Developing a Nisga'a Learning Objects Repository for Use in the Schools

Kim A. Hansen
Nova Southeastern University, khansen2415@gmail.com

This document is a product of extensive research conducted at the Nova Southeastern University College of Engineering and Computing. For more information on research and degree programs at the NSU College of Engineering and Computing, please click here.

Follow this and additional works at: https://nsuworks.nova.edu/gscis_etd

Part of the Computer Sciences Commons

Share Feedback About This Item

NSUWorks Citation

This Dissertation is brought to you by the College of Engineering and Computing at NSUWorks. It has been accepted for inclusion in CEC Theses and Dissertations by an authorized administrator of NSUWorks. For more information, please contact nsuworks@nova.edu.
Developing a Nisga’a Learning Objects Repository for Use in the Schools

by

Kim A. Hansen

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Computing Technology in Education

Graduate School of Computer and Information Sciences
Nova Southeastern University
2006
We hereby certify that this dissertation, submitted by Kim A. Hansen, conforms to acceptable standards and is fully adequate in scope and quality to fulfill the dissertation requirements for the degree of Doctor of Philosophy.

Gertrude W. Abramson, Ed.D.  
Chairperson of Dissertation Committee  

Helen St. Aubin, Ph.D.  
Dissertation Committee Member  

Steven R. Terrell, Ed.D.  
Dissertation Committee Member  

Approved:  

Edward Lieblein, Ph.D.  
Dean, Graduate School of Computer and Information Sciences  

Graduate School of Computer and Information Sciences  
Nova Southeastern University  

2006
An Abstract of a Dissertation Submitted to Nova Southeastern University
in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy

Developing a Nisga’a Learning Objects Repository for Use in the Schools

By
Kim A. Hansen

2006

The use of information technologies to develop, manage, access, and to use learning resources and content from a variety of sources has changed the academic and learning environment. There was a need to focus on the identification of tools and the development of skills to manage these resources, particularly in the kindergarten to grade 12 classrooms. For the students and educators of School District 92 (Nisga’a), there was also a need to provide access to important Nisga’a cultural and heritage learning objects as many preserved videos, pictures, historic documents, cultural teaching materials, and various printed matter were not available for student and teacher use in the schools. This study created an instance of a learning object repository, the Nisga’a Learning Object Repository, and deposited a sample set of 65 objects into the repository in order to evaluate the technology as a school resource. A teacher and student panel survey instrument evaluated the repository as a tool for accessing learning resources. Ten teachers and 15 students returned final surveys. Topics evaluated included uses of learning objects, learning object categories, object attributes, reasons to use the repository, the resource as a multimedia distribution system, and the resource as a digital reading room. The CAREO platform was used to construct the repository, and the ALOHA metadata tool was used to develop metadata for the objects. The Canadian Core Learning Metadata Application Profile was the standard used when writing the metadata.

The learning object repository functioned successfully in its ability to store and retrieve different types of objects. The resulting product is truly a technology-based storehouse of Nisga’a culture readily available for use by students and teachers. The technology moves learning and instruction further towards an integrated multimedia environment, and its potential depends on further development and use in the classroom. Additional research, teacher training, and showcase presentations would further lay the foundation for a broadening of classroom use.
Acknowledgements

I would be remiss without the acknowledgement and many thanks to my graduate advisor, Dr. Gertrude W. Abramson. Her dedication and expert advice made this dissertation possible. Many thanks also to the committee members, Dr. Steve Terrell, Dr. George Fornshell, and Dr. Helen St. Aubin for their support. In addition, the insight and expert advice about learning object repositories by Dr. Griff Richards was both timely and supportive. His dedication to the field is clear.
Table of Contents

Approval/Signature Page ii
Abstract iii
Acknowledgments iv
Table of Contents v
List of Tables vii
List of Figures viii

Chapters

1. Introduction 1
   Problem Statement and Goal 1
   Relevance and Significance 7
   Barriers and Issues 12
   Research Questions Investigated 16
   Definition of Terms 17
   Acronyms 17
   Summary of Introduction 18

2. Review of the Literature 21
   Media Distribution Systems and LOR Software 21
   Standards, Metadata and Learning Objects 25
   Educational Reasons to build LORs 27
   Research Methodology 31
   Summary and Contributions 34

3. Methodology 37
   Research Methods Employed 37
   Analysis and Surveys 39
   The Panels 41
   Student and Teacher Populations and Procedures 41
   Design, Development and Implementation 43
   Evaluation and Collection of Data 44
   Work Plan and Timeline 45
   Resource Requirements 47
4. Results 48
   Construction of the Repository  53
   NLOR Graphical User Interface  56
   Classification Standards and Searching Facility  58
   Nisga’a Learning Objects  60
   Using Learning Objects in the Classroom  64
   Incorporating Learning Objects into the Curriculum  67
   Recommendations for LOR Improvement  68
   Summary  71

5. Conclusions, Implications, Recommendations and Summary  78
   Conclusions  78
   How Will the Repository be Constructed?  78
   What Do the Teachers and Students Report About the Graphical User Interface?  80
   How Reliable and Valid Are the Classification Standards, and How Easily Can Teachers and Students Search the LOR?  81
   What Objects of the Nisga’a Culture Are Available, May be Digitized, and Will be Included in the Digital Repository?  83
   What Are the Uses of LOs in the Classroom?  86
   How Would Teachers Incorporate the LOs into the Curriculum?  86
   How Could the LOR be Enhanced in Future Versions?  89
   Implications  92
   Recommendations  94
   The Broadening and Increased Use of the LOR in the Classroom  94
   The Refinement of and Implementation of the LOR Technology  95
   The Use of LOR Technology as a Media Distribution System  96
   The Future Use of the LOR in the Classroom  96
   Summary  96

Appendixes 103
   A. Survey Instrument Introductory Letter and Information Sheet  104
   B. Survey Instrument  108
   C. Letter of Permission from School District 92(Nisga’a) 114

Reference List  115
List of Tables

Tables

1. List of NLOR Research Objectives 40
2. User Interface (attributes): Teacher Responses on the NLOR Survey Shown in Percentages 57
3. Learning Object Categories: Teacher Responses on the NLOR Survey Shown in Percentages 62
4. Learning Object Categories: Combined Panels Responses on the NLOR Survey Shown in Percentages 63
5. Learning Object Uses: Teacher Responses on NLOR Survey Shown in Percentages 66
6. Reasons to Use the Repository: Teacher Responses on the NLOR Survey Shown in Percentages 68
7. Using the NLOR as a Media Distribution System Would: Teacher Responses on the NLOR Survey Shown in Percentages 69
8. Teacher Responses to Open Comments on the Preliminary Survey 73
9. Teacher Responses to Open Comments on the NLOR 74
10. Observations During the Development and Assessment of the LOR Technology 75
List of Figures

Figures

1. Four Steps of the NLOR Rapid Prototype Model with Concurrent Processes 38, 49
2. Outline of NLOR Work Plan and Timeline 46, 50
3. Examples of Student and Teacher Use of a Learning Object Repository 65
4. Relevant Learning Objects Categories: Teacher Responses on the NLOR Survey Shown in Percentages 85
5. Important Learning Object Uses: Teacher Responses on the NLOR Survey Shown in Percentages 87
6. Using the NLOR as a Media Distribution System Would: Combined Probably and Yes Teacher Responses on the NLOR Survey Shown in Percentages 91
Chapter 1

Introduction

Problem Statement and Goal

This study addressed the development of a local digital library, or Learning Object Repository (LOR), the access to cultural content by students and educators of the School District 92 (Nisga’a) (www.nisgaa.bc.ca), and the use of LOR technology as a media distribution system. The problem identified for the study was that the Nisga’a culture is at risk and that school children did not have access to important cultural and heritage objects now in storage. Although many learning objects (LOs) have been preserved and experiences captured in many different forms, they were not readily available for use in the schools.

