A Report on Learning Object Repositories

Review and Recommendations for a Pan-Canadian Approach to Repository Implementation in Canada

for CANARIE Inc.

Study Team

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Any views expressed in this report are those of the study team and not the funding organizations.

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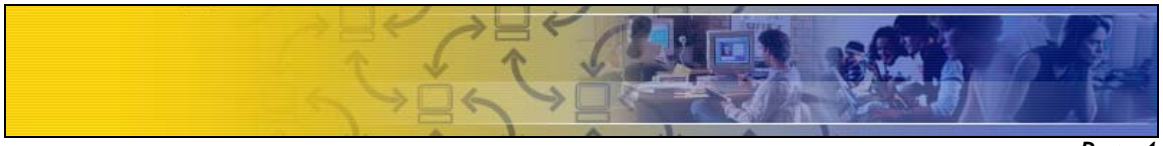

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1. INTRODUCTION

The increasing use of information technologies to create new learning resources, to manage existing learning resources, and to aggregate learning content from a wide variety of academic and publishing sources has completely altered expectations for teaching and learning. Around the world, academic institutions, professional associations, and corporations are striving to make better use of networks and databases to efficiently and effectively achieve learning and professional development goals. One of the ways they have chosen to pursue these goals is to make learning resources readily accessible to educators and learners through learning object repositories.

Object repositories are seen as key enablers for bringing increased value to learning resources by providing opportunities for reuse, repurposing, or reengineering to suit a variety of purposes and end-user needs. Creating learning resources in object formats is seen as way to bring about increased flexibility, customization, ease of update, searchability, and manageability to rich stores of content and learning resources that are available from publishers or that have been created by faculty members or teachers.

CANARIE Inc. and Industry Canada are currently funding several projects that are developing prototypes of the various applications and technologies required to operate learning object repositories. In particular, the CANARIE-funded BELLE Project, led by Netera Alliance in Calgary and the POOL Project, led by NewMIC in Vancouver are working on hardware and network architectures, as well as software and metadata tagging schemes that will underpin the operation of learning object repositories. In a complementary initiative, Industry Canada's Multimedia Learnware and Public Access Program has funded development of an advanced learning management system and tools called *Explor@*, in a project lead by Cogigraph Inc.

Over the past year it has become apparent that the field of learning object repositories (LORs):

- Is of considerable national and international interest
- Has the potential to innovate the way in which education and training are carried out
- Is congruent with recommendations from the Industry Canada and CMEC Online Learning Advisory Committee, with respect to pan-Canadian learning initiatives
- Is one in which Canada has a prominent position within world activities

Within the CANARIE projects, and in collaboration with other interested Canadian participants, there has been significant discussion on how to move forward the current applied research activities funded by CANARIE and Industry Canada. Meetings coordinated by CANARIE to develop interest and perspective on this topic were held in March, July and October 2000, and in June, August and November 2001. The most

recent meeting outlined a set of nine work packages that were felt to be essential components of an integrated learning repository strategy for Canada.

This document is designed to suggest a strategy that builds upon the knowledge and experience gained through the current CANARIE-funded projects that will end in September, 2002, to one or more projects that will demonstrate and evaluate a pan-Canadian learning repository implementation by March 2004. In addition to providing specific recommendations for CANARIE's request for proposals and Industry Canada's EduSpecs initiative, the study team urges CANARIE and Industry Canada to expand its current dissemination initiatives and serve an aggregator role to address knowledge gaps in LOR implementation and support emerging LOR communities of practice.

This report concludes with a recommendation for a vision for a next phase of LORS and identifies some of the Canadian organizations that must participate in a partnership framework. CANARIE and Industry Canada have an important role beyond 2004. It is extremely unlikely the LOR sector will be at a stage of maturity to continue to advance without the leadership of CANARIE in LOR implementations and Industry Canada in standards development. It is also unlikely that sustainable and connected LOR communities will be developed without the participation of provinces. Provincial ministries and other organizations recognize the value to ensure repositories are linked and shareable and that the international initiatives underway require the development of national strategies in LORs. Funding agencies and implementation groups are fragmented and no one organization has the necessary core competencies and funding programs to provide the total solution to develop the needed infrastructure and advance practice in the sector. The study team urges CANARIE and Industry Canada to continue its leadership role in LORs to develop the vision and partnerships to realize the potential of broadband networks to meet the education and training needs of Canadians.

2. SCOPE OF WORK

PROJECT APPROACH

The Project goal was to guide CANARIE Inc. and Industry Canada on how to best approach the following activities:

- Consolidate the work and competencies of the existing projects and activities;
- Disseminate the results of the current projects;
- Determine how Canada's efforts can connect with and learn from international efforts;
- Develop and disseminate appropriate interoperability standards;
- Develop commitment and identify partnerships from ministries of education, post-secondary institutions, and training organizations; and
- Demonstrate and evaluate in suitably scaled trials the learning repository concept for one or more communities of learners.

In order for CANARIE to support one or more projects going forward in 2002, the following are required:

- Selection of project(s) via an appropriate bidding process
- At least 50% support from project participants
- A pan-Canadian approach
- Activities that can lead to an implementation process
- Inclusion of an appropriate management structure

It was not obvious how to best move from the existing projects to a demonstration, testing, and implementation framework that will be both effective and as inclusive as possible. The study team, therefore, was engaged by CANARIE and Industry Canada to help inform CANARIE's go-forward process that will culminate in a request for proposals (RFP) in March 2002.

The project approach included:

- Secondary research, primarily web searches and email contact, with industry representatives and experts, to identify relevant work and developments in Canada and internationally, as well as other national and large-scale models of learning object repository use
- Telephone and email contact, to identify provincial interests, plans and investments
- Telephone interviews to consult with Canadian and international experts in the pubic, private and institutional sectors, including CANARIE and Industry Canada supported project

representatives, to identify developments, competencies, and potential models and approaches for a Pan-Canadian effort

- A face-to-face meeting involving team members and project sponsors to review data collected and first composites of the repository space, both nationally and internationally, and to begin the exploration of alternative models for Canada.
- A face-to-face meeting was held at the CANARIE-sponsored Second National E-Learning Workshop to obtain feedback to alternative Pan-Canadian visions and models. Over 60 individuals participated in this meeting including representatives of CANARIE projects as well as other participants invited by CANARIE, Industry Canada or the study team.

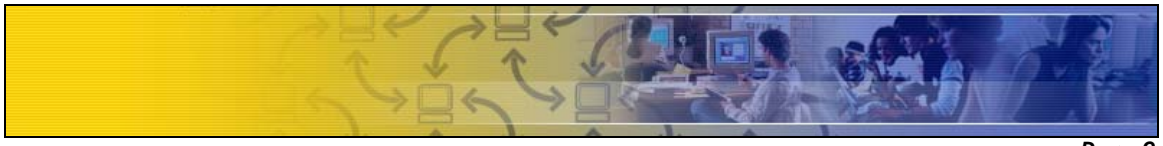
A primary task for the study team was to examine the existing CANARIE-funded "repository projects," through a review of their published documents and web sites, followed up by interviews with project managers or principal investigators. The process was designed to illuminate strengths, gaps or issues associated with the current projects and their implementation processes.

Additionally, interviews were conducted with representatives from various provincial technology teams or work groups. The study team sought to determine the importance placed upon potential pan-Canadian learning repository initiatives in the context of provincial projects that are exploring similar technological territory. The study team also interviewed a small number of resource persons from academia and industry who could provide both an academic and technical perspective on Canadian learning repository initiatives in the context of North American, European, Australian, and other international initiatives.

The results of this study are summarized in the following sections:

- Strengths, Gaps, and Issues (including key issues for Provincial Ministries)
- International LOR Efforts: Opportunities for Canada
- Potential Communications and Dissemination Framework
- Study Team Recommendations

Detailed summaries of the information collected by the study team are provided as appendices and include overviews of current repository projects and initiatives in Canada (Appendix A), provincial and territorial involvement in e-learning (Appendix B), and international repository development and implementation models (Appendix C).



3. STRENGTHS, GAPS, AND ISSUES

In Appendix A, information is summarized on current projects and initiatives in Canada. Individual strengths, gaps, and issues with respect to CANARIE-funded learning repository projects and other projects that are ongoing across Canada have been identified through examinations of project documents, through interviews with project staff or through examinations of project web sites and documents contained therein.

GENERAL STRENGTHS, GAPS, AND ISSUES IDENTIFIED FROM THE CANARIE PROJECTS

Strengths

- Demonstrations of multiple, linked partnerships, spanning a number of provinces is a key strength of the projects funded by CANARIE.

- Some projects have made their prototype repositories available for the demonstration and testing of object storage and retrieval.

- Most projects are using the CanCore metadata schema as the basis of the tagging model for objects that their repositories will store.

- Work on automated tagging schemes is beginning in at least one project. Automated tagging is seen as one way to reduce the load on end users who are creating or batch processing large collections of learning objects.

- The testing of desktop software applications is a component of some projects. Not only are these projects building infrastructure, they are also testing the end-user software tools that will be required to interoperate with repositories.

- Some projects are currently evolving a distributed architecture based upon Open Source tools. The Pool, Pond, Splash metaphor that has been employed by the POOL project is an example of an architecture for learning that recognizes the importance of contributions by end users at a number of levels including at personal desktop workstations, through communities of practice, and through large-scale digital libraries.

- Many CANARIE project leaders and participants are actively promoting repository theory and technologies through academic papers and presentations.

- Some projects have developed extensive web sites with project documents, resources, user guides, handbooks, sample materials, and links to participants.

- In one case, an outreach program that will include a promotional tour is being planned.

- A focus on teaching and learning practices is guiding a number of the CANARIE-funded projects. Not only are these projects building infrastructure and tools to support learning object creation, storage, retrieval, aggregation and presentation, they are also building the capacity to train instructors, faculty, and teachers in the effective use of repositories in the teaching and learning process. In particular, a number of project leaders are proponents of learning object repository community of practice models such as that pioneered by the MERLOT project in the United States. (http://www.merlot.org)

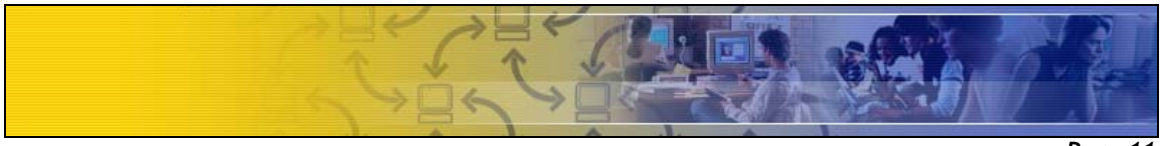
Gaps

- Most projects were primarily concerned with centralized repository structures and tools in the beginning, but are currently seeing the need for a distributed architecture. The POOL projects and others have evolved their architectural models to encompass the desktop, communities of practice or discipline-based repositories, as well as large-scale digital libraries.

- The need for an easy-to-use set of tools is being identified. While some projects have been testing end-user desktop applications, the primary focus of the projects to date has been the development of infrastructure. In the next round of projects, it is hoped that more focus will be placed on the development, implementation and testing of end-user applications.

- The need for less onerous metadata tagging strategies is also being explored. Accurate metadata tagging is the key to making learning objects accessible through search and retrieval functions. To date, only one project has been examining automated systems for metadata creation to lighten the burden for individuals or groups that seek to store large collections of objects.

- Some projects have a single province focus, and while this approach was designed to build support at the provincial level, it is recognized by the project leaders and other projects that interoperability across provinces and internationally is a both desirable and necessary future goal.



- To some degree, there is a lack of clarity on the technologies being developed or deployed within the projects. The study team found it difficult to isolate the actual technologies that could be shared or that could be licensed.

- Some of the project web sites examined by the study team require updating for their project documents and resources to be kept current.

- An Institute of e-learning Scholarship is needed. At least one project leader cited the need for an academic body associated with the repository infrastructure development work that had as its focus the scholarship and pedagogy of e-learning. It was felt that such a body could help bring balance to the project activities, renewing the challenge of promoting teaching and learning as the central theme of the technical activities.

Issues

- The sustainability of project-based funding was cited as an issue by some project leaders. At some point in time, the building of interoperable learning repositories will have to be institutionalized within provinces or federally to ensure that an ongoing, coherent, and sustainable implementation pattern across the country continues to be built. This will require additional information dissemination, and mechanisms for supporting collaboration, information management, and policy development.

- Concerns with the funding model and its relationship to administration and management of projects were cited by project leaders. In particular, difficulties in finding matching money to support administrative functions, travel, dissemination, and evaluation research were the problem areas most frequently cited.

- There is a growing requirement for communities of practice to help realize the educational goals of repository infrastructure development. Project leaders cited the need to expand their work to actual communities of practice. Building critical mass is seen a key factor for successfully deploying networks of learning object repositories.

- There is an increased need for a focus on training and skill development in communities of practice. Some projects are working with discipline groups to prototype training resources and methods. However, the problem is large and requires a project focus of its own.

- Any future development and deployment plans for learning object repositories will need to account for interoperability with large-scale provincial repositories being built in Alberta and being planned in Ontario.

- Project leaders cited a need for a focus on selective research into areas with momentum to control for potential funding differences between Canada and other countries. It was felt that funding levels for repository infrastructure and research were larger in other parts of the world. If Canada wanted to maintain its prominence, then focusing our funding in Canada in areas where we have currently developed leadership might be a prudent strategy.

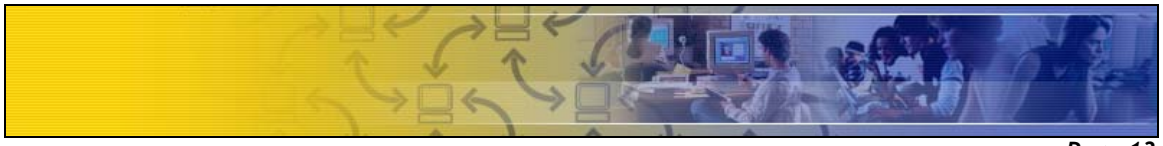
- A number of project leaders noted that evaluation research might not be getting the attention it requires if located within individual projects. It was recommended that a team of evaluators in a project dedicated to evaluation activities might control for the varying degrees to which evaluation is carried out in the current projects.

- A need for outreach and dissemination strategies targeted at Education ministries and communities of practice using SchoolNet-type activities was recommended by some project leaders. Industry Canada's practice of making activity grants available at a local level through SchoolNet was seen as a way to attract participants to new educational technologies and practices.

- A need for increased focus on workplace uses of learning object repositories was noted by some projects. To date most repository projects have largely been focused on the academic community.

- Some projects were looking for clarification of relationship between EduSpecs Office (Industry Canada) and initiatives such as CanCore that emerged from CANARIE projects. While projects applauded the notion of the EduSpecs Office, they were looking for additional clarification of its role in relation to other standards work that will need to be coordinated in Canada.

- While centralized repositories were the focus in the current round of CANARIE projects, an *open federation* model may make sense as a distributed repository architecture for the future. Such an architecture could provide a unifying structure, based upon common technology standards and metadata profiles, and could enable provinces, communities of practice, or individuals to connect their resources with those of federation members. Such an arrangement might also begin to facilitate the resolution of policy and issues for activities such as digital rights management. A coordinating body would be required to administer the federation.



KEY ISSUES FOR PROVINCIAL MINISTRIES OF EDUCATION

A recent Council of Ministers of Education report provides an excellent overview of provincial/ territorial involvement in on-line learning (Council of Ministers of Education, 2001). In Appendix B, some recent developments and other initiatives are described.

The following issues were identified through discussions with Ministry officials, a review of provincial government web sites, and a review of the relevant literature in the area of distance and distributed learning.

A central issue of concern to all Provinces was the need for development and implementation planning to ensure that linked repositories are effectively operational.

The specific issues discussed in the section that follows are compilations of concerns expressed in interviews with Ministry officials and from expert knowledge of the field of information and communications technology and educational policy development. While not exclusive, the following issues are an attempt to organize and document policy issues from across Canada.

