office that provided administrative, curriculum, and technological support. The board office organised the first rural district digital network, including the selection of online teachers and technical and organisational support. Because the issue of schools coordinating their timetables for senior classes was not fully resolved during the first year of operation, some classes had to be repeated. During the initial year it became apparent that students needed on-site as well as online support if they were to succeed. This was not understood before the intranet was established because participating students were considered by everyone—teachers, parents and themselves—to be ‘independent learners’. In almost all cases, AP students in each of the four initial science subjects reported that they needed help to stay ‘on task’ to succeed. In subsequent years some teachers were appointed as mediating teachers (M-teachers) whose job, in addition to teaching traditional classes on site, was to mentor and assist where necessary, and to liaise with the e-teacher who uses teaching from another site (Barbour & Mulcahy, 2005).

Conceptually, the development of a school district intranet required a different way of thinking about teaching, learning, and the organisation of schools (DiPietro, Ferdig, Black, & Preston, 2008). The first conceptual change for teachers was that, rather than being appointed to teach their own classes, in their own classrooms, in the schools to which they were appointed, a selected few were asked to teach other teachers’ students, in other classrooms beyond their own school and community, and online. A second conceptual change initiated by the first school

district intranet was the introduction of learning at a distance in traditional classrooms. In the first intranet in Newfoundland and Labrador, some teachers were introduced to the notion of teaching both in a traditional classroom and online, through the internet. This was an important step in the integration of virtual and actual teaching. Students were also introduced to the notion of learning both on site and online during a school day. These were significant steps in the integration of on-site and on-line education or the merging of actual and virtual classes (Stevens, 2005; Stevens & Stewart, 2005). A third conceptual change was that schools that were small in terms of the number of students attending in person, and the number of teachers who were appointed to them, could become relatively large schools in terms of the range of subjects they could offer by adding online instruction. Finally, there was a conceptual change in the realisation by students, parents, and teachers that school location was not necessarily a barrier to accessing areas of the curriculum that had not traditionally been provided on site in traditional classrooms. Advanced Placement subjects, taught in large urban schools throughout North America, could be accessed by senior students in small and geographically isolated schools.

Each of the four parts of the matrix in Figure 1 was shaped through collaboration with each of the other parts. The organisation of the intranet depended on the connectivity provided by internet-based technologies, assisted by the installation of satellite dishes in Newfoundland and Labrador schools. The technological dimension depended on the organisational skills of administrators in the school district office collaborating with on-site administrators and teachers. Several times during the first year of operation technological problems were solved collaboratively by administrators and teachers working alongside technicians. Technological changes, introduced by the internet and its application to school district organisation to facilitate the administrative and academic linking of classrooms in small and dispersed schools, encouraged teachers to consider new, collaborative ways of teaching in open learning environments. The introduction of the first school district intranet in Newfoundland and Labrador challenged the exclusivity of traditional classrooms in which a defined number of students were taught, in person, by a single teacher.

New Zealand

Conceptually, the Wellington Loop project set out to link educational institutions virtually so students could work between schools and learning levels with the aim of creating a seamless learning community (Zwimpfer, 2010). It promised a new way of teaching and learning, by sharing digital resources across the schools and by connecting students to the global online world. Its statement of purpose clearly focuses on the 'Cs' in ICT—communication, connectivity, and collaboration—and not just on the distribution of knowledge. The Loop facilitates the construction of learning and the generation of new knowledge. Ideally, the goal was to achieve personalised learning for students, and for teachers to collaborate via Web 2.0 tools for educational inclusion. Like the initiative in Newfoundland and Labrador, this initiative encountered social, organisational, technical, and pedagogical challenges. Conceptually, the Wellington schools had proud diverse cultural histories and had to move from a competitive relationship (they compete for student enrolments) to a collaborative one. This shift occurred as teachers in the same subject areas made connections, shared ideas, and started to coordinate activities. Gradually the level of connectedness grew and communities of practice emerged across disciplines, and with the librarians and the technical support staff (Craig & Stevens, 2011).