The goal of the study was to create a Learning Object Repository (LOR), the Nisga’a Learning Object Repository (NLOR), and to evaluate it as a viable, dynamic school resource. Once the product was assessed as valid and reliable, its potential as a classroom tool was to be explored. The questions driving the goal were:

1. How will the repository be constructed?
2. What do the teachers and students report about the graphical user interface?
3. How reliable and valid are the classification standards?
4. How easily can teachers and students search the LOR?
5. What objects of the Nisga’a culture are available, may be digitized, and will be included in the digital repository?
6. What are the uses of LOs in the classroom?
7. How would teachers incorporate the LOs into the curriculum?
8. How could the LOR be enhanced in future versions?
Multimedia technologies used in education have given educators and students more options when choosing a teaching or learning environment in distance education, or in the classroom. Research studies have shown that the use of educational technologies in the classroom improves instruction and student learning (Beckwith, 2000). As technology developed, the quality and use of multimedia in education advanced to a degree that it has been possible to build large-scale services where information is stored in digital format and retrieved over networks (Arms, 2001). Other researchers such as Laleuf and Spaltger (2001) proposed the creation of reusable software components, or LOs, which would result in increased production of interactive objects that would be important components of digital libraries.

A number of organizations have pioneered the development of such digital libraries. LORs in this context are essentially databases made up of LOs. The Institute of Electric and Electronic Engineers (IEEE) Learning Technology Standards Committee (LTSC) P1484 defined learning objects as *any entity that may be used for learning, education, or training* (http://ltsc.ieee.org/wg12/index.html). Existing repositories including HEAL (Health Education Assets Library) (http://www.healcentral.org/index.jsp), Lydia (www.lydialearn.com), the American-based Multimedia Educational Resource for Learning and Online Teaching (MERLOT) (www.merlot.org), and the Canadian Campus Alberta Repository of Educational Objects (CAREO) LOR prototype (http://www.careo.org). Most of these repositories are special purpose or directed at post-secondary education, with very little work directed at the Kindergarten to grade 12 (K-12) level.
Porter, Curry, Muirhead and Galan (2002) noted that organizations that would pioneer readily available and effective LORs and make them available to educators, particularly in the K-12 area, were required. In addition, the development of available, cost efficient and effective LORs was the missing element required for the development of relevant materials and learning paradigms in the classroom. LOs and resources to develop LOs are not available to most educators for use in learning, instruction, or the development of new instructional methodology. This problem prevents developers, and educators, to go to the next level of evolution to develop instructional methodologies that will improve learning and increase the effectiveness of technology in the classroom or online learning.

The development of repositories paralleled proposals for creating a uniform standard that will provide a basis for universal use, reuse, and sharing of learning objects (Sonwalkar, 2001). Learning Objects Metadata (LOM) within this standard described the characteristics of the L.O. Each I.O is tagged with LOM descriptors and LOMs are required to search and locate learning objects in a repository. Standards relate to availability, for without metadata standards the objects in a repository may not be available to all users. Repositories therefore require the use of a metadata standard, such as the Canadian Core Learning Resource Metadata Application Profile (CanCore) (http://www.cancore.ca/about.html), Instructional Management System (IMS) Meta Data (www.imsglobal.org), or the Dublin Core (www.dublincore.org).

Longmire (2001) noted that to solve problems with transferability and efficient search capability the adoption of a metadata standard is required. To meet that need, Canadian educators and technology developers, developed the CanCore metadata
standard to allow educators, researchers, and students in Canada and elsewhere to search and locate material from online repositories (www.cancore.ca). This metadata standard is based on and is fully compatible with the IEEE LOM standard (http://ltsc.ieee.org/wg12/index.html) and the IMS Learning Resources Metadata specifications (www.imsglobal.org). It is a subset of the IMS initiatives and is designed to make the technology user friendly from the perspective of educators.

The Nisga’a people are a First Nations (aboriginal) people located along the Nass River in Northern British Columbia, Canada (http://www.schoolnet.ca/aboriginal/nisga2). A treaty, The Final Nisga’a Agreement (http://nisgaalisims.ca/treaty.html), signed by the province of British Columbia (BC), Canada, and the former Nisga’a Tribal Council (NTC) created the present central Nisga’a Lisims Government (NLG). The majority of people in the Nass valley live in the five semi-isolated communities of Gitwinksihlkw, Laxgalts’ap, Gingolx, Nass Camp, and New Aiyansh (http://nisgaalisims.ca/pdf/). Educational services for grades K-12 is delivered by the public School District 92 (Nisga’a) through three elementary schools, situated in the villages of Gingolx, Laxgalts’ap, and Gitwinksihlk, and a K-12 school, the Nisga’a Elementary Secondary School (NESS) situated in the village of New Aiyansh (www.nisgaa.bc.ca). The student population in the K-12 program is around 500 with about 250 students in the grade nine to twelve secondary program (BC Ministry of Education, 2004). More than 97% of the students are of Nisga’a descent. Nisga’a secondary students from the other communities are bussed daily, or live in residences situated on school grounds. The school district delivers Nisga’a language and culture courses for students in both elementary and secondary programs. A university college (http://wwni.bc.ca/), Wilp Wil Xo’oskwhl
Nisga’a (WWN), which is associated with the University of Northern British Columbia (UNBC) (www.unbc.ca), serves the area’s post-secondary students. The main WWN campus is also in New Aiyansh. The WWN delivers the UNBC Nisga’a Language and Culture certificate and degree programs, and other programs.

A Nisga’a Language and Culture program is an important part of the curriculum in both institutions. Many Elders, who have been passing on the Nisga’a knowledge base to the younger population as language and culture instructors, are now at retirement age and both educational institutions will soon be replacing retired Nisga’a instructors. A related problem is access by instructors and students to relevant materials. Over the last 20 years, Nisga’a Language and Culture Department of the Nisga’a School District (#92) and WWN have amassed a large quantity of culturally based (aboriginal) learning materials. The resources include stories, video, art objects, cultural artifacts, special documents, photographs, and software. The materials are found in various media, including paper, audio tapes, computer files (in various formats), laserdiscs, floppy disks, hard drives, video and film stock. For example, the songs of the Nisga’a (McKay, 2002) recorded in 1927 on wax cylinders had been lost to the Nisga’a people, and have now been located in a vault at the Canadian Museum of Civilization (http://www.civilization.ca/). The present mixture of different formats, and different locations of many resources, makes it difficult to locate, retrieve and utilize these resources for educational or research purposes. As a result, most of the materials are rarely used. Converting all the resources to a standardized digital format stored in one repository would enable the access and use of these materials as LOs. Educators could then incorporate the material into their lesson planning by using presentation software,
the web, or other instructional software for use in the classroom. One of the challenges of this approach was to build the repository and then to create a culture of technically advanced instructors and students that will be able to use the repository effectively. A few should eventually become expert enough to be able to develop objects and contribute to the repository.

The collection of learning objects in this study was in part Nisga’a cultural and language material developed, or obtained by School District #92 (Nisga’a) of British Columbia, Canada. Due to the availability of existing media material, the Nisga’a School District was an ideal location to establish and develop a local LOR, the Nisga’a Learning Object Repository (NLOR).

Abraham (2000) examined the impact of the Dukane Smartsystem media distribution system on a classroom environment. With Dukane, the instructor could use a remote control to access slide projectors, stereo receivers, digital photography, CD interactive programs, cable television, and satellite programming. Participants found that the media distribution system was more efficient, allowed more spontaneous classroom instruction, and that teaching styles become more hands-off while student participation styles become more hands-on. Teachers used more video and found that the needs of visual learners were better met than before. Instructors liked the ability to show the same media in multiple classrooms simultaneously. Problems encountered by users included difficulties running the system and the need for more in-service training.