Infrastructure Development

- Infrastructure development is critical to enabling the growth of online learning. Provinces have identified the cost of expanding broadband access to rural areas as a key ingredient to the expansion of e-learning to address equitable access to learning opportunities for K-12 and postsecondary learners. Moreover, expansion of connectivity to schools and to rural areas will assist in justifying investments in digital content development.

Digital Copyright

- While copyright is an area of federal jurisdiction, provinces/territories have identified the issue of fair use of digital content for educational purposes as a key policy concern.

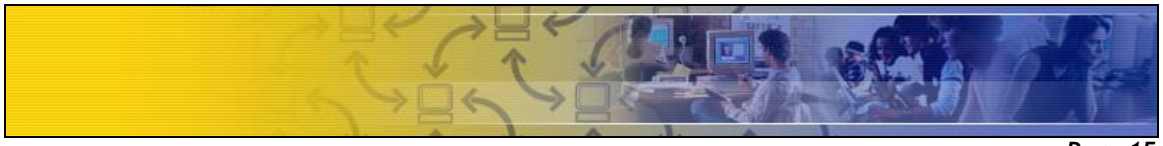
Content Development

- Provinces and territories wish to explore collaborative approaches to support the development of online content for K-12 and postsecondary institutions through provincial/territorial and/or K-12 institutional partnerships. Many provincial representatives contacted identify the need for a linked distributed repository structure as a necessary "connection" investment. This would ensure that the policy development and implementation would occur. One benefit identified by all provinces is to avoid duplication of efforts in developing content.

Promoting Implementation Studies and Best Practices

- Provincial Ministries of Education have identified the need for research into the development of implementation strategies for information and communication technologies at the school and

classroom level. Additionally, research into online learning and blended learning is required to identify the benefits that online learning can bring to lifelong learning.



- Research into what blend of technologies is most effective for K-12 learners, what types of pedagogies are most effective with younger vs. older learners is required. Additional research is required to develop appropriate learner assessments (rubrics, demonstrations of learning) that are based upon evolving professional practices and instructional pedagogies for new technologies and the use of new digital teaching resources.

- Research concerning successful use of learning objects in a variety of instructional settings by both teachers and faculty is required to identify the appropriate professional development required for teacher certification.

- The issue of provincial curricula and the effect of multiple standards upon the potential to share learning objects across provincial borders is an emerging concern. Research into the required curricular standards to support interoperability and content sharing is necessary. It is also important to investigate the impediments that copyright presents to Ministries as content is potentially "pooled" in Canada. Attention must be paid to establishing "best practices" regarding provincial ministry partnerships and collaboration with the private sector, and intersectoral partnerships to develop online and digital educational resources. New working arrangements are necessary to create digital education marketplaces that justify investments in content development.

- Provinces have identified the need to investigate how assessments can be more effectively administered using new technologies. Best practices with respect to security, assessment tools, and the development of effective measures to address a variety of learning styles is needed.

Pre-service and In-service Teacher Training

- Research is required to develop provincial/territorial/institutional networks and approaches to promote innovation and best practices for infusing new technologies and resources into learning environments.

- New standards for teacher certification are required to support the use of new technologies. Provincial Ministries see the potential to collaborate on the development of mandatory standards for pre-service teachers and the development of online professional development for their current teaching cohort.

- There exists a need to address professional development through the use of new technologies. As the use of information and communications technologies (ICT) grows in classrooms, the necessity to address new practices, skill acquisition among teachers, the effective use of digital resources by students and teachers, will require new professional development models. Technology may hold part of the answer to the digital skills gap among teachers.

INTERNATIONAL LEARNING OBJECT REPOSITORY EFFORTS: OPPORTUNITIES FOR CANADA

Interest in learning object repositories is a worldwide phenomenon, with large-scale initiatives emerging in the United States, Europe, and Australia. Appendix C of this report outlines the specifics of some of these developments. In general, international LOR developments have taken shape in three forms that are for the most part congruent with development activities in Canada. They include:

- Development of interoperability standards and metadata schemes based upon the IMS Global Consortium's work
- Design and deployment of centralized repositories, digital libraries, or federated repository networks aimed at empowering individual educators as well as communities of practice
- Renewed focus on peer-to-peer initiatives that have as their aim the notion of empowering all users in a network to play a role in the development and utilization of learning objects and LORs, from the desktop level, to communities of practice, to large-scale digital libraries

The initial standards work of the IMS Global Consortium is beginning to mature and has spawned regional offices in various locations around the world. Canada is playing a direct role in this work through Industry Canada's EduSpecs initiative and the involvement of Canadian repository project participants in the thematic working group activities of IMS, including the development of accessibility methods and the creation of metadata profiles such as CanCore – two theme areas in which Canada has demonstrated world class leadership.

In Europe, the United States, and Australia LOR initiatives have been developed in most cases through consortium approaches, funded by a central agency, in order to seed the activity. Examples include:

- National Learning Network (NLN) in the United Kingdom http://www.nln.ac.uk/
- SMETE Open Federation in the United States http://www.smete.org
- Schools Online Curriculum Content Initiative in Australia http://socci.edna.edu.au/

These projects have received significant funding in their respective countries and are designed to be the blueprint for additional LOR activities. In all cases they have a national approach that brings together or provides a LOR forum for educational stakeholders from the federal, state, provincial, or regional levels. These projects demonstrate that for a mature and sustainable model to emerge, a collaborative national strategy is required. These projects also demonstrate that it is possible to operate valuable educational technology projects of a national scope in the absence of policy, while allowing the policy requirements to emerge and be dealt with in concrete terms rather than in the abstract.

A third trend that is emerging internationally is a focus on the development of communities of practice as a method for enlarging and expanding LORs into the work of faculty, instructors, and teachers. Exemplars of this approach include:

- MERLOT http://www.merlot.org
- Edutella http://edutella.jxta.org

MERLOT is organized as a consortium, providing a repository structure for peer-reviewed learning objects that are accessible to the academic community. It is organized around discipline-specific libraries of objects and demonstrates a viable method for organizing end users to both contribute and benefit from the learning objects accessible from its library. Canadians play influential roles on the board of MERLOT, and a number of Canadian repository projects and provinces are participants in the MERLOT framework. It provides not only a model for further development in Canada, but also provides a natural connection to a network of repositories that will undoubtedly emerge in the United States based upon the MERLOT template.

Edutella takes a user-centric approach to communities of practice, based upon peer-to-peer technology (P2P) that uses the SUN Microsystems JXTA specification. It is focused on the notion that users are the primary catalyst in the success of a LOR network and that this success can be enabled by providing users with convivial desktop tools that allow them to classify, store, search, and retrieve learning objects from their desktop systems, from discipline specific servers, and from large-scale digital libraries. The CANARIE sponsored POOL project has also developed a sophisticated peer-to-peer architecture in its LOR development and demonstrates another potential connection for Canada to the LOR developments taking place internationally.

4. POTENTIAL COMMUNICATION AND DISSEMINATION FRAMEWORK

As part of this study, opportunities and strategies for greater knowledge sharing among organizations and people involved in learning object repository research and deployment for education and training were considered.

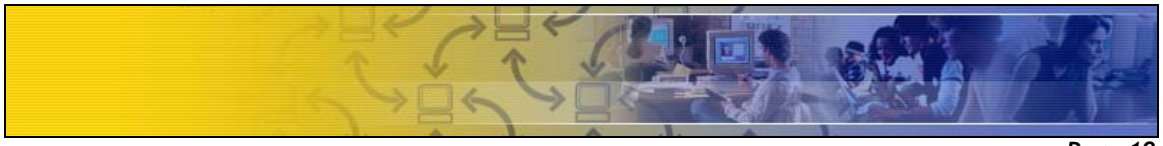
A number of groups and organizations are active in disseminating the results of their work in academic publications and presentations at most Canadian and international conferences. However, only a few Canadian organizations or groups working in the area of learning object repositories are attempting to serve as an aggregator by compiling and making available useful reports and overviews or facilitating networking and liaison among groups in Canada. The CANARIE-funded BELLE project has posted a number of useful reports for general audiences at their website (www.belle.netera.ca) but CANARIE and Industry Canada have been the most active in dissemination and networking. The POOL project has lead an initiative to edit a special edition of the *Canadian Journal of Learning and Technology* dealing with learning objects that will be disseminated in the fall of 2002.

CANARIE has worked to ensure that the learning object repository projects it funds are connecting their efforts by initiating meetings and communicating their expectations for collaboration. This process would be enhanced by using a common template for reporting progress such as the one used in Appendix A. CANARIE has also organized the annual CANARIE National E-learning Workshop, which has been a useful venue for sharing results among the CANARIE-funded projects. Each year the Workshop draws a wider audience of practitioners from the public and private sector.

Industry Canada has been active in keeping Canadian groups informed of global developments by sponsoring Canadians to participate in international meetings and, in 2000, hosting an IMS meeting in Ottawa that involved many public and private sector players. The recently established EduSpecs Technical Liaison Office (TLO) will implement a communications plan to disseminate information on standards and specifications and facilitate networking among key players. The National Research Council e-learning Research Group also has plans to expand efforts in the LOR area, by producing publications aimed at decision-makers in implementing organizations.

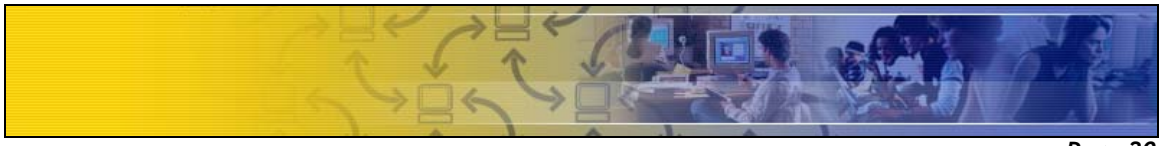
While greater coordination and leveraging of existing communication and dissemination channels is recommended, further investment is needed to expand efforts and to address specific needs of target groups. Some of these groups, their needs, as well as possible communication vehicles and key organizations are provided in the tables that follow.

More detailed recommendations are provided in the final section of this report.



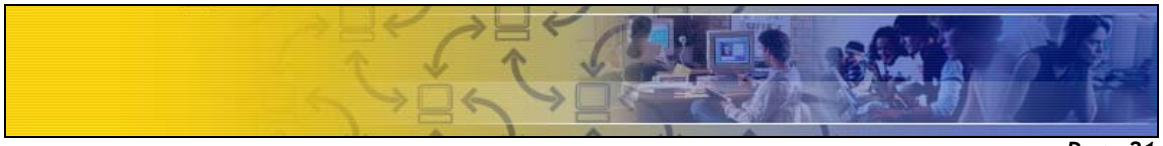
POTENTIAL DISSEMINATION STRATEGIES TO ADDRESS COMMON NEEDS

AUDIENCE	KEY COMMON NEEDS	POSSIBLE COMMUNICATION VEHICLES	KEY ORGANIZATIONS
Educators and trainers (practitioners) • K-12 • Post-Secondary • Workplace Policy-makers and decision makers at provincial and federal level Private sector developers of LOR solutions and services Researchers	Identification of organizations involved in either research or deployment of LORs, including implementing organizations as well as available technologies (Open Source products and commercial solutions) and available expertise, services, and training Rapid dissemination of lessons learned in deploying LORs to avoid reinventing the wheel or taking approaches unlikely to be successful Developments in meta-tagging standards Rapid communication of research findings both nationally and internationally International developments	Introductory primers/tutorials on key areas (meta-tagging, standards, architectures, deployment strategies) by experts (see for example, the Masie Centre E-learning Consortium "Making Sense of Learning Specifications and Standards: A Decision Maker's Guide to their Adoption" at http://www.masie.com/standards/S3_Guide.pdf) Case studies and profiles of implementations and evaluations (possible CANARIE/Industry Canada sponsored report series) Web site that collects, annotates and posts available reports (see BELLE as an exemplar) Continued use of CANARIE National E-learning Workshop as dissemination vehicle. Organize workshops at CADE conference Email bulletins/multimedia newsletters of developments included in existing email and print newsletters of CMEC, TeleEducation NB, and others Web site that collects key research reports and identifies research issues Reader-friendly articles in magazines of SchoolNet, the Association of Canadian Community Colleges, AUCC, industry training organizations such as the Canadian Association of Education and Training Organizations (CAETO) Training Workshop Series, both online and face to face	Potential Aggregator Network Participants: • EduSpecs Technical Liaison Office • CANCORE • NRC E-learning Research Group • CANARIE-funded LOR projects • C2T2 (The Centre for Curriculum Transfer & Technology) • Pan-Canadian LOR Channels • Council of Ministers of Education (CMEC) • CANARIE Inc. • Industry Canada (SchoolNet & IHAB) • Canadian Association for Distance Education (CADE) • National Research Council Industrial Research Assistance Program (NRC IRAP) Funders • Department of Canadian Heritage • CANARIE Inc. • Industry Canada • Office of Learning Technologies and Human Resources Development Canada (OLT and HRDC) • Ministries of Education



POTENTIAL DISSEMINATION STRATEGIES TO ADDRESS SPECIFIC NEEDS

AUDIENCE	KEY NEEDS	COMMUNICATION VEHICLES	ORGANIZATIONS
Policy-makers and decision makers at provincial and federal level	Gain greater awareness and interest Educational rationale for learning object repositories: Why the learning object approach? Why is this an important area?	Developing targeted brochure(s) with more accessible language to remove the perception that this is only a technical area of interest and to highlight interest and actual use of LOR in Canada Development of network of champions at provincial level	CANARIE Inc. NRC E-learning Group Alberta Learning CMEC
International Community	Keep international organizations aware of developments in Canada Keep Canadian organizations informed of global developments and ensure representation of Canadian interests	Web site that collects key global research reports and identifies research CANARIE National E-learning Workshop CANARIE/Industry Canada sponsored report series Participation in international studies and implementations (MERLOT, EML) and committees (IMS)	CANARIE Inc. National Science Foundation/Researcher Links Industry Canada: IMS/EduSpecs TLO MERLOT (T. Carey, Board co-Chair) CANARIE Link with European Commission POOL link with AVIRE, and Australian architectural LOR



5. RECOMMENDATIONS

RECOMMENDATIONS FOR THE CANARIE RFP PROCESS

CANARIE has an immediate opportunity to consolidate existing work and advance implementations of learning object repositories with its Learning Program Request for Proposals (RFP). The following timelines are recommended for the development, release, submission, and announcements related to the CANARIE E-learning RFP process.

- RFP announcement
  - April 15, 2002
  - $6M ($3M CANARIE)
- RFP submission deadline
  - May 15, 2002
- RFP announcement
  - June 30, 2002
- RFP contract
  - September 2002

A PROBLEM-BASED RFP FORMAT

After consultation with project participants and after conducting an analysis of current activities related to learning object repository development and deployment, the study team proposes the following recommendations with regard to structural elements of the CANARIE E-learning RFP.

A. Provide a solutions orientation to the RFP process, with multiple scenarios that reflect the actual work of educators, instructors, resource developers, publishers, and faculty.

The study team believes that the CANARIE RFP process should seek to move beyond the project stage and move toward larger-scale implementation, informed by the needs of identified end users in the educational community. Some of those end users include:

- instructors, teachers, faculty members
- instructional designers
- media and resource developers
- publishers

The RFP could provide written scenarios that describe the typical work and workflow requirements for representative members of the educational community as a problem to be solved.

B. Provide targeted solutions that solve particular parts of the larger problem, but requiring integration to match components.

The "larger problem" includes the areas for development that were identified in nine work packages identified by project members and resource persons who attended the CANARIE coordinated meetings in Vancouver, BC in November 2001. Those work packages included repository activities that were needed in the following areas:

- Community building
- Content repository
  - Digital rights management
- Metadata
- Software
- Hardware
- Business and management models
- Evaluative research
- Project management and communications
  - Coordination (Knowledge Management)
- Policy development

C. Provide for a creative interpretation of potential solutions in the RFP process but ensure that they are backed up by common technical standards (CanCore, IMS, SCORM, XML) that will require interoperability between components.