Pedagogically, the online services had to enable what was already happening in the classroom, not be an add-on or place additional demands on the teacher. The technical challenge was to provide access to each resource with just two clicks. Teachers are time-poor, and certainty that the technology will work is key to their willingness to participate in an e-learning network. Without the speed and capacity afforded by the KAREN network, the Loop teachers would not

have enjoyed the benefits of the applications they considered most authentic or engaging, such as Google Earth (Craig & Stevens 2011; Gould & Wenmoth, 2009).

Organisationally, cloud-based applications provided the advantages of financial benefits as well as access to resources that are not limited to a single physical location (Gould & Wenmoth, 2009). Unlimited access posed some challenges to the traditional closed school in that students (and their parents and caregivers) could then log on to these resources from home and communicated with their teachers outside of regular school hours. Social software that enables collaboration, and the sharing and creation of resources, was the central core of this initiative and this, in turn, was supported by the technical and organisational features of the network.

Framework Two: Implications for teachers' professional education

Changes in rural education in Newfoundland and Labrador and urban New Zealand can be further considered within another four interconnected quadrants. The creation of school district intranets and the advent of e-learning led to the development of collaborative structures and processes, adaptation of new technologies, and innovative ways of using them in schools.



Figure 2 Professional development framework

Collaboration has been critical for the success of e-learning in rural schools in Newfoundland and Labrador. As rural schools changed from closed, autonomous institutions to become administratively and pedagogically open to other sites (schools) within intranets, collaborative teaching and learning was facilitated. Collaborative teaching and learning do not depend on school size or location; nor do they depend on school district intranets. The lesson for the global community from collaborative teaching and learning in Newfoundland and Labrador has been the need to create structures and processes to support this. Similarly, in the New Zealand context, teacher ICT capacity has been built through a collaborative professional development programme in which schools group together regionally and develop a programme of their own

design. These ICT PD clusters are characterised by collegial support within the group (Ham, Gilmore, Kachelhoffer, Morrow, Moeau, & Wenmoth, 2002). As the 3-year pilot scheme came to an end, the Wellington Loop schools received Ministry of Education funding to form their own ICT PD cluster. The cluster would support all teachers in this aggregated network to successfully integrate e-learning into their physical classrooms (Craig & Coman, 2009).

The creation of school district intranets was based on organisational and managerial *innovation* that led to the development of virtual educational structures to support traditional schools. Innovation that led to the creation of new educational structures and processes in Newfoundland and Labrador was grounded in the demise of the fishing industry and rural outmigration. The organisational and managerial response has been the development of extended learning opportunities for young people and, indirectly, for their families and communities. The structural innovation introduced into the New Zealand context is the development of e-learning communities of practice through the national education portal Te Kete Ipurangi (TKI) with support for all teachers, parents, and communities (Billowes & Alexander, 2010).

Educational changes in rural Newfoundland and Labrador are based on the *adaptation* of existing structures and processes within which teaching and learning have been extended by integrating traditional and virtual classrooms. By adapting to internet-based structures and processes, traditional small rural schools have increased their capacity. Many small Newfoundland and Labrador schools have become, in effect, sites within extended teaching and learning environments. The New Zealand cluster PD programme, on the other hand, is innovative in that it is a bottom-up approach to teacher professional education—teachers have a say in their learning, professional development is adapted to the culture and needs of their communities, and they are supported in their own classrooms.

Through collaboration, innovation, and adaptation, Newfoundland and Labrador has created sustainable rural schools, and preserved an important aspect of the *cultural identity* of the province. It could be argued that the CDLI supports the cultural identity of the province and sustains rural communities by creating extended learning opportunities. New Zealand, by taking a bottom-up innovative approach (rather than a top-down policy directive) to taking schools and teachers into the 21st century, values and upholds the cultural identity of individual schools and regional clusters.

Three implications for teachers and teacher educators

Teachers have traditionally been prepared for what have been, in effect, closed autonomous classrooms in schools. It is now necessary to consider the implications of networked, virtual environments that complement traditional schools and what Dawley, Rice and Hinck (2010) describe as the “unique needs of K–12 online teachers”.