The NLOR used technology that appears to be more efficient then that used in the Dukane system. Access to content on a LOR is under the control of the teacher, or student, since the content resides on a data server and is not dependent on media staff to
place the media into the media player connected to the system as in the Dukane System. One of the most useful features of a LOR is the ability to independently search the repository for the appropriate media. Using the metadata classification system attached to each object, an instructor can locate appropriate material for a particular group or grade level. As well, learning objects are downloadable to the instructor’s computer for incorporation into a lesson plan, demonstration, slideshow, or into a student project.

**Relevance and Significance**

The use of information technologies to develop and manage new learning resources, and to access and use learning content from a wide variety of academic and published sources has permanently changed the academic and learning environment (Porter et al., 2002). Education institutions and various corporations have engaged in research and activities with the goal of making their network and databases more effective. One of the ways to be more effective has been to make learning resources readily accessible to educators and learners through the development of learning LORs. In addition, Porter et al. noted that object repositories have been seen as key enablers to bring value to learning resources through the opportunity to reuse, re-purpose, or reengineer to suit the needs of the user. LORs also provided opportunities for innovation in the delivery of training and education. Barritt and Alderman (2004) noted that training was an expensive activity and that the promise of reusable LOs will be to reduce development time. It was their view that LOs, able to be leveraged, linked or copied by multiple authors, placed into any number of learning modules, and then delivered using a range of media would be ideal complements to learning resource development.
Okamoto, Cristea, and Kayama (2001) proposed that in future, education might use a combination of an adaptive intelligent system, enhancements with media, and the use of an online learning paradigm. It was their view that adaptive customized teaching environments may be superior to the standard classroom. Teachers using classic classroom methodology limit instruction by synchronous time limits, and are forced always to address the average student. The online learning paradigm used in the classroom can avoid some of the problems caused by teaching in a synchronous mode by better addressing the needs of most students.

Sonwalkar (2001, p.2) stated that “a fundamental paradigm shift is necessary to create a pedagogical model with the asynchronous technological interface in mind,” a pedagogy that is flexible, interactive, media rich, adaptive, and that provide individualized learning, yet is accessible to many learners. Such a flexible pedagogy would incorporate different media, and allow multiple modes of learning. Similarly, Vogel and Klassen (2001) concluded that educational environments are rapidly changing due to the ineffective teaching methodology of traditional education and the increasing availability of efficient and cost-effective alternatives that use technology. Technology should provide additional freedom for the student and instructor to explore alternatives to traditional education that satisfy a wider variety of needs. To achieve these efficiencies, material must be usable on multiple hardware and operating systems. This is especially true for web-based applications, currently characterized by a lack of operability of some material across platforms due to inefficient search engines (Taylor, 1999).

Standards for educational media are critical to the development of effective LORs. One problem noted by developers was the inability of many online software tools
to share resources and work together (Anido-Rifón, Fernandez-Iglesias, Llamas-Nistal, Caeiro-Rodriguez, Santos-Gago, & Rodríguez-Estevez, 2001). Software should be able to work with other software tools, utilities (including graphics and video packages), and be compatible to a wide range of formats (King, 1999). The standardization and interoperability of those resources would enable instructors to reuse learning resources and developers to reuse educational software (Anido-Rifón et al. 2001). Sonwalkar (2001) maintains that standards and markup languages may provide the means to define course structure and learning.

There have been several proposals for creating a uniform standard that would form the basis of universal use, reuse, and sharing of learning objects (Sonwalkar, 2001). Starting with the adaptation of models used in library science to categorize content objects, there has been a movement to create metadata and standards for shared media. Standard proposals include the Instructional Management System (IMS) metadata standards (www.imsglobal.org), Institute of Electric and Electronic Engineers (IEEE) 1484 metadata and database standards, eXtensible Markup Language (XML), educational markup language (EML), database structures for educational components (Aviation Industry CBT Committee-Computer Managed Instruction), and the Shareable Courseware Object Reference Model (SCORM).

In the public school system, the introduction of online software and learning repository using proprietary standards may be cost prohibitively and therefore ineffective. The availability and reuse of open standard LOs that may drastically reduce the cost of producing instructional media would therefore be of great interest to educators. Likewise, the use of similar templates may have a significant impact on the reduction of
development time, and help decrease the learning curve, especially when standards incorporate sound instructional design principles (King, 1999). Friesen (2001) supports the arguments for open standards in his assertion that educational stand-alone applications are incompatible with the normal production, distribution, and usage for educational software. Object-oriented software developers recognize the importance of opening up the inner workings of an object (software). Therefore, closing off content (in software objects) is not desirable for non-executable objects. Friesen also notes that educational resources are often outside the control of dominant commercial forces, and can therefore be reused, shared, and distributed. It is this potential for reuse and exchange of educational resources that needs to be realized, and open standard LOR’s are required to achieve this.

The Canadian Government has recognized the need for LORs by supporting the building of research learning object repositories through the Canadian Network for the Advancement of Research in Industry and Education (CANARIE) organization (www.canarie.ca). The Campus Alberta Repository of Educational Objects (CAREO) is one of the first Canadian prototypes (http://www.careo.org/). The primary goal of CAREO, as a research prototype, was to create a searchable, web based collection of multi-disciplinary teaching materials for educators. CAREO, developed jointly by the Universities of Alberta and Calgary in cooperation with BELLE (Broadband Enabled Lifelong Learning Environment), CANARIE, and as part of the Alberta Campus initiative, presently contains more than 4,000 learning objects from a variety of disciplines.
International repositories include HEAL (Health Education Assets Library) (http://www.healcentral.org/index.jsp), Lydia (www.lydialearn.com), and the American-based Multimedia Educational Resource for Learning and Online Teaching (MERLOT) (www.merlot.org). The HEAL National Multimedia Repository is a component of the National Science Digital Library and works closely with the Association of American Medical Colleges (AAMC). The goal of that repository is to provide digital multimedia files to educators in the health sciences. This prototype repository presently contains 1,800 images covering seven areas of medicine. The LYDIA Global Repository is an internet-based open exchange and learning resources hosting service for authors, developers, and distributors of computer-based education and training. The primary purpose of LYDIA is to provide the environment for clients to acquire, build, manage, and deliver content in one centralized location. MERLOT is a free and open resource for faculty and students of higher learning. Available resources include links to learning materials, sample assignments, evaluations of learning materials, and links to members with common interests or disciplines. The content in this multi-disciplinary repository is extensive and number in the thousands.

The Canadian education community has noted the potential of LORs in learning. Porter et al. (2002) recommended a Pan-Canadian approach to repository implementation in Canada. The increasing use of information technologies to create new learning resources, to manage existing ones, and to pool resources from a variety of sources has altered expectations for learning and instruction. As well, the ability to achieve greater efficiencies in education by making learning resources readily accessible to educators and learners will be important. In addition, educational LOs would bring immense value to
learning resources by providing the opportunity to reuse, repurpose, or change the learning object to suit the purpose of the end user.

Most LOR related projects to-date focused on the academic community and as noted by Porter et al. (2002), there was a need to focus on uses of learning objects repositories in the classroom. The Nisga’a Culture and Language Learning Objects Repository would meet that need in two unique ways. It would be the first to be available to the general use of students and teachers at the K-12 level in one school district. Equally important, it would become the first aboriginal (1st Nations) LOR containing cultural and language objects and would become a prototype repository for aboriginal organizations that have been searching for ways to effectively store and access learning resources.

The use of LOR technology has focused on the development of digital libraries, and archives for the development of learning objects, mainly for the use of post-secondary education, and the use of learning object developers. Meanwhile, knowledge about the use of LOR technology in the K-12 school system has been lacking and requires further research to determine the use of the technology for teachers, students, and developers. This is true also for the use of LOR technology as a media distribution system, which could have benefits both for K-12 education and in post-secondary education.