The study team recommends that the RFP process allow for creation interpretation of potential solutions, but that the RFP require adherence to common technical standards to ensure that components of the RFP process can interoperate. Emerging metadata profiles such as CanCore should be a requirement for all RFP submissions.

D. Ensure that accessibility is a required component of all RFP submissions.

The current CANARIE-funded project *Creating Barrier-Free Broadband Environments* has demonstrated that an approach to building learning repositories and aggregations of content from repositories can have *accessibility* as a central design tenet. The study team believes that this approach will ensure that all members of the educational community served by the project will be able to have access to the rich resources and tools as an intentional design requirement. The study team recommends that this

approach, the requirement for accessibility be followed with all components of the CANARIE RFP process. The team further believes that this approach will place Canada at the forefront of repository development for the future.

E. Ensure that RFP submissions are informed by best practices of comparable projects.

Projects such as the Multimedia Educational Resources for Learning and Teaching (MERLOT) project was frequently cited by project teams reviewed in this study as an exemplar of how communities of practice might be built to effectively utilize learning repositories. Other projects such as Edutella that seek to empower communities of practice from the desktop level through to the large scale repositories was also cited as an exemplar by project team members who were interviewed by the study team. The most recent project in the United States, the National Science Foundation (NSF) funded SMETE project is designed to enable a federation of repositories, each of which could ultimately be managed by its stakeholder community. The study team recommends, therefore, that RFP submissions ensure that they cite best practices from other jurisdictions with which their project could ultimately collaborate or interoperate both in Canada and elsewhere.

F. Ensure that RFP submissions are pre-qualified by an external review panel.

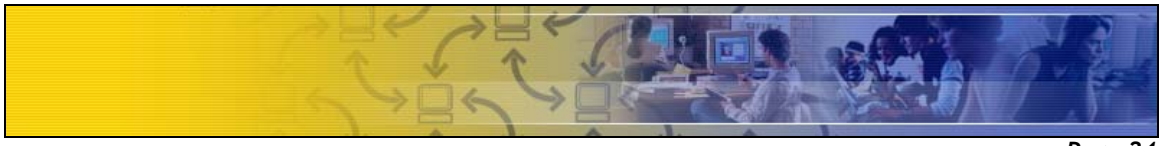
In reviewing the CANARIE RFP applications, CANARIE should initiate a review by qualified persons, and potentially invite an international reviewer, given the size of the community in Canada, who would provide a preliminary assessment of the technical strengths of the proposal as well as the business/sustainability case. It would be ideal to have the review panel provide guidance as a step before the application is reviewed by CANARIE analysts and the Learning Program Senior Steering Committee.

INDUSTRY CANADA AND EDUSPECS

The study team recommends that Canada continue to expand its work with the IMS Global Consortium through expansion of its influence into additional IMS working groups. Canadians are beginning to play a role in the instructional design working groups. As well, Canadians should play a role in the competency working group of IMS to ensure that training and corporate development initiatives in Canada are directly connected to LOR work on the global stage. Canada has much to offer in this realm.

OUTREACH AND DISSEMINATION

The study team recommends the following initiatives to address the major needs for information and knowledge sharing and to address specific target audiences, such as Ministries of Education and education companies, that are not addressed in current dissemination efforts.



- Given the great information needs in the deployment and use of learning object repositories, at minimum CANARIE and Industry Canada should coordinate their activities and investments and make better use of some of the existing communication channels. As one example, the EduSpecs TLO and CanCore groups need to leverage one another's strengths and connect activities, especially given limited budgets.

- CANARIE and Industry Canada should begin discussions with Ministries of Education to ensure that duplication of efforts is avoided and that initiatives are co-beneficial to the educational communities across Canada. Information sharing through a clearing-house of initiatives jointly sponsored by the Council of Ministers of Education (CMEC) and Industry Canada/CANARIE should be explored.

- Coordination of dissemination and outreach activities is a good step but will not be adequate. CANARIE should increase its investment in dissemination and outreach in learning object repositories to capitalize on the fact CANARIE is seen as the primary funder and resource in this area. Increased activities through partnerships with the Office of Learning Technologies (OLT), Department of Canadian Heritage, National Research Council, and CMEC should be pursued.

- If CANARIE and Industry Canada must limit their activities due to financial constraints, the following publications should be prioritized:

    - A short brochure targeting Ministries of Education and communities of users (e.g. such as teachers and trainers and administrators) that outlines in accessible language the opportunities created by use of learning object repositories and the state of their development and use.

    - An annual report targeting potential institutional users of learning object repositories, both public and private, that summarizes lessons learned in current implementations.

    - A primer on standards developed and published by Industry Canada's EduSpecs TLO and CanCore.

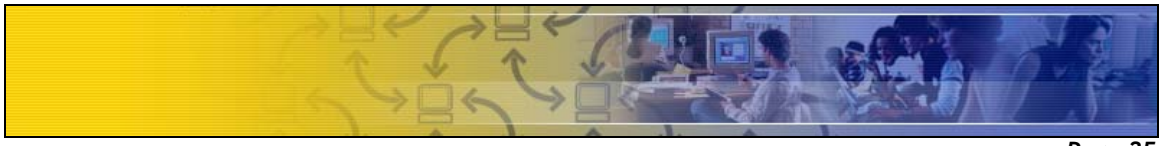
    - A primer or report on the intellectual property issues associated with the use of learning object repositories to guide administrators, institutions and individual educators concerning the Canadian environment for learning objects.

    - A comprehensive Canadian state-of-the-art publication that contains a series of articles corresponding to the topics of the key work packages recommended for the CANARIE Request for Proposals. This publication would be targeted to international agencies and organizations as well as to interested members of the Canadian community.

- CANARIE and Industry Canada should also consider the following aggregation and leadership initiatives:

    - Provide additional funding to BELLE to expand its web-site and become the CANARIE Learning Program one-stop knowledge resource on learning object repositories by posting the various papers and publications, and to the SavoirNet site for French publications. This site could link to EduSpecs TLO and CanCore for more detailed information on standards and specifications.

    - Sponsor a leadership/outreach initiative to create a "Network of Champions", a group of opinion leaders at the provincial and federal level who will be active in outreach



strategies and the development of matching funding opportunities.

- Support a learning object community of practice through outreach activities utilizing new technologies to support information sharing and professional practices. Such community building activities could include a pan-Canadian listserv, linking to the creation of a "test-bed" repository structure, and linking of existing CANARIE projects to the community of educators across Canada. The community should also include those responsible for online education, technology enhanced learning environments and content creation within Ministries of Education. A possible organization to assist with this initiative for the post-secondary sector is C2T2, an organization with experience in community building.

VISION FOR A NEXT PHASE OF LORS

The funded projects resulting from the CANARIE RFP and Industry Canada's work in standards development and dissemination with EduSpecs should be designed in a way that helps to achieve large-scale demonstrations and evaluations of the learning object repository approach. However, the study team recommends that both organizations continue their leadership beyond 2004.

During its Phase III, CANARIE supported the development of a world-class learning infrastructure with CA*net3. The CANARIE Learning Program has funded a portfolio of large multi-partner projects, often spanning many provinces. These projects are demonstrating the removal of barriers and the effective use of e-learning across all educational sectors and a variety of industries. Nearing the end of this phase, CANARIE is increasing its activities in disseminating results by organizing a National E-learning Workshop and bringing on other partners to co-invest in targeted areas (e.g. the CANARIE-OLT joint funding initiative in the health sector).

Industry Canada has been an early champion of the e-learning sector with the creation of funding programs for learning applications and product development. The department has also had a role in expanding Canada's learning infrastructure by creating networks of community access sites and connecting schools and libraries across Canada. Most importantly, Industry Canada initiated programs such as SchoolNet's Grassroots to build awareness and seed communities of content providers at the teacher/instructor level.

In the Learning Object Repository arena, both CANARIE and Industry Canada have played leadership roles that are widely acknowledged. CANARIE was one of the first investors in flagship learning object repository developments across Canada. Through this investment, Canadian project leaders were provided with the base to participate in international initiatives in the U.S., Europe, and Australia. Industry Canada was an early supporter of the IMS initiative and has prioritized the need to connect with the development of global standards.

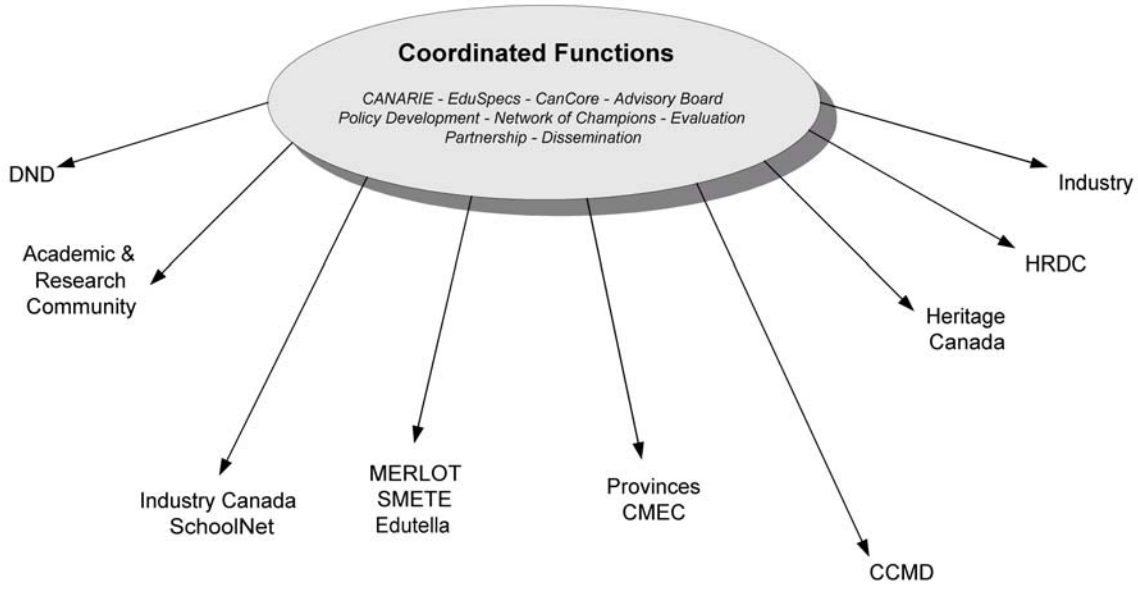
The learning object repository area presents CANARIE and Industry Canada with a timely opportunity to leverage this considerable base of technical infrastructure, knowledge and technology creation, community development, and relationships.

There are several reasons why involvement and support of various levels of government are critical at this early stage of large-scale learning object repository deployment. The utilization of learning object repositories is still at the demonstration phase and the market for the exchange of learning objects in its infancy. There are some benefits to this early stage of development as commons standards and interoperable repositories can be encouraged. The other major challenge to the application of learning object repositories is the fragmentation of the various funding agencies and implementation groups. To be successful and to lead to sustainable implementations, partnerships with provincial ministries and other federal government departments are required to carry out the following:

- Expand broadband networks across Canada including last mile investments
- Utilize and expand existing communities of content providers and users
- Expand support for the development of content
- Carry out the critical professional development to effectively use LOR
- Share effective practices
- Conduct applied research and development in both technical and social areas
- Ensure connection to international developments
- Support e-learning industry development

CANARIE and Industry Canada are positioned to catalyze and co-lead this initiative in the learning object repository area. Through coordination of efforts led by CANARIE and Industry Canada, greater economies of scale are possible. The diagram that follows is a view of the possible coordinated functions and some of the key players that will be involved in the funding of deployments or offering of testbed opportunities.

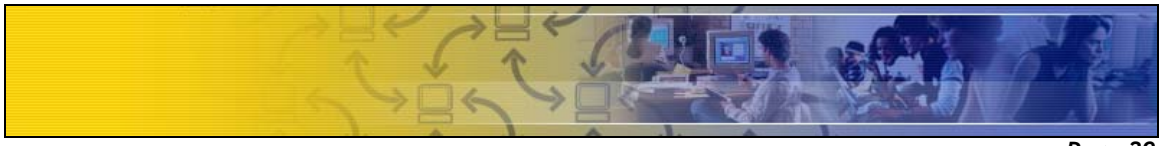
Coordinated Pan-Canadian Strategy Map



The wide-scale deployment of learning object repositories and related benefits in cost-effective development of education and training finds much support in the recently released Innovation Papers. There is a need to build "the country's learning infrastructure" (Knowledge Matters, page 38) in order to address the critical need to renew and upgrade the skills of Canada's workforce and strengthen the post-secondary education sector.

CANARIE and Industry Canada could begin over the next 18 months with a communications effort to identify the network of champions and communities of practice needed to carry out this vision. The table that follows outlines present activities and potential roles for a number of federal and provincial organizations with an interest in the development and deployment of learning object repositories.

ORGANIZATION	PRESENT ACTIVITIES	POSSIBLE ROLE IN JOINT INITIATIVE
CANARIE	▪ CA*Net3 ▪ Learning Program funds development and implementation of LORs ▪ Collaboration and information sharing through National E-learning Workshop	▪ Catalyst and initial co-lead with Industry Canada ▪ Lead on network infrastructure ▪ Program to support tools creation and industry development (TAD as possible model)
Industry Canada	▪ Sponsors of EduSpecs, IMS Technical Liaison Office and funder of CanCore ▪ Foster grassroots creation of online content and ICT skills development through SchoolNet ▪ Industry development through multimedia learnware program ▪ Promoting best practices in integrating ICT in learning. ▪ Mechanisms for collaboration and information-sharing such as the SchoolNet Advisory Board ▪ Canada's Campus Connection provides a portal for the promotion of on-line courses of Canada's universities and colleges to a growing market of government and private sector employees seeking skills upgrading. ▪ SchoolNet portal: 3,000 teacher-vetted and indexed online educational resources ▪ Support for partner-developed online services ▪ SchoolNet Network of Innovative Schools develops and shares best practices for ICT in learning	▪ Catalyst and initial co-lead with CANARIE ▪ Lead on standards ▪ Offering of "community bases" of the SchoolNet Grassroots, Community Access Program/or NIS and Campus Connect
National Defence	▪ ADL Co-Lab with emphasis on adaptable user interfaces	▪ Information resource and possible exemplar site
NSERC	▪ Fund base technology developments	▪ Research on new tools including peer to peer tools
SSHRC	▪	▪ Research on community-building and social issues ▪ New Economy Program could fund implementations and evaluations of LOR
National Research Council	▪ Conducts some research and dissemination activities related to meta-tagging	▪ E-learning Research Group at NRC Institute for Information Technology as a generator of summary and state-of-the-art reports
Department of Canadian Heritage	▪ Programs for content development	▪ Programs for content development
HRDC	▪ Has funded applications and evaluations of LOR approaches	▪ E-learning Sector Council and lead on professional development
CFI	▪ Funded some implementations of LOR (e.g. the Open Learning Agency)	▪ Support to individual organizations and consortium's implementing LOR
CMEC	▪ Initiated a number of reports and meetings of provincial stakeholders	• Joint sponsor of clearinghouse
Provincial ministries	▪ Alberta released RFP and sponsored Alberta LOR implementations	▪ A number of provinces are pursuing LOR projects including Alberta, Ontario, and New Brunswick. Other provinces such as Saskatchewan are major participants in Grassroots and are underway with strategy development.



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The list of references includes reports, papers, and studies that were both identified by the study team or submitted by interested parties.

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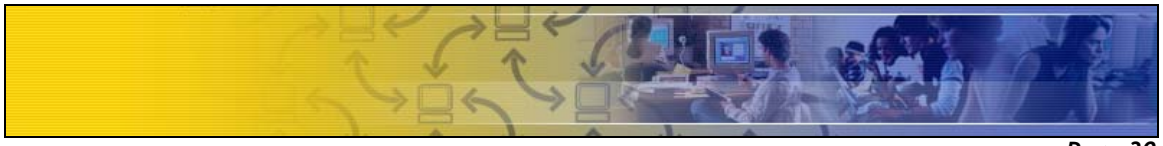


APPENDIX A: CURRENT REPOSITORY PROJECTS AND INITIATIVES IN CANADA

In order to conduct a review of current repository projects in Canada, a framework for reporting was developed that would provide a consistent method for documenting information. The framework used by the study team is outlined in the section that follows.