Students preparing to become teachers in rural Canada will increasingly be expected to contribute instruction to open, networked, virtual learning environments from the schools to which they are appointed (Furey & Stevens, 2008). The integration of virtual and actual (face-to-face) learning spaces provides opportunities to develop collaborative teaching and learning (Barab, Thomas and Merrill, 2001). While teachers in New Zealand initially hesitated to use online tools to develop and contribute to learning communities (Billowes & Alexander, 2010), preferring to interact in the face-to-face environment of their regional PD cluster, TKI now supports teachers to interact online.

In both contexts the implications for teacher education is that collaborative communities of practice can support a teaching environment where technologies are developing at an ever-increasing rate.

The Canadian and New Zealand studies have three implications for educators, particularly those charged with providing instruction for students who live in small communities distant from major centres of population. Firstly, collaborative pedagogy can be adapted to meet the reality of schools in internet-linked structures. In addition to preparing teachers for traditional, closed, autonomous classrooms, e-teaching and e-learning can extend classroom space, time, organisation, and capacity. Secondly, the introduction of virtual, collaborative teaching and learning presences in traditional school environments challenges the notion of geographical isolation as an educational policy consideration. The Wellington Loop, for example, where an aggregated network includes primary, secondary, and tertiary teachers and learners, challenges the notion of isolation by level of schooling. Thirdly, creating integrated virtual and actual learning communities has policy, pedagogical, and organisational implications for enhancing access to both teaching and learning opportunities.

Conclusion: Lessons for the global community

The problems faced by New Zealand and rural Newfoundland and Labrador over the last decade, and the community responses to them, are of potential interest to educators and policy makers in other places. The matrices show how schools and (indirectly through them) communities can be sustained. There are several lessons for the global community in the building of sustainable schools based on e-learning.

Firstly, small schools can become large schools. Schools that are small in terms of the number of students who attend, in person, every day, can become large educational institutions by electronically accessing and disseminating teaching and learning. In Newfoundland and Labrador this growth has been achieved by the first two cells in the matrices above: acceptance of new technologies and using them in collaborative ways. In New Zealand, aggregated networks are formed across levels of educational institutions, connecting schools and tertiary institutions. The lesson for the rest of the world is that school size, location and level are no longer important in educational terms.

Secondly, the importance of collaboration in teaching to complement new collaborative structures is highlighted by recent developments in both New Zealand and Canada.

Thirdly, virtual and actual teaching and learning can be integrated. In Newfoundland and Labrador steps have been taken to integrate traditional and virtual teaching and learning within intranets and, more recently, through CDLI. Today, many young people attend small schools in their rural communities in this province while also being taught by e-teachers employed by CDLI. There is a growing belief in New Zealand that a national system of education needs to evolve into a networked community, and that all classrooms will be sites for virtual learning experiences.

Finally, teaching and learning in traditional small schools and in larger urban counterparts can be complemented by introducing new structures and processes. The third cells of the matrices in Figures 1 and 2—organisation and adaptation—were applied in the development of intranets or shared services in both countries. This structure revolutionised the way education was delivered in both Canada and New Zealand. The concept of the intranet (or the loop), based on emerging collaborative technologies, is the foundation for building increased teaching and learning capacity in schools by merging traditional and virtual classrooms.

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Biographical notes

Barbara Craig

Barbara.Craig@vuw.ac.nz

Barbara Craig is based in the School of Policy and Implementation in the Faculty of Education at Victoria University of Wellington. Her research interests include digital literacy, school–community collaboration, social inclusion and other social justice issues regarding globalisation. She is a member of the New Zealand UNESCO Communications Sub-Commission.

Ken Stevens

stevensk@mun.ca

Ken Stevens is a Professor of Education at Memorial University of Newfoundland where he was appointed to a chair in e-learning funded by Industry Canada. He is currently cross-appointed as Adjunct Professor of Education at Victoria University of Wellington. He lives in Canada and New Zealand.

Craig, B., & Stevens, K. (2012). Two frameworks for preparing teachers for the shift from local to global educational environments. *Journal of Open, Flexible and Distance Learning*, 16(2), [11–25.].



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