**Barriers and Issues**

The issues related to the creation of LOM repositories, standards, metadata learning objects, repository technology, and the software required to access differently
formatted LOs and LOMs combine to make the creation of a LOR a challenging task at this stage of their development. These are all leading edge technologies and there are many different working groups creating related standards within IEEE LTSC, including such initiatives as SCORM and the IMS (Anido-Rifon et al., 2001). IMS develops and promotes open specification that facilitates online activities such as interoperability, XML-based specifications for exchanging learning contents, and tracking and reporting learning progress (www.imsglobal.org). Research topics by IMS Project Groups currently include specifications for competency, accessibility, digital repositories, and simple sequencing. The IMS Consortium is the forum through which participants collaborate to satisfy real-world requirements for interoperability and re-use. IMS specifications are gaining worldwide acceptance as de facto standards for the delivery of learning products and services.

Metadata can be embedded in a Web page by using Meta tags in the Hyper-Text Markup Language (HTML), as a HTML document linked to the described resource, or in a database linked to the resource (Taylor, 1999). The simplest method is to use the META tags in HTML as used in Web pages, or XML (eXtensible Markup Language), which is the updated version of HTML. XML is quickly becoming the standard format for network data exchange of Internet based e-learning applications (Singh, 2000). XML provides developers a standard way to tag information (Gerber, 2001) and separates style from content by providing a platform for content delivery for different applications. Structuring learning content with XML documents would make it usable on any XML enabled Learning Management System (LMS) regardless of where it was originally created. Researchers have developed prototype software that facilitates the use of XML
in repositories. One example is the prototype Portal for Online Objects in Learning (POOL) (www.edusplash.net). The POOL design promotes the sharing and re-use of learning content and to support the development of educational processes in collaboration with CanCore. This makes it an ideal candidate for use in a localized LOM repository.

Archivists had attempted to produce electronic access tools for collections in their repositories since the 1980s (Tibbo, 2002). Most special collection repositories mounted websites during the mid 1990s, and a few repositories took the next step for digitizing primary materials themselves in addition to providing electronic access to a description of these materials. Many archivist and curators saw scholars as their most important customers because of their published research. They also trained the next generation of researchers. While historians were the focus of the study, literacy scholars, genealogists, or K-12 students could be just as easily, and probably should be in future studies.

Tibbo (2002) examined how historians locate primary resource materials, what they are teaching their students regarding how to find these resources, and what improvements and changes they would like to see repositories make. He also examined what repositories were doing and were planning to do, and how archivists educate their clientele in the discovery and use of access tools. The qualitative and quantitative methodologies used included the use of surveys, interview, and content analysis of websites. Tentative conclusions indicated that the full range of traditional search utilities remain useful when used with the new access tools. The study indicated a need for user education in electronic search methodologies. The study also concluded that few historians accessing web sites with advanced tools seemed to know if they had used it.
Parker et al. (2002) identified a number of barriers and issues related to the development of LOR projects within Canada. The primary focus of projects to-date has been the development of infrastructure and there was now a need for identification of easy-to-use LOR tools. In addition, the hope was that future projects would focus on the development, implementation and testing of end-user software. There was also a need for automated systems for metadata creation in order to ease the burden for individuals or groups that seek to store large collections of objects. Porter et al. also noted that LOR project leaders cited the need to expand their work to actual communities of practice, and there was an increased need to focus on training and skill development. Most repository projects to-date had focused on the academic community, and workplace uses of LORs has not been a priority.

Beckwith (2001) noted that while teachers and administrators knew that the use of multimedia enhanced learning, there was a problem with teachers not being provided with the time, training, equipment, and support necessary to adequately integrate technology into the curriculum. Therefore, it would be important to build in training components in the introduction of any new technology in education, such as a LOR.

The ability of teachers to use the LOR technology was a concern and professional development should be incorporated into any technology plan or project. One would not expect that teachers have the expertise to be heavily involved in developing learning objects. However, some will want to have the option of doing so. One would assume that most teachers accessing and using the existing learning objects initially do very little revision when using the objects. LOR technology may be an element in the development
of a new paradigm that would include individualized learning, probably borrowing
other technology from the distance education sector.

**Research Questions Investigated**

This study addressed two main concerns; the necessity to develop a local LOR
using an open metadata standard, and the lack of access to cultural content by students
and educators in the Nisga’a School District. The goal of the study was to create a LOR,
the NLOR, and to evaluate it as a viable, dynamic school resource. Once the product was
assessed as valid and reliable, its potential as a classroom tools was to be explored. The
questions driving the goal were:

1. How will the repository be constructed?
2. What are the uses of Learning Objects (LOs) in the classroom?
3. What objects of the Nisga’a culture are available, may be digitized, and will be
   included in the digital repository?
4. How reliable and valid are the classification standards?
5. How easily can teachers and students search the LOR?
6. What do the teachers and students report about the user interface?
7. How would teachers incorporate the LOs into the curriculum?
8. How could the LOR be enhanced in future versions?

The object of the study was to assess prototype LOR technology. As such, a
longitudinal approach spanning years would not be appropriate, nor would proper training
of users in a long-term usability study be possible. The technology appears to evolve on
an annual basis and in time will stabilize and realize its full potential. Therefore, at this
time, a short snapshot approach seemed most appropriate and the most productive
approach, and could be seen as a stage one study, with further work required as
recommendations are assessed and applied, and the technology has evolved.
Definition of Terms

Digital Library
An Organized collection of information, including text, video, and audio, along with methods for access, retrieval, selection, organization, and maintenance of the collection (Witten & Bainbridge, 2003).

Learning Objects
Any entity used for learning, education, or training (http://ltsc.ieee.org/wg12/index.html).

Learning Object Repository
Digital storehouses for learning objects (Richards et al. 2002)

Metadata
The structured data describing the characteristics of a resource (Taylor, 1999).

Metadata repository
A database table containing Metadata (Marco, 2000).

SPLASH
Single-user repository software that combines a database program and a peer-to-peer search engine (Richards et al., 2002).

Standards (ISO definition)
Documented agreements containing technical specifications or other precise criteria used consistently as rules, guidelines, or definitions of characteristics, to ensure that materials, products, processes and services are fit for their purpose (Friesen, 2002, December).

Acronyms
AAMC  Association of American Medical Colleges
ADDIE  Analysis, Design, Development, Implementation and Evaluation
ALOHA  Alberta Learning Object Hub Application
BELLE  Broadband Enabled Lifelong Learning Environment
CANARIE  Canadian Network for the Advancement of Research in Industry and Education
CanCore  Canadian Core Learning Resource Metadata Application Profile
CAREO  Campus Alberta Repository of Education Objects
CI     Contectual Inquiry
DC     Dublin Core
DCMES  Dublin Core Metadata Element
GES    Gitzwinksihlkw Elementary School
GUI    Graphical User Interface
HEAL   Health Education Assets Library
Summary of Introduction

This study addressed two major needs, the need to develop a Learning Object Repository (LOR) in the K-12 education sector, and the need to provide access to cultural content by students, and educators in the Nisga’a School District 92. The goal of the study was to create a LOR, the Nisga’a Learning Object Repository (NLOR), and to
evaluate it as a viable, dynamic school resource. Once the product was assessed as valid and reliable, its potential as a classroom tools was to be explored.

Multimedia technologies used in education have given educators and students more options in their learning environment, and studies have shown that their use improved instruction and student learning. The quality and use of multimedia have advanced to the level where it is possible to build large-scale services for digital data stored and retrieved over networks, and the proposed creation of reusable educational objects would result in increased production of objects as part of digital libraries. However, the development of cost efficient and effective LORs have been the missing element required for the development of relevant materials and learning paradigms in the classroom. Creating a uniform standard will provide a basis for universal use, reuse, and sharing of learning objects. Repositories require the use of metadata standards that solve problems of transferability and search capability to make the objects in the repository available to all users. LOR related projects to-date focused on the academic community and there was a need to focus on access and uses of learning objects in the classroom, particularly in the K-12 sector.