REPORTING FRAMEWORK

The report framework consisted of the following elements:

- Project Name
- Summary
  - Educational Goals
  - Beneficiaries of Project
- Technology
- Implementation
  - General State of Project Progress
  - Lessons Learned from Current Implementation
- Staffing
  - Staffing Resource Details
- Budget
- Benefits
  - Primary Benefit
  - Value of Project to Beneficiaries
  - Value of Project to Canada
- Evaluation
  - Evaluation Methods and Results

PROJECTS REVIEWED AND INTERVIEWS CONDUCTED

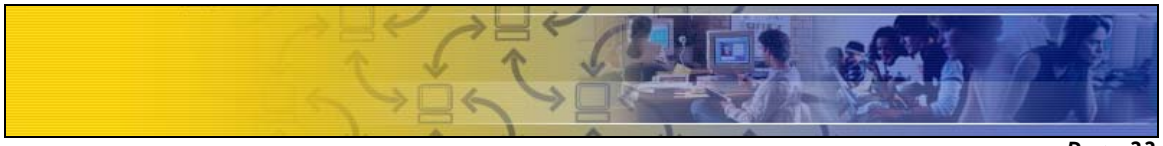
The projects were reviewed by the study team, and interviews were conducted with their project managers or principal investigators. The tables that follow summarize data from the following projects:

- Broadband Enabled Lifelong Learning Environment (BELLE)
- Campus Alberta Repository of Educational Objects (CAREO)
- Creating Barrier-Free Broadband Learning Environments
- Learn Canada
- Open Learning Agency – Canada Foundation for Innovation Project
- Partnerships for Learning, Innovation and Technology (PLIANT)
- Portal for Online Objects for Learning (POOL)
- SavoirNet (Explor@)

The following individuals provided their time for interviews with the study team:

- Terry Anderson — Athabasca University
- Tim Bray — Antarcti.ca
- Alan Burk — University of New Brunswick
- Tom Carey — University of Waterloo
- Stephen Downes — National Research Council
- Norm Friesen — University of Alberta
- Enid McCauley — Open Learning Agency
- Rory McGreal — Athabasca University
- Doug McLeod — Netera Alliance
- Gilbert Paquette — LICEF
- Nancy Parsons Heath — Stem~Net
- Gary Popowich — Alberta Learning
- Griff Richards — TeleLearning NCE
- Kevin Riley — JISC / BECTA (United Kingdom)
- Susan Schroeder — Alberta Learning
- Jutta Treviranus — University of Toronto

The tables that follow reference information collected for repository projects in Canada. Any errors or omissions are those of the study team.



<table>
<tr><th colspan="3">BROADBAND-ENABLED LIFELONG LEARNING ENVIRONMENT (BELLE)</th></tr>
<tr><td>Summary</td><td colspan="2">BELLE (Broadband Enabled Lifelong Learning Environment) is a project funded under the CANARIE Learning Program. BELLE's objective is to develop a prototype educational object repository.

Educational Goals:
Over the course of two years, BELLE is exploring the critical aspects of building object repositories. Specifically, BELLE is investigating four interconnected aspects of establishing this repository:

▪ Creating and cataloguing educational objects
▪ Pedagogical models and peer review processes
▪ Evaluation and support
▪ Test bed infrastructure

The aim of BELLE is to weave these four areas together to make a prototype for an educational object repository. While this prototype will not be a fully functional or a complete repository, it is intended to test, evaluate, and document key components of such a structure.

Beneficiaries of Project:
▪ Partners, researchers, educators, and students</td></tr>
<tr><td rowspan="8">Technology</td><td>Item</td><td>Benefit</td></tr>
<tr><td>Educational Objects</td><td>▪ Accessibility – object is defined and categorized for easy access
▪ Adaptability – user can locate and adapt the object with ease
▪ Interoperability – object will function across a wide variety of hardware, operating systems and web browsers</td></tr>
<tr><td>Peer Review</td><td>▪ Will improve the quality of learning
▪ Saves on cost and time
▪ Will examine models and approaches related to teaching evaluation, academic peer review, learning object evaluation and scholarly teaching
▪ Will assess scholarly contributions and individual faculty members at partner institutions</td></tr>
<tr><td>Content Repurposing</td><td>▪ Allows learning objects to become customizable and reusable, is cost effective, sustainable, and offers high-quality educational materials</td></tr>
<tr><td>Advanced Network
(broadband networks)</td><td>▪ Allows videoconferencing/streaming video to become practical by enabling delivery of interactive materials to classroom
▪ Allows interaction between geographically separated teachers and learners</td></tr>
<tr><td>Streaming Video
(VoD – video on demand)</td><td>▪ Users can simultaneously receive data
▪ Users can receive, jump to any point, or rewind and replay a presentation
▪ It cannot be saved, captured or modified
▪ Can create original video/audio
▪ Can compress video into suitable format for network delivery
▪ Digital delivery via internet to viewers desktops
▪ To replace analog video devices such as VCR's</td></tr>
<tr><td>Video Conferencing (MCU – Multipoint Control Unit)</td><td>▪ Exchange of information in real time, better video and audio quality, low transmission costs, convenient access with more video conferencing features</td></tr>
<tr><td>Client Learning Environment (CLE) - video conferencing system</td><td>▪ Mobile, scalable, self-contained low-cost video conferencing system
▪ It includes all hardware/software or H.323 video conferencing
▪ Only 120V AC power and 10 mbps internet connection required
▪ Easily configured</td></tr>
</table>

Implementation	**General State of Project Progress:** Progress Report 7 (Dec. 31, 2001) Work is progressing on all aspects of the project. Some of the highlights are: ▪ Full deployment of Client Learning Environment (CLE) ▪ Definition and schedule of partner pilot projects ▪ Definition of content repurposing facility specification and workflow ▪ Functional prototype repository (CAREO) ▪ Development of prototype for indexing and uploading of digital content (Learning Commons Metadata Hub) ▪ Training and support schedule for content repurposing and metadata generation **Lessons Learned from Current Implementation:** A proposal has been drafted requesting the project be extended from March to December 2002, and that further funds be provided for this period. (Refer to the BELLE Extension draft December 31, 2001).
Staffing	**Staffing Resource Details:** Totals: 11 fulltime; 23 part-time
Budget	$3.4 million shared-cost project
Benefits	**Primary Benefit:** Partners **Value of Project to Beneficiaries:** An opportunity to optimize and evaluate current learning conventions as well as create and implement a national standard. **Value of Project to Canada:** ▪ Because of the importance of education to Canada's economic future, building a robust infrastructure for a shared national object repository is an important project for the nation in the 21st century ▪ There is currently no standard for metadata on the Internet. The BELLE project will provide a much greater level of access to relevant online sources across Canada and will act a as lead for any other repository projects that are created. It will eliminate the problem of "information blindness." ▪ Content repurposing looks at standardizing ways to develop, deliver, and cost-effectively repurpose digital educational materials across the country. ▪ Advanced networks will enable users to deliver high-resolution video almost instantaneously to any school, office, or home in the country. ▪ Streaming video will replace analog video devices such as VCRs.
Evaluation	Throughout the duration of the BELLE Project, quantitative and qualitative evaluation tools will be used to establish the feasibility and acceptability of the broadband-enabled learning environments. These results will have an impact on both technology and learning as they are fed back into the teaching and learning development process. The continuing cooperation, communication and commitment of all of the partners are necessary to the success of the BELLE Project. These evaluative steps are presented in that spirit of collaboration. **Evaluation Methods (and results):** 1. Logs: a) System log for the Client Learning Environment (CLE) b) Activity log for the Client Learning Environment (CLE) c) Discussion log between partner institutions and Netera Alliance 2. Market research study 3. Evaluation questions 4. Pilot and evaluative projects The Core Evaluation Team (CET) will coordinate evaluation activities with the appropriate sub-groups at each stage of the evaluation process.
Project Partners	The BELLE project is a partnership led by the Netera Alliance, and includes: ▪ Banff Centre for the Arts ▪ McGill University, Faculty of Medicine ▪ Northern Alberta Institute of Technology ▪ Seneca College ▪ Sheridan College ▪ University of Alberta ▪ University of British Columbia ▪ University of Calgary Faculty of Medicine ▪ University of Calgary Learning Commons ▪ University of Lethbridge ▪ Vancouver Film School ▪ York University

<table>
<tr><th colspan="3">CAMPUS ALBERTA REPOSITORY OF EDUCATION OBJECTS (CAREO)</th></tr>
<tr><td>Summary</td><td colspan="2">The Campus Alberta Repository of Educational Objects (CAREO) project is supported by Alberta Learning and is also funded through the BELLE project. CAREO has as its primary goal the creation of a searchable, web-based collection of multidisciplinary teaching materials for educators across the province and beyond. CAREO is being undertaken jointly by the universities of Alberta and Calgary in cooperation with BELLE (Broadband Enabled Lifelong Learning Environment), CANARIE, and as a part of the Campus Alberta initiative. CAREO uses the CanCore metadata specifications and is modeled after the US-based MERLOT project.

Educational Goals:
GOAL 1: a functioning online learning object repository
Measure: 5000 Canadian visitors in 1 month; 200 objects added by Alberta users.

GOAL 2: Creation of user group and a support community around the repository
Measure: 150 personal members from Alberta; 25 institutional memberships from Alberta.

GOAL 3: Involvement of faculty members from U of A and U of C in the development and implementation of a peer review processes
Measure: Securing commitments from a total of 8 faculty members.

GOAL 4: Collaboration with existing and emerging repository efforts
Measure: Membership in other repository organizations; interoperability with other repositories.

GOAL 5: Research and dissemination of findings
Measure: 3 Peer-reviewed publications.

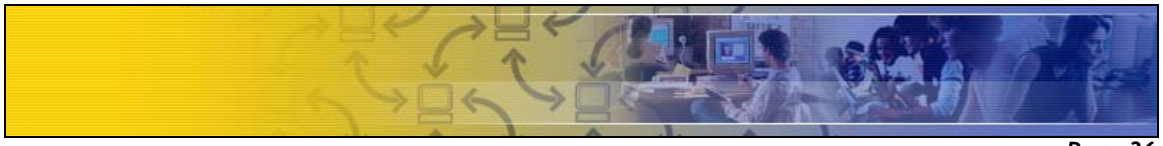
GOAL 6: Promotion of use of educational objects among instructors
Measure: See measures for first 2 goals. Integration of training and support for the use of educational objects with existing support efforts of Alberta Learning and the Learning Commons.

GOAL 7: Development of a business and sustainability plan
Measure: Secured funding and/or action plan

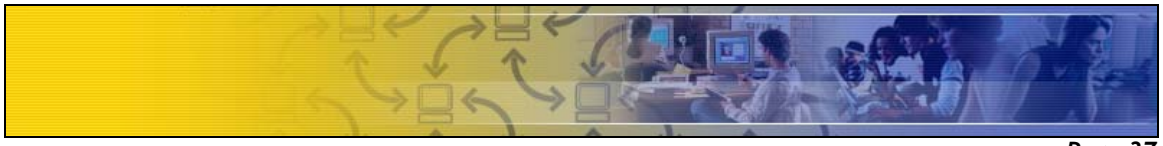
Beneficiaries of Project:
Educators and learners</td></tr>
<tr><td>Technology:
Object Repository</td><td>Item</td><td>Description / Benefits</td></tr>
<tr><td></td><td>Repository Application</td><td>Instructors & Learners: An HTML interface for searching and retrieving metadata records that describe and link to learning objects
Administrators: An HTML interface for maintenance functions (i.e. quality control of metadata records)
Only an internet connectivity and compliant web browser is required</td></tr>
<tr><td></td><td>Distributed Assets/Asset Repositories</td><td>The assets (a.k.a. learning objects) themselves would be distributed on servers across the web after being either submitted to the repository or collected via another repository or metadata store.</td></tr>
<tr><td></td><td>Metadata Interchange</td><td>▪ Will collect records available in other repositories or metadata stores
▪ Will ensure that collected metadata conforms with CanCore protocol
▪ Will make Metadata records available for collection by other repositories</td></tr>
<tr><td>Implementation</td><td colspan="2">General State of Project Progress: A prototype with limited learning objects is available at http://careo.netera.ca/cgi-bin/WebObjects/CAREO.

Lessons Learned from Current Implementation:
The main test facing CAREO goes beyond the technology. The repository technology is being refined and Alberta is rapidly upgrading bandwidth to its higher learning institutes and K–12 schools.
Populating the repository and the peer review process will be the major challenges, as will getting institutes to adopt MIT's and MERLOT's philosophies of the open source approach to sharing intellectual property. Another challenge will be in the training of educators in the consistent application of the metadata standard as applied to describing learning objects, and in the training of educators and learners in the use of the repository.</td></tr>
<tr><td>Staffing</td><td colspan="2">Staffing Resource Details:
Faculty Editorial Review Board Members = 7
CAREO Advisory Board = 6
Co-directors for CAREO Project = 2

Unable to find other data outlining additional resource details</td></tr>
</table>



Benefits	***Primary Benefit:*** To provide the educators and learners (K-12 and post-secondary) of Alberta and other jurisdictions with a web-based searchable database of learning objects across multiple curriculum areas. The learning objects will be utilized in traditional face-to-face learning environments, in distributed learning, and in the workplace. ***Value of Project to Beneficiaries:*** • To enable learners to take courses from any college or university, either on-site, on-line from their homes, or on the job • Reuse of modularized educational resources or learning objects • Easy access to learning objects through a searchable database • Single-click access to these resources through a repository architecture • Cost reduction • Professional recognition for staff engaged in development or delivery of educational resources • Maximization of investments in staff and course development • To provide quality control for learning content used in teaching through peer review ***Value of Project to Canada:*** The primary benefit to Canada is the creation of a searchable, web-based collection of multidisciplinary teaching materials for educators across the country.
Evaluation	***Evaluation Methods:*** The development and enhancement of these resources through quality control, peer review, reward and support practices. ***Results:*** A prototype object repository has been achieved.
Project Partners	▪ MERLOT ▪ Netera Alliance ▪ Alberta Learning ▪ BELLE Project ▪ CanCore Protocol



<table>
<tr><th colspan="3">CREATING BARRIER-FREE BROADBAND LEARNING ENVIRONMENTS</th></tr>
<tr><td>Summary</td><td colspan="2">This project supports educators in creating and repurposing learning content that is accessible to all learners. It also provides learners with on-line curriculum that adapts to their learning and access needs.

Development of broadband delivered education systems in Canada is at a critical juncture: conventions can be established that exclude a large sector of the Canadian population or conventions can be adopted that make education possible for many Canadians who have been previously excluded. If proactive steps are taken now, barrier-free education can be a naturally integrated component of broadband education delivery.

Educational Goals:
The overall goal of this project is to identify potential barriers to access in broadband education delivery systems, develop solutions to the barriers, advance alternative or multi-modal display and control mechanisms that are only possible in broadband environments and create tools that allow learners to customize the learning experience to their individual learning styles and needs.

