

# A Four-Step Process for the Development of Knowledge-Building Communities in a Digital Intranet

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In very small schools, most of which are located in rural communities, it is often difficult to justify the appointment of specialist teachers for small numbers of students. Senior students in the smallest and most remote communities often have difficulty accessing specialist teachers in subjects such as mathematics, science, foreign languages and art. When young rural people are denied access to advanced classes in science and mathematics in their local schools, subjects that are required for entry to engineering, medicine and other professional faculties in post-secondary institutions, many career options are closed. Accordingly, many senior students in rural schools have been encouraged to complete their secondary education in larger schools, most of which are located in urban areas.

In the Canadian province of Newfoundland and Labrador, where two thirds of schools are officially classified as rural, the search for alternative approaches to the provision of educational and, indirectly, career opportunities for senior students has been a priority (Stevens, 1999).

A four-step process has been piloted to enhance rural educational opportunities for senior students, using information and communication technologies, in one of the ten school districts of Newfoundland and Labrador. Within the new educational structure that has been created it has been necessary to reconsider teaching and learning processes:

- A new electronic educational structure known as a "Digital Intranet" has been established;
- Within the Digital Intranet, virtual classes in Biology, Chemistry, Mathematics and Physics have been organized;
- Within the virtual classes in each of the four disciplines, the organization of "knowledge-building communities" has been encouraged;
- Within each knowledge-building community, pedagogy appropriate to virtual teaching and learning environments is being developed.

**THE CREATION OF A DIGITAL INTRANET** A Digital Intranet is an electronic educational structure based on web-links between

teachers and learners at designated sites, in selected areas of the curriculum. A Digital Intranet enables schools to interface both administratively and academically and within this web-based structure, participating sites must coordinate their timetables.

Minimum specifications were adopted for computer hardware and network connectivity. All schools involved in the project had satellite dishes installed. Software had to be identified and evaluated. Software was required for both the development of the resources, and the delivery of instruction. Front Page 98 was selected as the software package. Additional software was used for development of images and animated gifs, including Snagit32, Gif Construction Set, Real Video, and similar packages.

Many course management 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 email, a calendar feature, public bulletin board for use by both instructor and student, a link to lessons, chat rooms for communication between teacher and student, and more.

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 Digital Intranet enrolled its first students in the 1998-1999 school year and in the 2000 school year this new educational structure was extended to serve selected sites in several other school districts in the province.

## THE DEVELOPMENT OF VIRTUAL CLASSES

The construction of a Digital Intranet to link eight rural sites in dispersed communities in one school district of Newfoundland and Labrador with the Centre for TeleLearning and Rural Education at Memorial University of Newfoundland has opened new educational opportunities for senior students in rural communities. Students are able to connect with teachers both synchronously and asynchronously from their local schools and, if they have Internet access, from their homes. Within the Digital Intranet virtual classes have been organized for senior students in Biology, Chemistry, Mathematics and Physics. By linking sites from dispersed communities to share resources within the Digital Intranet, students are able to participate in virtual classes. This contrasts with the traditional practice of taking senior students out of rural communities to complete their schooling in larger urban institutions.

## THE DEVELOPMENT OF KNOWLEDGE-BUILDING

**COMMUNITIES** The collaborative educational structure of the Digital Intranet and, within this, the construction of virtual classes, has led to the emergence of new ways of learning and teaching (Stevens, Power, Boone, & Barry, 1999). Instruction includes both synchronous and asynchronous components. Synchronous instruction is accomplished through the use of Microsoft Netmeeting and MeetingPoint. This combination of software allows students in multiple, rural schools to communicate in real time with each other and with their instructor. Students and instructor are

able to share applications, make use of whiteboard, chat, video and voice communication. At present, technical limitations restrict the use of this combination of software to the morning sessions of the school day.

Asynchronous delivery of instructional resources makes use of two software packages, WebCT and Knowledge Forum. WebCT provides student access to all asynchronous course resources including:

- Lessons: Complete course outline, lesson notes, homework, assignments, and labs (Physics, Chemistry and Biology).
- Bulletin Board: Enables public communication between students and instructor.
- Private E-mail: Allows students to communicate privately with their "virtual classmates" and their instructor.
- Calendar: Outlines daily activities, labs, lessons, assignment due dates, and general reminders.
- Tests (Quizzes): Provides for student self-evaluation. Evaluation items may include matching, multiple choice, short answer, and essay type questions that may include supporting graphics.
- Presentations: Used for creation of individual student web pages.
- My Record: Allows students private access to their evaluation records.
- Knowledge Forum: Knowledge Forum is a separate software package. The icon has been placed on the WebCT Welcome Page to facilitate student access.

During the pilot year (1998-1999), many of the students used their asynchronous class time to complete homework for

other courses. However, from the beginning of the new school year in September 1999, Knowledge Forum has proved to be a particularly useful addition to the resources used in the knowledge-building process as well as the development of virtual classes. Knowledge Forum enables students and their instructor, located in separate schools, at different times, to take part in virtual classroom discussions. For students in an unsupervised class, using Knowledge Forum has provided an important advantage in allowing the instructor to monitor, and more importantly, be a part of the activities of students who are neither physically present in the same building, nor present at the same time. Since the implementation of Knowledge Forum both student management and knowledge building have improved.

## PEDAGOGY APPROPRIATE TO TELELEARNING

In the development of a new educational structure (the Digital Intranet) and process (virtual classes), new ways of organizing teaching and learning are taking shape. The difference in the pedagogy of traditional (face to face) and telelearning classes is to be found not in the structures, processes or technologies that are used, but in the pedagogy that mediates teaching and learning. The pedagogy of telelearning in this pilot study is shaped by synchronous and asynchronous learning environments. By introducing Knowledge Forum, knowledge can be developed symmetrically or asymmetrically. Symmetric knowledge advances occur when students' activities are organized in such a way that they can learn from one another. Asymmetric knowledge advances occur when each student is expected to learn the same

things from the teacher, which are specified in advance. In asymmetrical knowledge advancement the flow of information is in one direction: the teacher does not necessarily learn from the students and students do not necessarily learn from one another except insofar as they cooperate to help one another achieve what is prescribed to be learnt.

Four types of knowledge advancement are being developed in virtual science classes, structured by the Digital Intranet:

- Type 1: Symmetric Knowledge Building in a Synchronous Learning Environment (students primarily learning from other students simultaneously).
- Type 2: Symmetric Knowledge Building in an Asynchronous Learning Environment (students primarily learning from other students in delayed time).
- Type 3: Asymmetric Knowledge Building in a Synchronous Learning Environment (students primarily taking instruction from the teacher, simultaneously).
- Type 4: Asymmetric Knowledge Building in an Asynchronous Learning Environment (students primarily taking instruction from the teacher in delayed time).

The search for appropriate pedagogy for telelearning aims to develop a seamless on-line relationship between teacher and student as well as between students themselves, within which knowledge can be constructed.

The TeleLearning and Rural Education Centre at Memorial University of Newfoundland is linked to several other Canadian Universities through the

TeleLearning Network of Centres of Excellence (TL•NCE), an organization that seeks to prepare young people for living in a digital world (Information Highway Advisory Council, 1997). A vital part of this process is the search for effective applications of information and communication technologies for teaching and learning in the K-12 system.

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