The Nisga’a Language and Culture Department of the Nisga’a School District have amassed a large quantity of culturally-based learning materials in various media, including paper, audio tapes, computer files (in various formats), laserdiscs, hard drives, and video and film stock. Much of this material has not been readily available to educators or students and converting all the resources to standardized digital formats stored in a repository would enable the access and use of these materials as learning
objects. Due to the availability of existing media material, the school district was an ideal location to establish and develop a local LOR, the NLOR.

The use of the NLOR as a media distribution system in the classroom environment may be more efficient than previously developed media distribution systems. Access to content on a LOR was under the control of the teachers, or students, since the content resides on a data server and was not dependent on media staff to search for or place the media into a media player. The technology provided additional freedom for the student and instructor to explore alternatives to traditional education that satisfied a wider variety of needs and the availability. The reuse of open standard learning objects may reduce the cost of producing and delivering instructional media, and LOR technology may be an element in the development of new learning paradigms. There was also a need to expand the work of creating LORs to communities of practice and to focus on training and skill development. In addition, there was a need to focus on the development, implementation, and testing of end-user tools. The study addressed those issues and explored the LOR as a product, as an instructional resource, and as a future resource.
Chapter 2

Review of the Literature

The literature review covered four main areas. The first section reviews selected works related to the building of media distributions systems and related software. The second section reviewed standards, metadata, and learning objects as important elements in the development of LORs. The third section discussed learning methodology. Finally, the fourth section reviewed research methodology that was useful to the project.

Media Distribution Systems and LOR Software

Abraham (2000) reported on the impact of an early version digital information system, the Dukane Smartsystem, and found that classrooms with a media distribution system were more efficient than the previous system of moving video machines, televisions, overheads and other media equipment between locations. The Dukane Smartsystem was easy to learn and use, and provided more communication media services in an effective manner. Anido-Rifon et al. (2001) illustrated a more advanced tele-education system using SimulNet software, which modeled then current recommendations for standardization by world standard associations. Anido-Rifon et al. stated that the model used Web based interactive and collaborative applications divided into three layers on top of a foundation composed of standard Internet protocols and commercial services. The SimulNet model presented a new design, particularly the three-
layered Web based technology incorporated into the model. Recommendations for improvement included better standardization of the software user interface and better time response from the server side.

Witten and Bainbridge (2003) described the building of a digital library using the open standard Greenstone Digital Library Software. The software provided a convenient way of organizing information and making it available over the Internet. The open standard software could be used to construct and present collections of millions of documents, including text, images, audio, and video. The interface allows users to access, operate, and search the collection.

Digital libraries are especially useful in the support of human development, in science, in music, and in the preservation of traditional culture (Witten & Bainbridge, 2003). A common complaint in traditional societies is that young people are not learning the culture and language due to the exposure of the popular commercial culture. One of the solutions to that problem was to develop a multimedia artifact or digital library, which is publicly available and that involves members of the tribe in collection and dissemination. This library would include artifacts in the form of images and descriptions, an oral history compilation, with interviews of elders in their native languages, an anthology of traditional songs, with audio recordings, musical scores transcribed from them and lyrics translated by a native speaker. It could also include video recordings of tribal members performing dances and ceremonies, along with a synopsis describing each ceremony and a transcription and translation of the recorded audio.
A critical feature of digital libraries for cultural preservation is the ability to work in local languages (Witten & Bainbridge, 2003). This strengthened individual cultures, promotes diversity, and reduced the dominance of English. Getting learners to produce their own content is one of the best ways to utilize information technology in learning environments. Further, the material produced enriches the learning experience and benefits the community.

Yuan (2001) proposed that metadata management is important for online learning systems. The study used widely accepted technical standards of metadata for digital library content. Metadata specifications for distributed learning established a metadata schema providing specifications for ten classes of learning object metadata. The objective of the Metadata Management System was to facilitate the creation, storage, and utilization of learning object metadata. The Web application described used a three-tier system using XML to transfer data between tiers. The tiers consisted of the client/server system architecture using a User Service Tier, a Business Service Tier, and the Data Service Tier. The metadata content was self-generated by the system, or keyed in by the author. Once complete, the objective was to incorporate the system into the Multimedia Interactive Telelearning System (MITS) developed at the Multimedia and Mobile Agent Research Laboratory of the University of Ottawa.

Richards, McGreal, and Friesen (2002) noted that repositories provide the tools to encourage the discovery, exchange, and re-use of learning objects. SPLASH, single-user repository software, combines a database program and a peer-to-peer search engine with a CanCore metatagging interface. SPLASH has the ability to search other peers and, subject to permission granted, to exchange learning objects or learning object metadata.
with other members. Repositories with specialized and robust databases such as POOL or CAREO have the potential to become PONDS in the POOL network.

Porter et al. (2002) proposed a strategy to build on the knowledge and experience gained through current related projects, to one or more projects that will demonstrate and evaluate a pan-Canadian learning repository implementation. This strategy required organizations willing to pioneer the creation of effective LORs and make them available to educators, particularly in the K-12 area. Objects repositories are key enablers for bringing value to learning resources by providing opportunities for reuse, re-purposing, or reengineering to suit a variety of purposes and end-user needs. Research into what type of pedagogies are most effective with younger vs. older learners was required. Approaches to develop national networks and to promote innovation and best practices for infusing new technologies and resources into learning environments were also required.

Richards and Hatala (2003) predicted that the development and delivery of curriculum using e-learning based methodology would increasingly focus on the reuse of learning objects. The development of learning object repositories that are able to interoperate will parallel this increased focus. Hatala, Richards, Eap, and Willms (2004) described the communications protocol, the Edusource communications Layer (ECL), designed to closely implement the IMS Digital Repository Interoperability (DRI) specifications and architecture. They noted that the ECL enables any LOR provider to join the network.
Standards, Metadata and Learning Objects

Standards are linked to availability, for without metadata standards, the objects in a repository may not be available to all users. Traditionally, cultural heritage and information professionals such as museum registrars, library catalogues, and archivists have used the term metadata to refer to cataloguing or indexing information that they create to arrange, describe, or enhance access to an information object (Baca, 1998). Taylor (1999) defined metadata as structured data that describes the characteristics of a resource. A metadata record consists of pre-defined elements representing specific attributes of a resource, and each element can have one or more values. Taylor also noted that metadata usually have a limited number of elements, the name of each element, and the meaning of each element. Key metadata elements supporting access to published documents included the originator of a work, its title, data and place of publication and the subject areas it covers. The data would be unusable unless the encoding allows the metadata to be processed using a computer program. Metadata is the essential link between use and creator of a resource. Further, metadata can be stored and created by embedding the metadata in a Web page using META tags in the HTML coding of the page, as a separate HTML document linked to the resource it describes, or in a database linked to the resource.

Richards and Hatala (2001) explained that the growing activity in internet-based course delivery created a demand for high-quality re-useable components called Learning Objects. The role for learning object repository technology is to develop methods to store, find and exchange learning objects. The intent of the architecture is to provide
scalable and flexible tools to manage a repository in an efficient manner for learners and teachers.

Hatala and Richards (2002) related a historic view of the development of LORs. Centralized digital learning object repositories evolved as a means of collecting and cataloguing learning objects in the hope of reducing the need to re-develop existing assets and enabling users to build on the ideas and designs, while protecting the rights of ownership and use of the object. In addition, Hatala and Richards explained the common standards for interoperability between different learning platforms. The standard created by the IMS Global Learning Consortium identified a minimum set of metadata elements called IMS Core. The IMS core consisted of more than 80 elements that describe the learning object. However, the education community has been slow to adopt the full IMS standard due to the high number of fields and vagueness of the values defined for the fields. CanCore addressed those problems in order for the metadata to be more useful to educators.