Overall Plan:
▪ Iterative development
▪ Implementation
▪ Evaluation
▪ Prepare for commercialization and dissemination

Beneficiaries of Project:
Learners who are presently excluded from using network based educational environments due to access barriers (i.e. disabilities) include individuals of all ages who are:

▪ Blind and depend upon screen reading or refreshable Braille technology
▪ Deaf and hard of hearing and rely on captioning for access to audio components
▪ Visually impaired and require screen magnification tools
▪ Physically disabled and require alternatives to the keyboard and mouse
▪ Have learning disabilities that require text-to-speech and/or voice recognition tools</td></tr>
<tr><td>Deliverables</td><td>Item</td><td>Benefit</td></tr>
<tr><td></td><td>Authoring Tools</td><td>Will provide the capability of alternative formats to video learning materials (i.e. captions and audio descriptions, to enhance learning materials with graphics, interactive exercises, hyperlinks, etc.)</td></tr>
<tr><td></td><td>Player</td><td>Will allow learner to interact with educational material</td></tr>
<tr><td></td><td>Learner Preferences</td><td>Will allow content authors to specify their defaults for the presentation of the learning materials, and allow learners to specify their own personal preferences</td></tr>
<tr><td></td><td>Learning Object Repository</td><td>A database of learning objects will be designed to house the various media items allowing the learner to access only the components they require.</td></tr>
<tr><td></td><td>Accessible and Customizable Educational Videos</td><td>Will enable teachers/authors to use the authoring tool to create educational videos customized with content related to their own classroom/student needs.</td></tr>
<tr><td></td><td>Haptic Interactive Exercises</td><td>Will provide tactile exercises to supplement the learning materials. These modules will be linked in with the learning materials by the author through the authoring tool, and the learners will experience the exercises through the Player tool.</td></tr>
<tr><td></td><td>Sign Translation Requirements</td><td>Will be investigated, to determine how to make effective use of the broadband environment to transmit sign translations of learning materials.</td></tr>
<tr><td>Implementation</td><td colspan="2">General State of Project Progress:
Authoring Tools
An early version of the Authoring Tool is currently being tested. The Authoring Tool can be used to:

▪ Supplement a video presentation with alternative modalities, including
o Multiple text caption tracks (e.g. different languages, different reading levels)
o Multiple audio descriptions (e.g. different languages, etc.)
o Alternate videos (e.g. ASL translation)
▪ Add instructor annotations
▪ Add hyperlinks to supplementary information, such as definitions and web-based material
▪ Add graphic overlays, such as diagrams, or highlight indicators

The Authoring Tool will be integrated with the Repository, allowing the user to search the Repository for learning objects that could be added to the presentation.</td></tr>
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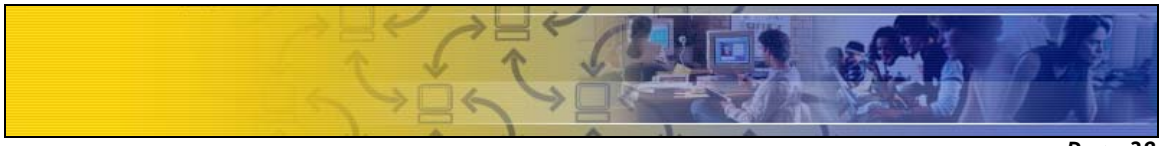

	Player An early version of the Player is currently being tested. This Java application allows learners to access education material authored using the Authoring Tool, and configure it according to their own learning style, as specified in the Learner Preferences. ***Learner Preferences*** The learner can specify whether or not they wish to view a text caption, or hear an audio description, and express their preference for which version of the supplementary material they prefer, based on language preferences, and other factors such as reading level. They can indicate whether or not they wish to view any instructor annotation, or supplementary images. ***Learning Object Repository*** The repository is organized around a three-tier architecture. ▪ The first tier is the database ▪ The second tier of the learning repository is a "server" ▪ The third tier of the repository is the client software which runs on computers used by end users ***Accessible and Customizable Educational Videos*** The partners involved in this project have collaborated and developed a sample half-hour video. Episode One of the Canadian Learning Television series *Physics- A World in Motion* has been enhanced with caption tracks, audio descriptions and a broad range of supplementary learning materials, including web-based simulations, diagrams, tables, charts and haptic exercises. This video represents the power of being able to transform learning materials to meet the individual needs of both the instructor and the learners. **Lessons Learned from Current Implementation:** ***Sign Translation Requirements*** In preparing the evaluation material for American Sign Language (ASL) translation it was determined by the partners that this deliverable should be expanded. One of the considerations not included in the original plan was to determine how broadband systems can help to overcome some of the problems of traditional broadcast ASL translation. Because of the ability to view materials in a non-linear fashion, to display overlay graphics and to show more than one video window, a number of traditional challenges to effective ASL translation may be overcome in a broadband environment
Benefits	**Primary Benefit:** To learners, teachers, and authors with disabilities **Value of Project to Beneficiaries:** To provide users with disabilities the same quality of access to education and instruction as non-disabled persons. **Value of Project to Canada:** Conventions can be adopted that make education possible for many Canadians who have been previously excluded.
Evaluation	**Evaluation Methods:** 1. Formative evaluation for broadband accessibility study 2. ASL video evaluation 3. Summary of interface evaluation activities 4. Additional evaluation initiatives: Literature review and expert survey
Project Partners	▪ Canadian Learning Television ▪ Adaptive Technology Resource Centre, University of Toronto ▪ Centre for Learning Technologies, Ryerson Polytechnic University ▪ Canadian National Institute for the Blind Library (CNIB) ▪ Canadian Hearing Society (CHS) ▪ National Educational Association of Disabled Students (NEADS) ▪ Marblemedia Inc. **Contributors and Consultants:** ▪ Immersion Corporation ▪ Expresto Software Corp.

<table>
<tr><th colspan="3">LEARN CANADA</th></tr>
<tr><td>Summary</td><td colspan="2">LearnCanada's mission is to leverage the potential of CA*net 3 to develop a broadband interactive virtual learning community for Canadian K-12 educators.

Educational Goals:
LearnCanada will develop broadband infrastructure, multimedia tools and middleware for professional development through virtual peer-learning communities, and telementoring within a portal/repository environment.

▪ Will connect multiple sites at each of six school boards across Canada
▪ Will carry out and evaluate field trials with 300 K-12 educators across Canada
▪ Will generate broadband multimedia software that may be useful to other research projects
▪ Will focus on project based learning
▪ Will develop tools for online dialogue and interaction for video annotation and multimedia databases
▪ Will initiate long-term work on portal/repository middleware for access and distribution of multimedia learning objects across Canada
▪ Usability, security, privacy and e-commerce requirements will be developed
▪ Portal user-interface functionality will be prototyped and evaluated
▪ Will develop scenarios for Canada wide deployment of broadband infrastructure and middleware

Beneficiaries of Project:
LearnCanada will focus on professional development of K-12 educators, but the approach is applicable to adult learners in a much wider context.</td></tr>
<tr><td>Technology:</td><td>Portal Repository</td><td>Benefits / Description</td></tr>
<tr><td></td><td>Virtual peer-learning community
Description: geographically distributed peers, bound together via broadband networks, supporting each other in specific learning goals</td><td>▪ Operates both synchronously and asynchronously
▪ Will use CA *net 3 to support online virtual meetings
▪ Will allow peers to create, send, receive, and annotate digital video segments
▪ Video annotation will include opportunities to attach voice, text, hypertext, video and hand-drawn graphics to specific points within the video
▪ Will create new intellectual property</td></tr>
<tr><td></td><td>Telementoring
Description: broadband interaction of geographically distributed learners with one or more mentors</td><td>▪ Online meetings and seminars
▪ Live observation
▪ Annotation of captured video
▪ Will create new intellectual property</td></tr>
<tr><td>Benefits</td><td colspan="2">Primary Benefit:
K-12 educators

Value of Project to Beneficiaries:
▪ Access, quality partnerships, and national best practices at reduced costs
▪ Access to a high-speed national and international channel to sell learning content and services
▪ Access to high-speed networks, middleware, and multimedia objects and tools
▪ Re-purpose multi-media content for distribution and multiple use at reduced cost
▪ Membership within a national and international virtual community of educators
▪ Input into the development of standards and protocols for distributed learning services
▪ Staying on the leading edge of technology that supports teaching and learning

Value of Project to Canada:
▪ LearnCanada will demonstrate the value of emerging broadband networks by connecting learners and learning resources from across Canada and the world.
▪ LearnCanada will impact learning in Canada by contributing directly to establishment of an innovative learning culture that will sustain and enhance Canada's position in the global knowledge economy.
▪ Using the LearnCanada approach developing countries that cannot afford bricks-and-mortar for education, will benefit from opportunities to learn from mentors and peers internationally.
▪ LearnCanada will generate economic benefits to Canada through accelerated learning and development of best practices in a wide variety of learning communities, through export of Canadian technologies, expertise and multimedia intellectual property for learning applications of broadband networks and through the export of Canadian expertise serving in telementoring roles internationally.
▪ LearnCanada benefits Canada by establishing Canada as an international leader in learning technology, by initiating collaborative research between educators and technology researchers and by demonstrating a model whereby school boards leverage each other's knowledge and capabilities.</td></tr>
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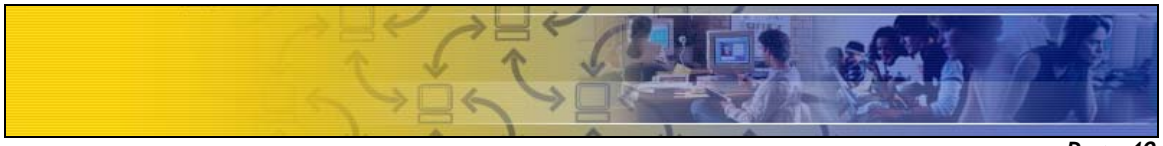
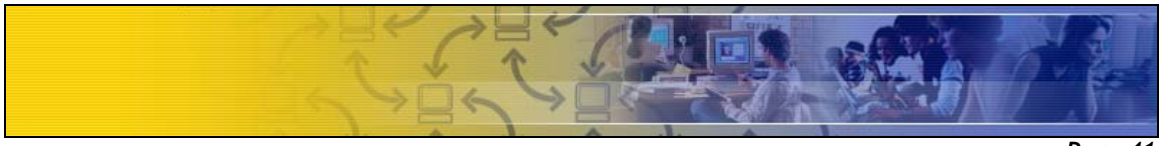


Evaluation	*Evaluation Methods:* ▪ Benchmark the metrics using qualitative and quantitative research techniques. This will be done to establish the extreme points and internal scales for each metric continuum. ▪ Regular and periodic tracking and monitoring of the teams' and project's progress against the established metrics. This will include techniques such as interviews, questionnaires, self-evaluation, surveys, focus groups, facilitated meetings and naturalistic observation. The project participants will be the primary sample for data collection. On occasion, in order to get different viewpoints, the sample will extend to adult learners outside of the project. ▪ Ongoing and regular dissemination of results to all stakeholders. ▪ Final evaluation at project end to determine the degree of the project success against its overall objectives.
Project Partners	**LEARNCANADA FOUNDING MEMBERS:** STEM Net, Memorial University of Newfoundland Canada's SchoolNet Shaw Communications Kawartha Pine Ridge District School Board(KPRDSB) Toronto District School Board (TDSB) Ottawa Carleton District School Board (OCDSB) Edmonton Public School Board (EPSB) Avalon East School Board (AESB) Conseil Commission Scolaire au Coeur-des-Valées (CSCV) National Research Council (NRC) Communications Research Centre Canada (CRC) **ASSOCIATE MEMBERS:** National Arts Centre Open Learning Agency (OLA) Fifth Framework Program (FP5) Canada Israel Industrial Research and Development Foundation ENO (Education Network of Ontario) LearnCanada Network Topology Diagram

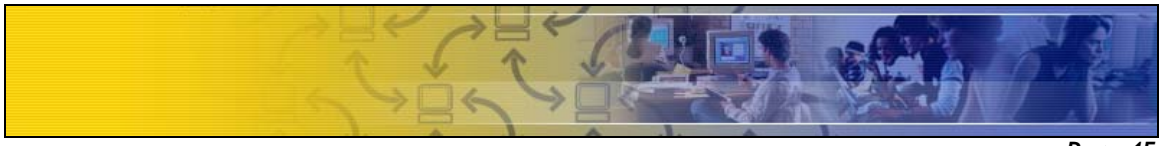


ON DEMAND LEARNING: INFRASTRUCTURE, DESIGN AND MANAGEMENT	
Summary	**Open Learning Agency Project: Funded by Canada Foundation for Innovation and the British Columbia Knowledge Development Fund** **On Demand Learning: Infrastructure, Design and Management** This project helps to increase the capacity of education and training providers in British Columbia to lead and compete successfully in the global "learning object" economy. The global learning object economy is based on the convergence of technology and new learning models. Using structured information strategies, education and training providers can deconstruct educational materials into structural components called "learning objects". Objects such as learning outcomes, assessment strategies, content blocks, video, images, and other instructional elements can be recombined into a variety of educational products and tools. The learning objects are tagged with metadata for storing and cataloguing, according to internationally recognized standards such as IMS, Dublin Core, CanCore, etc. The owners of the intellectual property can then exchange these materials with others who use the same metadata standards, and reconstitute them into customized "courses" or "modules" for use by individual learners and groups. The potential of this process can lower the cost to both the provider and the consumer by making it possible to repurpose and customize instructional materials to meet specific learning needs and to deliver the same materials in multiple formats (e.g., print, web, CD-Rom). Education and training providers can benefit from substantial economies of scale if they know how to use structured information technologies and have access to the appropriate educational infrastructure. **Educational Goals:** The overall goal of this project is to provide the education system in British Columbia with the tools and training required to design, develop and share resources through standardized development methodology, and application of either a centralized repository strategy or a network of distributed repositories across the province/country and internationally. With sufficient resources, OLA will be able to create new methods and processes for instructional design, for the development of electronic media management systems, for research information systems to support applied research projects, and to develop new partnership models with the BC education and training system as well as with business and industry. This educational infrastructure will provide the BC education and training industry with the foundation needed to secure a leadership position in the rapidly expanding global learning object economy. **Overall Plan:** • Establish the infrastructure to effectively design, develop, store, and exchange learning objects. This includes an object repository, a digital media management system, a storage area network, and a non-structured document management system. • Establish metadata standards in collaboration with colleagues across the system. (i.e. IMS, CanCore) • Develop XML schema and SGML DTD structures for a variety of content applications (K-12 courses, self-directed learning programs, competency-based programs, course information sheets, external resources, etc.) • Develop training materials, programs and institutes for educators, instructional designers, and content authors. • Participate in international discussions around metadata and the learning object economy. • Prepare for commercialization of the training program and the infrastructure. **Beneficiaries of Project:** Education and training providers of British Columbia, educators, instructional designers, content authors who are currently engaged in the traditional models of course/resource development will benefit from the ability to: • share learning objects and localize the content to their needs • engage in rapid development methodology • participate in national and international metadata standards discussions • expand their research capacity • participate in professional development activities focused on applied research programs such as The Learning Lab and the Learning Systems Institute

Deliverables	Item	Benefit
	Object repository	Will provide an object store coupled with distributed authoring capability. Adds workflow, versioning, and output to a variety of media.
	Digital media management system	Manages the metadata associated with digital video objects for easy storage and retrieval from the Storage Area Network.
	Unstructured document management system	Manages workflow and storage of unstructured intellectual property associated with development of learning objects (instructional design plans, legacy print content, etc).
	Storage area network (SAN)	Provides expanded storage capacity for digital video learning objects.
	Metadata standards development	Ensures that OLA metadata complies with national and international standards for easy interoperability and sharing of learning objects.
	XML schemas and DTDs	Based on IMS standards, educational schemas and DTDs for K-12 courses, competency-based business courses, self-directed learner-designed courses for teachers, course information documentation for calendars and CEISS provide the basis for common development and interoperability.
	Instructional design methodology	Development of DTDs, Schemas, Best Practices Guides, Writers' Guides which can be used as the basis for training and to ensure instructional design standards are met.
	Distributed authoring capacity	Web interface for distributed authoring provides educators, instructional designers, content authors, and production staff with the ability to work at a distance, and collaboratively, on creation of learning objects.
	Training program development and annual institutes for educators and instructional designers	The training program provides learning object creators with the skills they need to engage in instructional design, distributed authoring, and pedagogy. Learning Design Institutes provide participants with hands-on training that can be supplemented with online coursework at the undergraduate, post-baccalaureate, and master's level.
Implementation	**General State of Project Progress:** ***Object Repository*** The object repository consists of an Object Store (Astoria), Authoring and Output engines (iEngine), and Web Navigator for distributed authoring. The system is undergoing upgrades over the next two quarters as the software improves. ***Digital Media Asset Management System*** The digital media asset management system requirements are under review by the Knowledge Network, Digital Media Production, and Information Technology Staff. The requirement for all the infrastructure systems to work together seamlessly is crucial to the successful implementation of the learning object model. ***Storage Area Network*** The storage area network and backup system are in process of being purchased and installed. The network has been upgraded to the digital media workstations and editing suites to accommodate rapid development and use of digital objects from the storage area network through the digital media asset management system. ***Unstructured Content Management System*** Research and Development staff are reviewing, with Information Technology staff, the most effective way to upgrade the Documentum system to provide much needed management infrastructure for the vast array of legacy course content, accompanying documentation, student records, and other unstructured documents that can benefit from the application of metadata and workflow management processes. ***Metadata Standards Development*** The Agency is participating in IMS, EML, CanCore, and other metadata standards discussions internationally through the Industry Canada EduSpecs "Technical Liaison Office".	

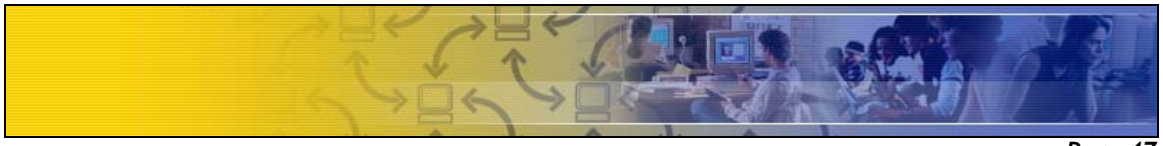
	XML Schemas and DTDs XML Schemas and DTDs have been developed for a variety of structured documents including K-12 courses, post-secondary courses, competency-based programs, self-directed learning programs, course information sheets, and online resources. We are in the process of updating metadata standards to comply with CanCore. ***Instructional Design Methodology*** Structured development has altered the instructional design methodology at the Agency by separating design from development from production. The "cottage industry" instructional designer now focuses on learning outcomes, assessment, activities and content. Development is done by teams of subject matter experts, media experts, designers, and writers. Production passes to a separate team. Development has moved from a rigidly linear process to a more collaborative process. This process has been integrated into K-12, teacher education, and the business programs at the Agency. Currently plans are under development to fully engage the post-secondary development team in the new model. ***Distributed Authoring Capacity*** Distributed authoring will not be in place until the upgrades to the Astoria and iEngine software are completed. At that time, web-based authoring directly into the repository will be possible. In the interim, authors are working with Microsoft Word templates and submitting the content to the internal production team. ***Training Program Development*** The training program has focused on instructional designers, content authors, production staff, and writers. Writers' Guides, templates in Word and Framemaker Plus SGML, Best Practices Guides and Element Dictionaries have been developed and training sessions have been held. As we move towards XML, we will be required to update materials and retrain staff. ***Learning Systems Institute & Learning Lab*** The Learning Design Institutes are summer training sessions, face-to-face, for BC educators. They focus on broader instructional design and digital media development for online learning as well as structured development models. This year, we expect to continue the development of our online training program, The Learning Lab, to include a certificate program, a post-baccalaureate diploma program, and to ladder into a master's program for educators, instructional designers, and others. **Lessons Learned from Current Implementation:** ***Infrastructure Funding without Operational Funding*** The biggest difficulty we have encountered to date has been lack of operational funding to ensure all of the infrastructure components are working, while altering the culture of the organization. New paradigms need to run in parallel to old paradigms while the shift from one to the other occurs.
Staffing	**Staffing Resource Details:** Director: .25 FTE, Systems Analysts: 4 FTEs, Developers: 6 FTEs, Production: 7 FTEs.
Budget	Overall project budget over 4 years: $2,000,000
Benefits	**Primary Benefit:** To education and training institutions, instructional designers, media developers, educators, content authors. **Value of Project to Beneficiaries:** To provide opportunities for beneficiaries to engage in the learning object economy, take advantage of economies of scale and interoperability. **Value of Project to Canada:** Increase capacity of Canadians to participate in the global learning object economy.
Project Partners	Lightspeed Interactive **Contributors and Consultants:** Ingenuity Works Sun Microsystems

PARTNERSHIPS FOR LEARNING, INNOVATIONS AND TECHNOLOGY (PLIANT)		
Summary	The Partnerships for Learning, Innovation & Technology (PLIANT) program involves universities, colleges, industrial and not-for-profit partners from coast to coast sharing expertise across diverse geographies. It has two sub-projects: ▪ Collaborative Graduate Classes ▪ Learning Technology Institute The first half of the project focuses on using *broadband-enabled* collaborative learning using interactive video over CA*net3 for shared synchronous activities. The second half will take full advantage of the broadband capability to prototype *broadband-enhanced* learning innovations, such as: ▪ Integrated desktop & distributed classroom learning activities, ▪ Small group activities supported across sites, and ▪ Capturing distributed design collaborations captured for reuse. Other users of CA*net3 will be able to apply the lessons learned in PLIANT to share learning activities across institutions, sectors, and regions. In addition, the collaborative design activities will lead to improved designs for elements in the learning technology repositories proposed in complementary CANARIE Learning Program projects. ***Educational Goals:*** The project has two goals, represented in two phases: ▪ To demonstrate viability of *broadband-enabled* collaborative learning using interactive video ▪ To develop innovations in *broadband-enhanced* learning activities through broadband networking ***Beneficiaries of Project:*** ▪ Universities, colleges, industrial, and not-for-profit partners	
Deliverables: **Collaborative Graduate Classes**	**Item**	**Benefit**
	Video over IP (Guelph/Waterloo) Description: Video link for classes in Physics and Chemistry	• Provides necessary platform without extensive investment of a satellite or microwave link • Broadband connectivity in the workplace through the availability of continuing professional education with graduate level accreditation
	TeleCHI (Carleton/ Waterloo IBM and Nortel) Description: distance learning techniques to provide state of the art training for HCI professionals in universities and in the workplace	• Participating institutions will share resources to build a world-class user-centered design program • Students will can enrol at Carleton and take courses at Waterloo and vice versa (Waterloo students have been using this since Jan. 2002) • Courses use real time audio and video, application sharing, shared whiteboards, etc. • Assignments are carried out with teams located at each site • A proven record of collaboration • Incorporated into the innovative graduate programs at TechBC • Being considered for adaptation to WestMOST program for continuing graduate education
Technology: **Learning Technology Institute**	**Item**	**Benefit**
	Description: Co-operative development of learning technology elements Complementary projects include: 1. Association of Universities and Colleges in Canada – to foster faculty incentives and scholarly support for developing learning technology elements 2. Industry Canada/HRDC – to support young Canadians acquiring skills in developing learning technology 3. Industry Canada – a pilot study for to develop a distinctive Canadian role for standards in learning technology elements 4. POOL and BELLE learnware repositories – to make elements accessible for re-use	• To make elements accessible for re-use • Improving design quality by collaborative critique and faculty development • The long-term costs of these shared design sessions are a fraction of what it would cost to mount similar discipline-centered faculty development programs • The shared benefits of collaborative faculty development and critical mass of participants make a clear case for sustainability • Share a focus on learning elements • Shared development of resources • Supported by developments at the IBM Pacific Development Centre • Faculty members will interact with others teaching the same content across the country, sharing ideas and demonstrating prototypes

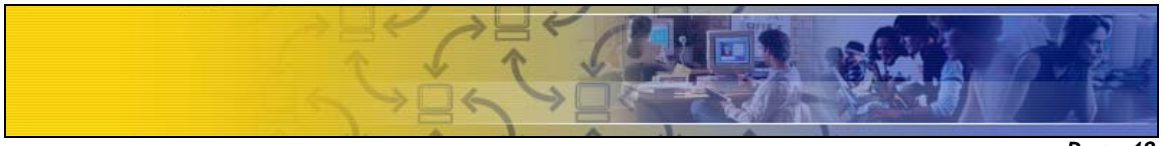


Implementation	
Benefits	***Primary Benefit:*** High technology areas that represent critical skill requirements for the Canadian industry (i.e. Instructional designers and instructors). ***Value of Project to Beneficiaries:*** It will enhance both the quality and quantity of learning technology components being developed, and insure their "*sharability*" *by* early collaboration on design and development. This will help to accelerate the development of high quality modular content in learning technology developments. ***Value of Project to Canada:*** The sub-projects are part of larger initiatives impacting economic/social development in Canada.
Evaluation	In this project, evaluation procedures cover two sub-projects: Collaborative Graduate Courses (CGC) and the Learning Technology Institute (LTI). Running the two sub-projects simultaneously over the duration of the project presents opportunities to analyze and compare findings both within and, where feasible, across the sub-projects. Evaluation plans will be developed through a series of four steps: ▪ Baseline ▪ Technology implementation ▪ Pilot ▪ Public offering for broadband-enabled activity ***Evaluation Methods:*** We propose a mixed method evaluation approach, that is, a combination of complementary qualitative and quantitative techniques. ***Results:*** **Data collection, analysis and validation of findings** Data collection instruments will comprise structured interviews for instructors, a combined Likert scale and open-ended questionnaire for students, a coding schema for tracking interactive video exchanges between instructors and students, and performance indicators for students. Collection, coding and interpretation of data will proceed by a process of *methodological triangulation*, where each data source is counterbalanced by at least two other sources drawn from different methods of data collection. The triangulation process establishes the validity of results to better support interpretation of the findings. The primary tool to be used for data analysis and management is the ATLAS.ti Knowledge Workbench software package. It has functions that include coding, filing, and managing the text, graphic, audio, and video data needed to effectively evaluate the project. Our main initial concerns are the relationships amongst the following elements: ▪ Technology parameters [e.g. quality of service in transmission] ▪ Instructional design [e.g. a *jigsaw* approach with distributed small groups] ▪ Learning outcomes [should reflect content-related objectives set by instructors] ▪ Collaborative interactions coded from text and video segments. Analysis of these interactions will identify those attributes of group dynamics that contribute to participants' sense of professional worth, of group cohesion, and integration into the working group. Our analysis approach will allow us to investigate these emergent properties from multiple perspectives. Although the scoring categories and data collection instruments will vary somewhat between the broadband-enabled and broadband-enhanced activities across the two sub-projects, the method and procedures of evaluation will remain consistent. Consistency of approach, careful data management, and validation of findings by triangulation are important to establishing confidence in the evaluation outcomes and the resulting recommendations about the benefits of using broadband networking for collaborative learning. The mixed method analysis will be combined with other elements in reports submitted from each phase of the project.
Project Partners	University of Waterloo, University of Alberta, University of Calgary, Centre for Curriculum Transfer and Training (BC), University of Guelph, Carleton University

PORTAL FOR ONLINE OBJECT IN LEARNING (POOL)	
Summary	The POOL Project is a collaboration of several educational, private, and public sector organizations to create Portals for Online Objects in Learning. The Portals for Online Objects in Learning (POOL) Project creates resources for organizations that are producing learning content for online delivery. By facilitating the management, storage and retrieval of learning objects, such as audio or video clips, simulation applets, and multimedia case studies, POOL provides organizations in higher education, workplace training, and continuing education with gateways to learning resources and distribution channels for their learning objects. In Phase I, a prototype repository was developed for the storage and management of learning resources at varying levels of granularity. This prototype repository was designed to promote the sharing and re-use of learning content to support the instructional development process in organizations. Designed to manage broadband multimedia content, the POOL Project collaborated with the developers of the Canadian Core Learning Resource Metadata Protocol (CanCore). A national effort, CanCore is designed to facilitate the discovery of learning content across repositories around the country and internationally. In Phase II, POOL is extending its toolset and services to include: ▪ *Splash*, a desktop based, peer-to-peer learning object application and personal repository ▪ CanLOM, a central learning object metadata repository ▪ Further development of the CanCore protocol ***Educational Goals:*** POOL will provide support to Canadian organizations for more rapid and economical production and distribution of high quality online content. POOL will demonstrate the value offered by broadband environments and create a mechanism for the training of instructional designers, trainers, and learners in the uses of broadband-enabled teaching and learning environments. Other goals of the project are to: • Develop business-to-business commercial and non-commercial models to promote the exchange of learning content. • Create a strong community of education and business designers and developers who are focused on the sharing of learning objects; and • Create a functional model and proof of value for organizations and offer them a solution for learning resource hosting and end-to-end delivery requirements. ***Beneficiaries of Project:*** Instructional designers, trainers, authors, and learners
Technology:	1. Prototype repository portal for online objects in learning 2. CanCore Learning Resource Metadata Protocol 3. Canadian Learning Object Metadata Repository 4. Splash peer-to-peer application
Implementation	A working prototype repository application has been built and populated with learning objects, CanCore protocol developed and disseminated, CanLOM repository under development, Splash released in alpha.
Staffing	***Staffing Resource Details:*** 34 staff (12 management/admin, 22 technical)
Budget	$1.5 million over two years
Benefits	***Primary Benefit:*** • A greater opportunity for the reuse and reconfiguration of learning objects and materials to extend shelf life while cutting redevelopment costs. ***Value of Project to Beneficiaries:*** • A greater ability for designers, authors, and learners to maintain the value of their learning objects over time. • Opportunities for the reuse and reconfiguration of learning objects and materials within and between organizations ***Value of Project to Canada:*** • A Canadian-branded, national, and worldwide shared economy for learning resources. POOL will create clearinghouses, or transaction services, for the exchange of learning objects, in both commercial and non-commercial settings. • It will contribute to the critical content and application requirements of national broadband network deployments by creating an environment and incentives for practitioners to take advantage of available network bandwidth (e.g., CA*NET 3 and 4).



Evaluation	***Evaluation Methods:*** Phase I Evaluation: Usability evaluation of POOL prototype. Evaluation report delivered to CANARIE in July, 2001. ***Results:*** Challenges include completing a true peer-to-peer learning object sharing environment, dissemination of results and products, and moving the technology to market to generate revenue.
Project Partners	• **Lead Organization:** NewMIC., Vancouver, BC • TeleLearning Network Inc. • Centre for Curriculum, Transfer and Technology, BC • University of New Brunswick Electronic Text Centre • Open Learning Agency, BC • Technical University of British Columbia, BC • New Brunswick Distance Education Network Inc., NB • TELEStraining Inc., BC • IBM Canada Pacific Development Centre, BC • MaxLink Communications, Ottawa, ON



<table>
<tr><th colspan="3">SAVOIRNET AND EXPLOR@</th></tr>
<tr><td>Summary</td><td colspan="2">By March 2002, this project aims to endow the institutions of education of new means for course delivery on broadband Internet, coordinated with the television channel that Canal Savoir has been operating for the last 15 years.

The SavoirNet project aims to develop the test bed for a new digital broadcast service dedicated to distance learning, ensuring a solid convergence between television and the Internet. A Web site linked to specific broadband access providers is the main entry point to a virtual community. It groups together and aligns tools, resources and instructional format and gives access to a number of services. Broadcast services for digital television and PC, either in real-time or delayed, education engineering services and online help, hosting on a specialized server making remote management of a virtual campus possible, or secure electronic publication service and e-commerce will be made available to users according to the role that they will play in the virtual community.