Richards and Hatala (2001) noted that objects placed on the Internet did not necessarily make the object available to users. General web search tools were too broad, and searches usually returned too much information. A solution is to index (or tag) the object with metadata to identify the object, its location, and to further describe the object. Too little information in the tag results in many false positive results. The Dublin Core protocol identifies only 15 fields while IMS identifies 86 fields. CanCore was an effort to identify 36 fields that will be useful for educators, without overburdening the indexing process. Not all fields in CanCore need to be completed. CanCore also organize metadata elements into nine groups that describe different characteristics of the learning object.
Creating Learning Objects, and providing access to them, are prime motivators for developing LORs. Longmire (2001) stated that content designed as an object, and developed for use in multiple settings, can be reused and become a valuable commodity for a specific purpose such as a course or software program. Arguments for a reusable learning object (RLO) design approach included: flexibility, ease of updating and management, ability to customize, interoperability, competency-based learning facilitation, and increased value of content. Two parts of a learning object are the object content and its metadata tag. The ideal RLO content is modular and freestanding, non-sequential, able to satisfy a single learning object, accessible to broad audiences, coherent and unitary, and not embedded within formatting (so that it can be re-purposed). Developing techniques for the learner to contextualize information deployed learning objects effectively, and learning objects empower learners by enabling them to participate more actively.

**Educational Reasons to build LORs**

The development of available, cost efficient, and effective Learning Object Repositories was a missing element required for the development of relevant materials and learning paradigms in the classroom (Porter et al. 2000). The literature supported the potential beneficial effects of computer technology in education. For example, Billera (1999) reported on the effects of multimedia instruction on achievement of college history students and found evidence that multimedia instruction has some potential to be positive in the learning process. Okamoto et al. (2001) proposed that a combination of intelligent, media-rich, and distance technology could dominate future education.
Okamoto et al. stated that initially, educators saw the Web as an information tools for disbursing educational content and, as a collaboration tools for interactive applications. Okamoto et al. also noted that three trends were apparent in education: distance learning, ITS systems, and media-oriented learning. Many authoring tools create distance courses that mimic the typical classroom while the latest model contains a layered evaluation of the learning in order to adapt activities to the user. Finally, Barritt and Alderman (2004) noted training was an expensive activity and that the promise of reusable learning objects will be to reduce development time. Linked learning objects, reusable by multiple authors, placed into any number of training activities, and then delivered to the user using a wide range of media, will optimize their value.

Dong and Agogino (2001) investigated the support of learning through the resources of a digital library and incorporating the information into the design architecture of an educational digital library. They suggested the use of a constructivist model of learning to develop an information architecture that meets the needs of learners and educators. Needs assessments incorporated into the evaluation process establish the primary impact the digital library had on teaching and learning. There exists a need for systems that incorporate user needs into the design and technical functions of the system. In addition, a contextual design approach that applies current learning research to the instructional technology in further studies and new technologies would better meet student and teacher needs.

Education faces a broad range of challenges with shifts in technology, paradigms and resources for learning (Vogel & Klassen, 2001). Teachers should broaden their range of instructional methodology, and, teaching colleges expect graduates to be conversant in
the world of communications that includes email, Intranet, Internet, conferencing systems and the world-wide-web. Teaching faculties also expect graduates to apply high cognitive skills such as analyzing, summarizing and synthesizing information, and engaging in creative and critical thinking. Teaching methodology that assume a single language and shared homogeneity of proficiencies, learning styles, and motivational systems are increasingly inadequate and inappropriate and teachers willing to re-evaluate traditional instructional methods have discovered that the use of new technologies produce more effective learners bringing a shift towards self-accessed and student-directed learning.

Vogel and Klassen (2001) suggested that interactive multimedia learning environments with a variety of characteristics facilitate a shift away from lecture-driven learning towards self-accessed and student-directed learning, and that teachers expend their efforts to developing students’ competencies and talents through the recognition that students possess a wide variety of learning styles and abilities. Teaching in the new environment then becomes a complex application of theory and research in the enhancement of student learning, and, research through innovation and multimedia technology would become a basic ingredient. Future educational environments would rapidly change due to the combination of the lack of effectiveness of traditional approaches, and the increasingly cost-effective availability of technology to enable alternatives to the traditional approach.

Sonwalkar (2001) discussed a shift from classroom teaching and learning to asynchronous Web-based and Web-supported learning environments, and noted that the dissemination of educational content was moving from a teacher-to-student model to a
technology-enabled interface. Internet browsers provided the adhesive to connect
students to teachers and to self-paced online courses. Also, the evolution of learning
theories defined learning in terms of complex cognitive processes. However, online
learning models should not mimic the normal classroom that can restrict individual
learning and learning environments must allow multiple modes of cognition. A paradigm
shift would be required to develop a model that allow for flexibility, interactivity, and
media-rich and adaptive environments that provide both individual learning and group
interactivity. Proposals for creating a uniform standard that would provide a basis for
universal use, reuse, and sharing of learning objects have adapted models used in the
library sciences to categorize content objects. It would be necessary to consider changing
the interface of education and reinventing pedagogy for the new interface, including
multimedia and hypermedia enhancements, and create the standards required for general
deployment.

Jonassen and Rohrere-Murphy (1999) proposed an activity theory as a framework
for designing constructivist learning environments (CLE). They argued that activity
theory provided an appropriate framework for analyzing needs, tasks, and outcomes for
designing CLEs. Activity theory focus on the interaction of human activity within its
context, and, used in the design of human-computer interaction provide a clear
framework for the design of CLEs. LORs by nature are activity based and activity theory
could be used when analyzing the design of a LOR. The use of activity theory in a design
framework would be divided into six steps (Jonassen & Rohrere-Murphy, 1999);
1. clarify the purpose of the activity system,
2. analyze the activity system,
3. analyze the activity structure,
4. analyze tools and mediators,
5. analyze the context, and
6. analyze activity system dynamics.

**Research Methodology**

Methodology and research instruments selected for use in the NLOR project provided some answers to stated problems and questions. The purpose of this section is to provide an overview of the research methodology that was useful in the development of the research design.

This was a developmental research study using rapid prototyping (RP) methodology and the traditional instructional design (ID) procedures consisting of analysis, design, development, implementation, and evaluation (ADDIE). Evaluation is a central component of the educational research and development process (Gall, Gall & Borg, 1999). Therefore, evaluative data collection included the observation of users and their survey conclusions and comments. RP, as noted, was used to develop a working prototype. RP is used early in a project to analyze, design, develop, and evaluate instructional innovation (Jones & Richey, 2000). RP studies also tend to use traditional procedures such as ADDIE, but also use concurrent processing of various design and development tasks. RP was used to save design and development time, and to increase the quality of the product.

Evaluation is a central component of the educational research and development process (Gall, Gall & Borg, 1999). Dick and Carey (1996) proposed a systems approach
model to educational research and development using 10 steps starting with needs assessment. Their approach included both formative and summative evaluation. Scriven (1967) noted that formative evaluation involved the collection of data about the educational product while under development for the purpose of guiding the developer in revising the product or deciding to discontinue. Summative evaluation, on the other hand, involved the determination of the final product’s worth in the educational setting.

Spinuzzi (2000) observed that qualitative field methods were widely regarded as valuable for investigating relationships between technology and work, examining workplaces and work practices, designing and developing documentation and software, and evaluating the impact of an initiative. He also noted that the literature revealed three field methods, that of ethnography, participatory design, and contextual inquiry. Ethnography developed from work in cultural anthropology. The goal was to understand ways of living within a social group, including rules, practices, and conventions that govern. The ethnography approach used only very general research questions.