Educational Goals:
▪ TCI will be responsible for building the SavoirNet Portal on the basis of its Explor@ system
▪ The R&D part will develop an editor for 3D Web sites allowing one to create immersive telelearning environments: virtual conferences, exhibitions, laboratories and/or museums

Beneficiaries of Project:
Students, designers, mangers and instructors</td></tr>
<tr><td rowspan="3">Technology</td><td>Item</td><td>Benefit</td></tr>
<tr><td>Explor@™</td><td>It has been retained by Canal Savoir as the base of its delivery system SavoirNet. This portal will be developed by TCI. It should allow the delivery of high-level courses combining TV broadcasting and broadband Internet delivery.
▪ The Virtual Learning Centre allows for a set of courses to share a series of teaching resources (tools, files, means of communication, documents, etc.)
▪ Follow-up and counselling tools that promote individual and collaborative learning as well as teaching support and management can be integrated into this on-line learning system
▪ Can be seamlessly integrated into the Intranet or Extranet of an organization linked with its learning management systems and databases
▪ Creates environments for sharing resource
▪ Supports 5 types of users: learners, designers, instructors, content experts and course administrators
▪ Manages a central bank
▪ Manages 5 types of resources: providing information, fulfilling assignments, collaboration, providing assistance and learning activity management
▪ Provides a designer with an abundance of tools (i.e. to form groups of learners; to assign trainers to groups; to describe course and content structure; to define user tracking and modeling etc.)
▪ Is a totally flexible environment
▪ Diversity of approaches
▪ Flexible customized transition of training practices
▪ Integration of third party tools
▪ Faster design upgrade and creation
▪ Decreased costs and delivery time</td></tr>
<tr><td>EXPLORA-II
(TCI has received grants from BELL Canada and CANARIE)</td><td>It will improve considerably the technical and educational capacities of the current system, while reducing development and delivery costs for organizations and customers.</td></tr>
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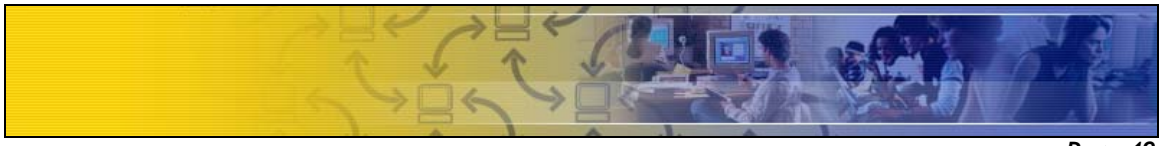
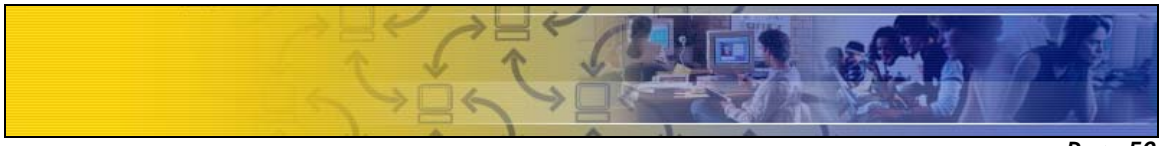


Implementation	**General State of Project Progress:** EXPLOR@ is the result of work undertaken six years ago by TéléUniversité's LICEF Research Centre. Initially financed by the Quebec Technological Development Fund within the Telecom Multimedia Project, the EXPLOR@ project subsequently received important financial support from the Information Highway Fund through the HyperGuides - Recto Project and finally from the TeleLearning Network of Centres of Excellence (TL-NCE). Over 5 millions dollars have been invested so far in R&D. Other R&D projects are under way to enhance current functionality. The Explor@ server actually support hundreds of students enrolled in several courses at TéléUniversité, and for the continuous training of professionals into three important associations. In addition, other EXPLOR@-based courses are being developed for Hydro-Quebec and other organizations.
Budget	$5,000,000 to date for R&D
Benefits	**Primary Benefit:** Canadian educational institutions **Value of Project to Beneficiaries:** The opportunity to play a proactive role in learning. **Value of Project to Canada:** SavoirNet will be linked directly to all major high-speed Internet access providers and will constitute an economic and educational opportunity for the deployment of networks into the home. The entire population will be able to benefit from distance learning and innovative courses, credited and not, while facilitating the networking of the players and the management of all the technological and economic aspects of distance learning. The strength of this collaboration, through the maximum use of the broadband, will ensure outstanding communication between content producers and television broadcast companies driving the design and broadcast of innovative educational content. This is in an effort to the increasing demands in the area of education.
Evaluation	**Evaluation Methods (and Results):** The test bed will be the proof of design and a marketing tool for broadcast and the subsequent business operation of the SavoirNet network.
Project Partners	▪ **Lead Organization:** Canal Savoir, Montreal, QC ▪ Vidéotron, QC ▪ Bell Canada, QC, ON ▪ Technologies Cogigraph Inc., QC ▪ Savoir Multimédia Inc., QC ▪ Star Choice/Cancom, QC, ON ▪ LICEF research centre, QC ▪ Look Communication, QC, ON



APPENDIX B: SCAN OF FEDERAL, PROVINCIAL AND TERRITORIAL INVOLVEMENT IN E-LEARNING

Provinces and Territories have developed online learning initiatives within their jurisdictions, in collaboration with educational institutions and other partners to develop and promote more flexible learning programs based upon the use of new technologies.

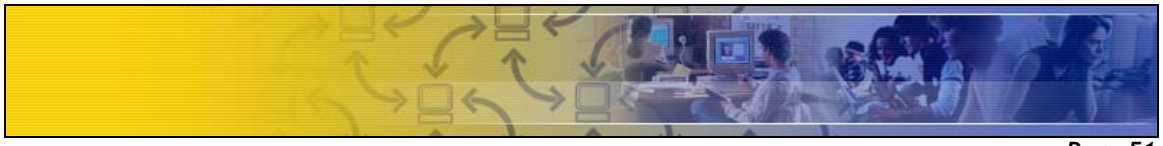
SCOPE OF REVIEW

This review of provincial initiatives focuses on e-learning initiatives at primarily the postsecondary level and to some extent the K-12 level. Specific initiatives that address e-learning at the K-12 level are in their infancy. Many provinces are at the beginning stages of implementing information and communication technologies within classrooms. Only the province of Alberta has developed an ICT curriculum that is embedded into all curricular areas. However, the initiatives that follow present the thinking in the area of e-learning and suggest possible future directions for K-12 and postsecondary sectors across Canada.

The information was gleaned from interviews with Ministry officials, review of Ministry documents, and web searches. In addition, key non-governmental representatives in K-12 and post-secondary institutions concerned with e-learning were contacted to ensure that projects or schemes not directly administered by provincial governments were also reviewed.

Interviews were conducted with the following provincial representatives:

- Susan Savage — Alberta Learning, Technology Policy Development
- Carolyn Fewekes — Alberta Learning, CMEC Liaison and Policy Development
- Garry Popowich — Alberta Learning: Director Learning Technologies Branch
- Kenna Barradel — British Columbia Ministry of Education
- Sue Amundrud — Acting Director, Learning Technologies Branch, Saskatchewan
- Barry Bashutski — Saskatchewan School Trustees Association
- Sam Steindel — Director, Manitoba Learning Technologies Unit
- Michael Jeffery — Director, Learning Resources and Technologies, Nova Scotia
- Genevieve Gallant — Open Learning and Information Network, Newfoundland
- Catherine Henderson — CIO, Postsecondary Community Cluster, Ontario
- Lucile Pacey — Consultant, British Columbia
- Therese Laferriere — Laval University
- Rory McGreal — Athabasca University
- Paddy Elliott — Government of the Northwest Territories
- Jacklyn Burles — Government of the Northwest Territories
- Wade Sheppard — Director, Center for Distance Learning and Innovation
- Margaret Haughey — Professor, University of Alberta



For an excellent overview of provincial/territorial involvement in on-line learning, refer to Council of Misters of Education Canada (2001). *Overview of Provincial/Territorial Involvement in On-line Learning*. Final report of the Advisory Committee for Online Learning. Toronto, ON. This report is available online at http://www.cmec.ca/postsec/on-lineInventoryEN.pdf

The following are some updates and additions to this overview.

BRITISH COLUMBIA

Recent policy changes to the funding distance education programs at the K-12 level suggest that there will be an increase in online schools, programs, and courses available to students in the 2002-2003 academic year. Recent changes involve:

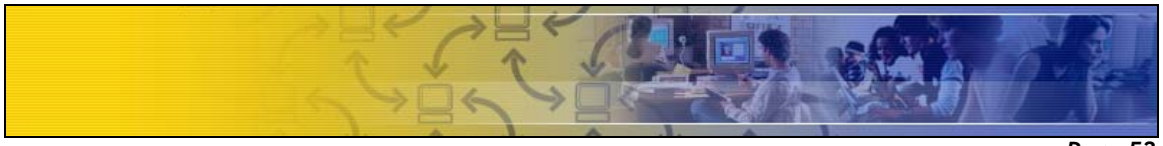
- Lifting the cap on distance education student enrolments across British Columbia
- Funding distance education and online education students to the same level as students who physically attend school
- Supporting parental choice by allowing students to enrol in any school district in British Columbia regardless of their domicile

Recent decisions will stimulate discussions among school districts, regional distance education consortia (http://www.k12connect.ca and http://www.coolschool.bc.ca), distance education schools and the provincial government to set up a provincial online education consortium similar to the Alberta Online Consortium. Clearly, the market for digital education content and online professional development will multiply over the coming years.

ALBERTA

Alberta Technology Mediated Curricula

- The Galileo Educational Network is a professional development and research initiative based at the University of Calgary and is focused on the fundamental changes to teaching, learning and staff development that information and communications technology both requires and enables. It provides a range of services to teachers and schools in the implementation of information and communication technologies (http://www.galileo.org/).
- The Alberta Learning, Stakeholder Technology Task Group works with partners to provide direction and coordination for the implementation of evolving technologies in learning in the k-12 sector (http://www.learning.gov.ab.ca/technology/blackgold/sttg.asp)



Alberta Funding Programs

- The goal of the LearnAlberta.ca project is to support lifelong learning by providing students, parents, teachers and others in the Alberta Kindergarten to Grade 12 (K-12) community with access to high quality learning resources via the LearnAlberta.ca portal. These resources will be in the form of learner-centred multimedia learning objects that directly relate to the Alberta programs of studies. The LearnAlberta.ca project web site was launched on November 19, 2001 (http://www.learnalberta.ca). This interim site offers project information (overview, contacts, guided tour, FAQs, glossary and activities) and learning resources such as the Online Reference Centre and Online Elementary Mathematics Resource. This web site will be rolled over to the LearnAlberta.ca portal when additional content is acquired and/or developed by Alberta Learning. Initially, the LearnAlberta.ca portal will serve approximately 600,000 students and their parents, and approximately 27,000 teachers and school/division staff in the K-12 community in Alberta. User interfaces will be available in English and French. The portal will grow to provide extensive resources to over one million users and will be highly dynamic with a fresh look and feel for different types of users over time. The LearnAlberta.ca project is built on the strength of shared knowledge, experience and resources of many Government of Alberta branches. The project is collaborative and considers the needs of stakeholders in the Alberta K-12 community, and the importance of the activities of several parallel initiatives such as:

    - New Century Schools (http://www.learning.gov.ab.ca/k_12/newcentury.asp)
    - TELUS Learning Connection (http://www.2learn.ca/)
    - Campus Alberta Repository of Educational Objects (CAREO) (http://www.careo.org/)
    - Tools4Teachers (http://www.learning.gov.ab.ca/ltb/t4t/T4T.html)
    - Alberta Online Consortium (AOC) (http://www.albertaonline.ab.ca/) and others

  Access to the LearnAlberta.ca portal in Alberta homes and schools will be enhanced by the rollout of SuperNet (see http://www.albertasupernet.ca/). Completion of SuperNet is expected in July 2004. SuperNet aims to provide affordable high-speed network connectivity and Internet access to all universities, school boards, libraries, hospitals, provincial government buildings, and regional health authorities throughout Alberta. Vendors must propose sustainable solutions that are compatible with the current infrastructure and with the evolving SuperNet infrastructure.

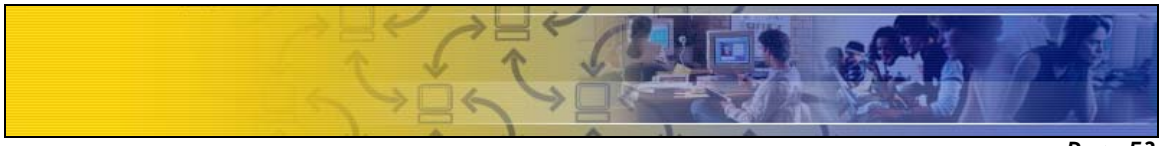
  Faced with the challenge and opportunity of developing a comprehensive, innovative and flexible learning portal for Albertans, Alberta Learning released a Request for Proposals on February 14, 2002. The LearnAlberta.ca Technical Environment – Design, Development and Implementation Project RFP describes the needs and requirements of the technical environment that will support the LearnAlberta.ca portal. The RFP does not state a design specification, per se, but invites creative solutions that address the needs and requirements outlined in the RFP as Solution Components and Service Components.

  LearnAlberta.ca Technical Environment – Design, Development and Implementation Project requires a solution to address the needs and requirements of each of the following components:

  1. Solution Components:
     a. Portal Design and Implementation
     b. Content Management System
     c. Hosting and Content Delivery
     d. Security and Authentication

  2. Service Components
     a. Project Management Office
     b. Usability and Evaluation

  Ongoing administration and support requirements are associated with each of the solution components. These include ongoing technical support and tools for end users as well as ongoing



maintenance and enhancements. The components described in the RFP will be designed, developed and implemented over a three-year period.
Vendors are asked to propose a future-proofed, sharable, standards-based solution that promotes interoperability and the sharing of learning resources across national and provincial repository initiatives. Aligning the LearnAlberta.ca project with these initiatives will provide additional support to the project and will reduce the duplication of work around learning resource development within Alberta and across Canada.

Due to the size and scope of the RFP, vendors are encouraged to establish a consortium, strategic alliances, business relationships or partner arrangements with companies and research and development (R&D) organizations/associations with the necessary competencies as these are seen as beneficial to the LearnAlberta.ca project. An operating model whereby the vendor implements the LearnAlberta.ca technical environment with Alberta Learning managing the highly dynamic and secure information such as content indexes, curriculum outcomes, and user information and authentication is likely. However, other proposed operating models may have merit and will be considered.

Alberta Learning may award the entire contract to one vendor or an alliance of vendors, or smaller independent contracts may be awarded to several vendors. Given the standards-based approach, high probability of exporting developed technology to other markets/regions, and the collaborative nature of this project, vendors are encouraged to offer one or more value-added components.

SASKATCHEWAN

- *CommunityNet:* Beginning in April 2002 all connectivity costs for schools in Saskatchewan will be supported by Saskatchewan Education. Additional funding has been allocated to support the development of wide area networks in all school districts and postsecondary institutions (http://www.communitynet.ca/intro.html).

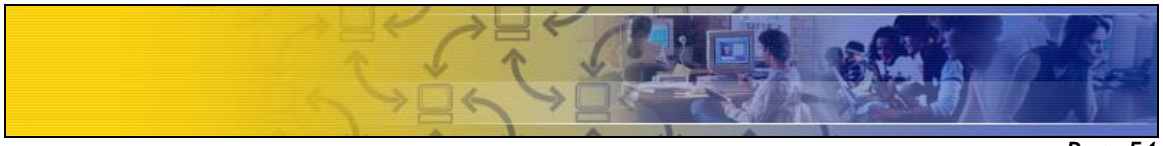
- Grassroots, a $1 million program in Saskatchewan funds creative collaborative based projects throughout the province. Over 186 projects have been funded resulting in curricular-based content which is linked to the Saskatchewan curriculum database. Each project receives $5000.00, which is often matched by local schools or school authorities. More information about this initiative can be found at (http://www.sasked.gov.sk.ca/grassroots3/index.html).

MANITOBA

Manitoba Technology Mediated Curricula

- Manitoba Education Research and Learning Information Networks (MERLIN) was created as a special operating agency with the Department of Education, Training and Youth in April 1995. It was formed as a facilitating body to coordinate the delivery of technology services to the education community across Manitoba (http://www.merlin.mb.ca/about/index.html). MERLIN is responsible for provincial licensing, research into best practices, Internet services to schools and technology training to schools and school districts.

- Manitoba Education Training and Youth has developed an Oracle database (Curriculum Information Technology Integration (CITI) Project) of learning resources including assessment strategies, instructional strategies, electronic resources and technology integration activities for use by K-8 teachers in the province. The goal of this initiative is to support the integration of



information technology in schools and to develop curricular based materials to support teachers in traditional classrooms. More information can be found about this initiative at (http://www.edu.gov.mb.ca/metks4/tech/currtech/citi/purpose.html).