Participatory Design (PD) represented a new approach towards computer systems design in which the people using the system are critical in designing it. PD emphasized active, democratic participation by users. PD is primarily a design method than a research method. Research participants co-define a research question for data collection, and researchers collect the data through observations of participant’s work, interviews with participants, collaborative design, walkthroughs, and prototyping. The Contextual Inquiry (CI) methods involve short-targeted observations and interviews with analyses guided by work structure models. CI starts with a clearly defined set of concerns based on cultural
aspects, rather than a research question. CI allows researchers to create abstract models that describe the underlying work structure based on focused by short-term data.

Richey (1998) outlined ways to enhance instructional technology research to produce usable knowledge. Research should be relevant to the professionals in the field. Suggestions included a focus on real world problems related to both instructional technology issues and practice, and the use of a variety of methodologies. Research must also be credible by demonstrating authenticity through causal relationships, demonstrated replicability, or other means.

Jones and Richey (2000) researched the use of similar rapid prototyping (RP) methodology in two projects carried out in a work setting, and made suggestions for a revised RP model. RP, used in the design of computer-based projects, but used in a variety of other ways, typically involves the building of a pilot product, or prototype. This saved the expense and expenditure of time required for the full final product. The prototypes are either workable models of the final product, or facsimiles of the projected final product and executable models typically evolve into the final product. RP models typically applied concurrent processes using traditional ID phases of Analysis, Design, Development, Implementation, and Evaluation (ADDIE). The use of RP methodology in the development of the NLOR project appears to have merit, particularly since the working environment will in part be dependent on the schedule of participants or project partners. For example, integration of the analysis and design functions would save valuable time and effort.

Pfleeger and Kitchenham (2001) outlined principles of survey research and provided a set of best practices to use when designing survey question for the research
component and survey work required in the assessment of the LOR and its use. This would be useful because the evidence produced by the research community to support the adoption of technology is not always the kind of evidence sought.

The survey instrument could be part of a larger survey process with clearly outlined activities (Pfleeger & Kitchenham, 2001). Activities included setting objectives, planning activities, designing selection of target participants, administration, analyzing the data, and reporting the results. Objectives must be clear and measurable because they are essential to subsequent survey activities. Objectives determine the question asked of whom, and the data collected. Further, rephrased objectives turn into research questions, or hypotheses, and help define variables. Objectives also define the appropriate type of research instrument.

**Summary and Contribution**

We understand the potential of multimedia learning objects to enhance education. However, we also understand that multimedia LOs, particularly interactive LOs, can be very expensive and time consuming to develop. Centralized digital LOs repositories evolved as a way to collect and catalogue LOs. The hope was that reusable and accessible LOs would reduce development time and encourage the use of digital LOs, thus incurring considerable economic and efficiency savings. In this scheme, repositories appear as key factors for increasing the value of learning resources by providing the ability to reuse, repurpose, or reengineer learning objects to suit users.

LOR project to-date focused primarily on infrastructure. A number of projects were concerned with centralized structures and tools lead to the development of
repositories such as CAREO, MERLOT, and CLOE, while a few projects such as POOL and the European Edutella project used a federated approach. A parallel development was the evolution of metadata standards, required to standardize searching and access by users to learning objects. Metadata described the characteristics of a resource and consisted of pre-defined elements that represent specific attributes of the resource. The IMS Global Consortium, the IEEE LTSC, and the ISO/IEC develop standards to ensure interoperability, portability, and reusability. Based on the IMS metadata profile, subsets of the IMS standard such as the Dublin Core and CanCore have evolved with the objective of simplifying the IMS metadata profile for specific user needs. The CanCore subset, developed to fill the needs of the education community and to be interoperable with the IMS profile, was widely adopted by the Canadian education community. LOMs were required to search and locate learning objects in a repository, and applications, such as the Alberta Learning Object Hub Application (ALOHA), developed to enter metadata into the metadata server and applied tags to the learning object using a variety of metadata profiles such as CanCore. The tags of choice were usually in XML and used a subset of the IMS profile as a standard.

In a parallel development, multimedia distribution systems, such as the Dukane Smartsystem, were developed and installed in many educational institutions. The focus of this system, at least initially, was solely media distribution and replaced the previous system of moving video machines, televisions, overheads, and other media equipment between locations. To-date there has been very little, if any, research into the specific use of LOR technology as a media distribution system. The focus of LOR research to-date has been the use of the technology as an archive, or as a repository for developers of LOs.
There has been an increased focus on adopting the technologies of federated repositories with that of centralized repositories. One example, the Canadian eduSource project proposes to connect LORs to a global network using the eduSource Communications Layer. There is also a need for identification of easy-to-use LOR tools and the development, implementation and testing of end-user software.

There are a number of levels where the use of LOR technology are largely unknown, including the impact and use of the technology by users at the workplace, particularly at the K-12 education sector. There was a need to focus on implementation of these technologies at the K-12 school and classroom level, as well as research into what mix of technologies work best for K-12. An emphasis on training and skill development and other workplace uses of LORs will fully explore and fulfill the promise of this technology for the benefit of developers and users.

This study guided further development of the LOR technology in the K-12 sector. As this was prototype technology, many issues need to be resolved. To address some of these issues further work in the field will be required, both in the use of the technology and in the technology required to build the LOR. The questions and areas addressed or validated in this study included:

- The quality of the graphical user interface used in an LOR.
- What metadata standard was useful in searching for and locating educational learning objects?
- What types of learning objects were useful to students and educators in the K-12 sector in the Nisga’a School District?
- Was the CAREO LOR platform useful in the K-12 sector?
- What type of multimedia access was useful to educators and students in the K-12 sector?
- How did ready multimedia access enhance the learning of students and the instructional methodology of educators?
- What were the benefits of using LOR technology as a media distribution system?
Chapter 3

Methodology

Research Methods Employed

This was a developmental research study using rapid prototyping (RP) methodology and the traditional instructional design (ID) procedures consisting of analysis, design, development, implementation, and evaluation (ADDIE). RP in computer-based projects are typically used to construct a pilot product, or prototype (Jones & Richey 2000). The pilot product developed and evaluated in this study was the Nisga’a Learning Objects Repository (NLOR). Evaluation is a central component of the educational research and development process (Gall, Gall & Borg, 1999). The evaluative data collected included the observation of users and their survey conclusions and comments. Other observations dealing with any aspect of the Learning Objects Repository (LOR) that appeared during the period of assessment were noted and incorporated into the discussion. Conclusions were based on the analysis of data collected, observations of user, and informal interviews.

RP, as noted, was used to develop a working prototype. RP is used early in a project to analyze, design, develop, and evaluate instructional innovation (Jones & Richey, 2000). RP studies also tend to use traditional procedures such as ADDIE, but also use concurrent processing of various design and development tasks (see Figure 1). The use of RP appeared to save design and development time, and increased the quality of the product, the NLOR.
Step One
Design and Development
- Design and install beginning webpages
- Consult with cultural panel
- Evaluation of preliminary student panel review
- Evaluation of preliminary teacher panel review
- Choose sample learning objects
- Digitize learning objects
- Decide on type of LOR platform
- Decide on type of metadata software
- Decide on metadata protocol to use
- Decide on operating system of LOR server
- Decide on server hardware
- Plan for connectivity with the network
- Plan for connectivity with Nisga’a web server

Step Two
Implementation
- Install metadata software
- Copy learning objects to LOR server
- Create metadata for learning objects
- Install LOR server hardware
- Install LOR server operating system
- Install LOR software and platform
- Test all components

Step Three and Four
Evaluation and Collection of Data
- Two month observation of LOR use
- Interviews with panels as required
- Evaluation surveys by panels
- Summations and analysis of data
- Conclusions and recommendations
- Panel review
- Writing of final report

Figure 1. Four steps of the NJOR rapid prototype model with concurrent processes.
Processes carried out in the study included:

1. Introduction of teachers and students to the ways that a LOR can enhance the learning process.
2. The use of a preliminary survey to determine contents of the NLOR and to answer immediate design questions.
3. Development and implementation of the NLOR.
4. The use of the NLOR evaluation survey to determine present and future use of the LOR and to answer future design questions.
5. Collections of a variety of data during NLOR use.
6. Evaluation of the data findings to arrive at conclusions and recommendations.