QUÉBEC

Québec Technology Mediated Curriculum

- Quebec Scientific Information Network (RISQ): (www.risq.qc.ca) Significant investment has been made by Quebec learning institutions in the development of and deployment of "dark fibre". Since 1989, the RISQ network has expanded to include connectivity to more than 26 Quebec school boards representing more than 1,000 schools. The deployment of fibre primarily in southern Quebec supports the exchange of scientific information among -institutions and universities. The services offered by RISQ promote the development of knowledge by exploiting modern information technology, interactive multimedia systems and high speed digital communications.

NEW BRUNSWICK

New Brunswick Technology Mediated Curricula

- TeleEducation NB is part of the provincial Department of Education, which delivers more than 15 online courses to high schools around the province. The Department is investigating the creation of a learning object repository for the province.

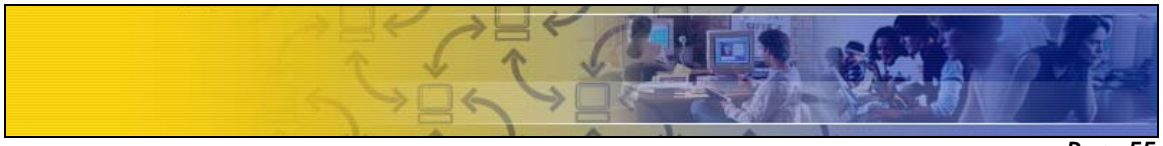
- The National Research Council (NRC) Centre for E-Commerce: The NRC has established a centre for e-commerce in New Brunswick. This centre is spread among the two campuses of the University of New Brunswick, the Université de Moncton and the NB Community College Miramichi. This centre is focusing specifically on e-learning and digital rights management.

NOVA SCOTIA

Nova Scotia Funding Programs

- In Nova Scotia the use of ICT in public schools is guided by the "Vision and Learning Outcomes for the Integration of IT within Nova Scotia Public School Programs" (1999: see http://lrt.ednet.ns.ca/vision.pdf). That vision generally indicates that ICT supports the achievement of curriculum outcomes and is not a focus of study in itself. Funding was provided for hardware, curriculum-related and utility software, professional development for teachers, increased connectivity and technical support. Central to the use of ICT in public schools in Nova Scotia is the Ednet wide area network which connects all schools, colleges, public libraries and many other sites.

- Currently emphasis is on extending the successful Information Economy Initiative (see: www.gov.ns.ca/econ/iei/default.asp) to grades 4-6. Funding will provide over 1200 computers per year with software, teacher professional development and technical support. The Information Economy Initiative is a significant partnership among several levels of government and is a model for the successful implementation of ICT in an education environment.



NEWFOUNDLAND (NFLD)

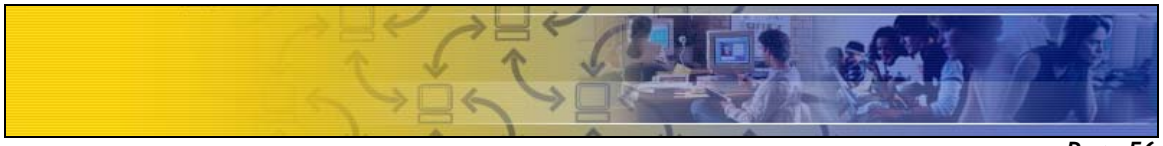
NFLD Technology Mediated Curricula

- Operation Online: is a not-for-profit corporation established to advance growth in Newfoundland and Labrador's information technology sector. Its mandate is to provide leadership and investment in information technology as a catalyst for economic renewal and growth in the province. The organization's activities involve partnering and business development, accessing national and international markets, promotion and awareness, building human resources and enabling other economic sectors through information technology. (http://www.online.nf.ca/html/s_aboutus/main.html)

NORTHWEST TERRITORIES

- *Online Learning Project* is in the second year of a two year MOU with Chinook College. Utilizing Chinook standards, almost 500 students will have completed the introductory and compulsory Info Highways 1090 course as well as many core credit courses. To provide senior secondary courses for students throughout the NWT but particularly in the more remote schools where subject specialists are unavailable on site.

- In recent years the Northwest Territories has established the Digital Communications Network (DCN) to link small communities to a wide area network. The network links, schools, local government offices, libraries and health facilities in urban and rural communities. This network is a vital resource for the expansion of distance education in the NWT. The network is shared among each facility in small settlements and therefore as usage increases the available bandwidth per user (bandwidth per user) is rapidly declining. Increased connectivity is a priority of the government and numerous solutions are being investigated including expanded satellite capabilities.



APPENDIX C: SCAN INTERNATIONAL REPOSITORY DEVELOPMENT AND IMPLEMENTATION MODELS

Repository development projects are taking place in a number of international locations. The projects described in the following sections are representative of the initiatives being undertaken internationally. The projects described in this report have been at the forefront of repository development activity in their own jurisdictions.

The study team sought to identify, classify, and describe international projects using the process described below:

- Discover leading projects outside of Canada
- Conduct interviews with resource persons
- Identify objectives, stages of maturity, lessons learned
- Identify strengths and gaps
- Discover funding and sustainability strategies
- Identify potential further linkages other than those already formalized (e.g. Industry Canada)

The study has identified three ways in which the international projects can be classified:

- Interoperability standards
- Centralized repositories or repository networks
- Peer-to-peer computing initiatives

INTEROPERABILITY STANDARDS

Dublin Core Metadata Initiative (http://www.dublincore.org)

From its beginnings in 1995, the Dublin Core Metadata Initiative has contributed greatly to the effort of standardized strategies and approaches for electronic resource discovery. The Dublin Core initiative is a voluntary organization, made up of and contributed to by several committees and working groups in several countries.

IMS Global Consortium (http://www.imsproject.org)

The IMS Global Learning Consortium is the dominant project that has led the process for defining requirements for interoperability in earning materials. It is based on a metadata specification that permits structured information approaches to the authoring and packaging of content. The IMS Global Learning Consortium Web site lists directories of vendors and products that currently or will shortly comply with the IMS specifications in their product and service offerings. It is clear that when major hardware, software and product vendors get behind a standard, it has the potential to become the dominant specification worldwide. Already, there are IMS Global Learning Consortium development centres in the United Kingdom, Australia and Singapore (for the Asia region).

The IMS Global Consortium/Project is funded via a graduated membership scheme in which member organizations' membership dues are determined by the level at which they wish to participate. Industry Canada is a contributing member of the IMS, and supplies key Canadian experts to IMS's various working groups.

Advanced Distributed Learning Initiative (http://www.adlnet.org)

The Advanced Distributed Learning Initiative (ADLI) of the U.S. Department of Defence launched an implementation project in partnership with IMS in 1997 with the purpose of ensuring "access to high-quality education and training materials that can be tailored to individual learner needs and made available whenever and wherever they are required" (ADLI, 2001).

The initiative was designed to "accelerate large-scale development of dynamic and cost effective learning software and to stimulate an efficient market for these products in order to meet the education and training needs of the military and the nation's workforce in the 21st century … through the development of a common technical framework for computer and net-based learning that will foster the creation of reusable learning content as instructional objects" (ADLI, 2001). The result of the ADLI initiative is the Sharable Courseware Object Reference Model (SCORM), an XML schema that describes the hierarchy for packaging course components using IMS metadata standards.

The ADLI is entirely funded by the US Department of Defence. Canada's Department of National Defence is an active member and contributor to the ADLI's various initiatives and activities.

Educational Modeling Language (http://eml.ou.nl)

The Open University of the Netherlands is experimenting with Educational Modeling Language (EML), an XML-based notational system that allows the construction of course materials from their component elements. The EML Web site describes the work as follows:

> *To date no comprehensive notational system exists that allows one to codify units of study (e.g., courses, course components and study programmes), in an integral fashion. EML is the first system to achieve precisely this. EML describes not just the content of a unit of study (texts, tasks, tests, assignments) but also the roles, relations, interactions and activities of students and teachers. EML is neutral with respect to the pedagogy and mode of delivery used. One may use EML to model for instance a competence-based pedagogy, problem-based learning, performance support, self-study packages or even traditional face-to-face teaching; EML allows one to deliver learning materials on paper, on CDROM, via the Internet, or via e-books. EML merely records the way in which the various elements of a particular educational setting are related in order that they may be interpreted by a computer.*

The EML implementation is built using XML (eXtensible Markup Language), an internationally accepted meta-language for the structured description of documents and data (Open University of the Netherlands, 2001).

The EML Project is a research and development project funded by the Dutch national government through programmes providing structural funds for universities.

CENTRALIZED REPOSITORIES AND REPOSITORY NETWORKS

Multimedia Educational Resource for Learning and Online Teaching (http://www.merlot.org)

Examples of collaborative sharing models based on learning object attributes are already visible in the public education space. The Multimedia Educational Resource for Learning and Online Teaching (MERLOT) is one example of a consortium approach to providing online resources for faculty and students. MERLOT was created in 1997 by the California State University Center for Distributed Learning as "a free and open resource designed primarily for faculty and students in higher education. Information hosted in MERLOT is free to use for educational, non-commercial purposes, and materials linked to by MERLOT have a range of license agreements from public domain to commercial" (www.taste.merlot.org).

The MERLOT web site describes the organization's activities as follows:

> *Merlot is a free and open resource designed primarily for faculty and students in higher education. With a continually growing collection of online learning materials, peer reviews and assignments, MERLOT helps faculty enhance instruction. MERLOT is also a community of people who strive to enrich teaching and learning experiences. (http://www.merlot.org)*

The Merlot Project operates under a cooperative structure providing free memberships to contributors. Member organizations, such as universities and consortia, support Merlot through annual membership dues.

National SMETE Digital Library (http://www.smete.org)

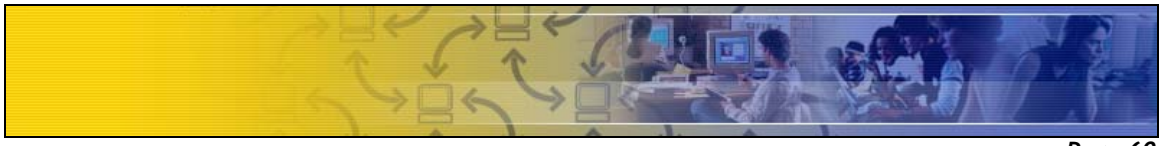
The National Science Foundation in the United States has funded a federation of digital repositories to enable science, mathematics, engineering and technology education (SMETE) at all levels. The SMETE web site describes the activities as follows :

> *The SMETE Open Federation was formed to promote the teaching and learning of science, mathematics, engineering and technology at all levels. The Federation was founded through funding by the National Science Foundation and partnerships with nationally recognized professional educational organizations, academic institutions and private e-learning companies. The SMETE Open Federation exists to foster the ongoing collaborative development among partner organizations, provide tools and services to support collection and service providers, and develop programs and organizational structures that ensure stability, sustainability and scalability of the Federation's programs and projects.*
>
> *SMETE.ORG is the gateway to a comprehensive collection of science, math, engineering and technology (SMET) education content and services to learners, educators, and academic policy-makers. This portal is the product of the collaboration of the SMETE Open Federation. SMETE.ORG serves as the integrative organization and distributes pedagogical material through the establishment of a federation of digital libraries. Providing direct access and delivery of instructional resources, the SMETE Open Federation advances education through participatory communities of learners. (http://www.smete.org/about_smete/)*

The National SMETE Digital Library is funded through the US National Science Foundation and supports in excess of 60 contributing projects throughout the US.

National Learning Network (http://www.nln.ac.uk/)

The National Learning Network (NLN) is a joint initiative of a number of British organizations mandated to further the use of technology in higher and further education (HE and FE). NLN provides information on various Instructional Learning Technology (ILT) solutions to UK colleges seeking to take advantage of



learning technologies. The NLN website is intended to be a repository for information, knowledge and reports available to assist client organizations. Through funding organizations such as the Joint Information Systems Committee (JISC) and BECTA (British Educational Communications and Technology Agency (BECTA), NLN is a recipient of long-term funding provided by the British National Government. Funding for the organizations and initiatives described above is provided as a percentage of the total annual funding to the UK HE and FE sectors.

Schools Online Curriculum Content Initiative (http://socci.edna.edu.au/content/)

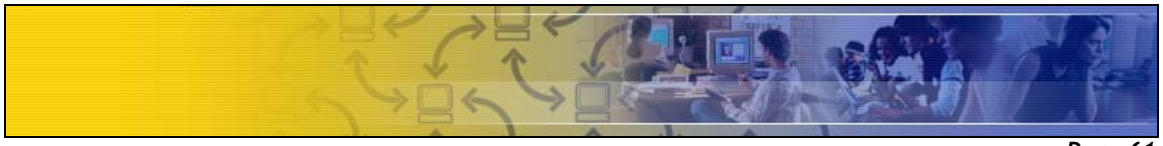
The Le@rning Federation's Schools Online Curriculum Content Initiative (SOCCI) is a national digital repository project for schools in Australia. The project web site provides the following description :

> *In 2001-2006 all States, Territories and the Commonwealth of Australia are collaborating in this Initiative – The Le@rning Federation – to generate, over time, online curriculum content for Australian schools. This commitment is built on scoping work completed in 2000-2001.*
>
> *Content and the quality assurance, market and digital rights frameworks to support that content, will be rolled out from 2001-2006.*
>
> *The web site outlines the progress of the Initiative, provides access to key documents and reports as well as forums and services through which stakeholders and the public can be kept informed of the Initiative.*
> (http://socci.edna.edu.au/content/)

SOCCI is funded as a joint venture with investments from all the states and territories of Australia. Funding and projects are managed by two not-for-profit corporations, Curriculum Corporation and education.au Ltd., formed expressly by the Ministers of Education and Training of Australia.

Open Courseware and Open Knowledge Initiatives (http://web.mit.edu/oki)

In April 2001, the Massachusetts Institute of Technology (MIT) announced an initiative that will further stimulate thinking in the learning object domain. MIT OpenCourseWare will make "course materials that are used in the teaching of almost all undergraduate and graduate subjects available on the Web, free of charge, to any user anywhere in the world" (MIT, 2001a.). A collaborative venture between MIT and Stanford University will also make available to the educational community an object-based instructional delivery and management system, called the Open Knowledge Initiative. "The Open Knowledge Initiative (OKI) addresses what is perceived by many in higher education as a critical need: meaningful, coherent, modular, easy-to-use Web-based environments for assembling, delivering and accessing educational resources and activities." The initiative is sponsored by a grant from the Andrew W. Mellon Foundation (MIT, 2001b).



PEER-TO-PEER COMPUTING INITIATIVES

Edutella (http://edutella.jxta.org/)

The Edutella project is designed to:

> *… addresses the shortcomings of current P2P applications by building on the W3C metadata standard RDF. The project is a multi-staged effort to scope, specify, architect and implement an RDF-based metadata infrastructure for P2P-networks based on the recently announced JXTA framework.*
>
> *The initial Edutella services will be* Query Service *(standardized query and retrieval of RDF metadata),* Replication Service *(providing data persistence / availability and workload balancing while maintaining data integrity and consistency),* Mapping Service *(translating between different metadata vocabularies to enable interoperability between different peers),* Mediation Service *(define views that join data from different meta-data sources and reconcile conflicting and overlapping information) and* Annotation Service *(annotate materials stored anywhere within the Edutella Network).*
>
> *Our vision is to provide the metadata services needed to enable interoperability between heterogeneous JXTA applications. Our first application will focus on a P2P network for the exchange of educational resources (using schemas like IEEE LOM, IMS, and ADL SCORM to describe course materials), other application areas will follow.* (Nejdl, W. et al., 2002)

Edutella is among the first educational resource discovery projects to use a peer-to-peer approach to repository technology. The Edutella project is funded by its university participant partners : Hannover, Braunschweig and Karlsruhe (Germany); Stockholm and Uppsala (Sweden); Stanford (USA).