To allow for concurrent processes, the NLOR RP in this chapter was discussed in three sections. First, the analysis and survey section discussed the surveys, panels and population procedures. Secondly, the design, development, and implementation sections discussed the building of the NLOR. The third section, the evaluation and collection of data, discussed the collection and analysis of data, the work plan and timeline, and the resources used.

**Analysis and Surveys**

Activities in survey research include the setting of objectives, planning activities, designing, selecting target participants, administration, analyzing the data, and reporting the results (Pfleeger & Kitchenham, 2001). Survey questions must match the research objectives. Therefore, in the NLOR study the survey instruments included questions that followed the research objectives as listed in Table 1.
Table 1. List of NLOR Research Objectives

**Evaluation of the NLOR as a product**
- Do the stakeholders believe that LOR access will be a technology for the future?
- Is the NLOR graphical user interface efficient?
- Is the NLOR classification standard suitable for the educational program?
- Is the NLOR search capability efficient?
- What changes to the NLOR interface would make it more efficient?

**Evaluation of the NLOR as an instructional resource**
- What changes might occur in the classroom environment due to access to the resource?
- Will the NLOR make it easier for instructors to deliver the instructional program?
- What might the impact on learning due to access to the NLOR?

**The NLOR as a future resource**
- What changes or additions should be included in future versions of the resource?
- What other classes of learning objects are suitable for deposit to the resource?
- What changes would be useful to future users of the NLOR?

**The NLOR as a media distribution system.**
- Can LOR technology serve as a media delivery system?
- What would be the benefit of using LOR technology as a media distribution system?
- What will be the instructional benefit of using a LOR as a media distribution system?

The survey instruments consisted of two parts. The first part was a letter and information sheet (see Appendix A) introducing the resource and defining the concepts involved, and the second part consisted of the survey. There were two surveys, the preliminary survey, and the final NLOR survey (Appendix B). The letter and information sheet formed the basis of a review of the concept and potential uses of an NLOR. The
surveys included both closed and open-ended responses, and were divided into four main sections, which matched the research objectives.

The Panels

The student panels used the assessment instruments, the surveys, to assess the usability of the NLOR from a technical, content, and learning perspective. After a period of more than two months the student panel validated the content and usability of the NLOR along with recommendations for future use and changes to the NLOR through the evaluation survey. Approximately 35 students from three classes constituted the student panel, including two classes from senior secondary (grades 11 & 12), and one class from junior secondary (grade 10).

The teacher panel reviewed the content and usability of an LOR through the preliminary survey. The teacher panel also agreed to use the NLOR for their instruction over a three week period or more. The panel then used the NLOR assessment instrument to assess the usability of the NLOR from a technical, content, and learning perspective, along with recommendations for future use and changes to the NLOR. More than 10 teachers agreed to participate in the teacher panel.

Student and Teacher Populations and Procedures

The concurrent RP needs assessment and analysis steps started with the training of the survey panels, followed by preliminary surveys completed by the student and teacher panels. The targets of the surveys were potential LOR and NLOR users. Potential NLOR users (populations) were classed into two categories, students and teachers.

As noted, the students of two senior grade 11-12 classes and one junior secondary grade 10 class participated in the study. Subject areas consisted of one senior computer
science class, one senior humanities class (Career and Personal Planning 11/12), and one junior information technology class. Two periods of time were set aside for training and to introduce the concepts of learning objects and repositories. Once the students were comfortable with the subject they were asked to complete the survey in one period. To justify the use of three formal hours of class time, the content of the sessions were relevant to course curriculum objectives as much as possible. Therefore, the curriculum of participating courses consisted of Information Technology (IT), assignments related to Nisga’a language and culture, research skills, and combinations of those topics. The instructor introduced the topics of digital libraries, LORs, and their use in education. Sample student uses consisted of downloading learning objects for use in research papers, or for multimedia presentations.

The instructor guided the students through the questions at the beginning of the survey. The preliminary survey assessed the technology after visiting three existing, yet different prototype LOR platforms. The National Science Digital Library at www.nsdl.org/collections, the University of Calgary Learning Commons at http://careo.ucalgary.ca/, and the resource pool hosted by Prince River North (PRN) district at http://careo.prn.bc.ca/. The results of the preliminary survey provided information about the content used in the building of the NLOR, and for future reference. Students were then asked to use the NLOR to complete subject assignments and basic research designed by their instructor. The instructor and the researcher observed student use of the NLOR over a three week period. Students were permitted to use the NLOR for work in other classes, or outside of class activities. The final evaluation instrument
(Appendix B) was administered to the students at the end of the study period (by April 18th, 2005). Only the NLOR site was evaluated in the final survey.

A teacher panel from all schools was recruited on an individual and small group basis, and through a school district wide professional day workshop and training session. Once the teachers were comfortable with the technology they were asked to complete the preliminary survey. The orientation topics included digital libraries, LORs, and their potential use in education. Sample teacher uses included multimedia presentations, curriculum development, lesson planning, and the use of LOR technology as a media distribution system. Like the student panel, an introductory letter and the information sheet (as in Appendix A) were provided for additional support. The results of the survey provided information about the content and configuration that may be required for the NLOR. In addition, it served as a good preliminary introduction to the resource.

Teachers participating in the study were asked to include NLOR use in their class assignments. The teacher panel was also asked to use the NLOR for their own research and when designing student activities. A short teacher interview also assessed NLOR use during the study period. As a final evaluation instrument, the NLOR evaluation survey in Appendix B was administered to the participating teachers at the end of the study period. Teachers completing the final evaluation survey evaluated only the NLOR site.

**Design, Development and Implementation**

The RP design, development and implementation steps ran concurrently during the technical portion of the project. The researcher, with some assistance by students, prepared a sample set of Nisga’a learning objects to include in the repository. Meanwhile,
a computer engineer, with the assistance of the technical staff of School District 92
configured a LOR based on the CAREO prototype platform (www.careo.org).

The sample set of Nisga’ a learning objects primarily consisted of static learning
objects such as text and/or graphic materials. Most of the static text material was
converted to digital format using a scanner. A variety of video clips were prepared,
however, the length of some of the video clips presented a temporary technical problem.
Presently, video clips need to be downloaded for the user to play the video. For large
video clips this may be time prohibiting and not practical depending on the existing
network bandwidth. The analog video stock was captured using an analog capture card on
one of the school’s video editing stations. However, the older video clip formats and film
stock presented another technical challenge, as the school district does not have many of
the components for the older formats.

**Evaluation and Collection of Data**

Conclusions and recommendations from this study was based on three main
sources of data: observations of student LOR use, informal interviews with panel
participants, and the data collected from the preliminary and final (N Lor) evaluation
surveys. Informal observations of panel participants by the researcher/instructor occurred
during course activities over the evaluation period. Further training and feedback was
available at anytime during the study period.

The data collected by the surveys took the form of responses from both open
ended and closed ended survey questions. In addition, relevant observations by the
researcher during the workshop training and survey activities were noted. Descriptive
data from the surveys, observations, and interviews were summarized before interpretation. As noted, the study sampled two populations, the secondary students at NESS and the teachers of the Nisga’a school district. The student sample consisted of three classes of secondary students. The teacher sample consisted of a group of K-12 teachers.

Three types of scores are computed in educational research studies (Gall, Gall, & Borg, 1999): continuous scores, gain scores, and categorical scores. Categorical scores are variables that contain discrete and un-ordered values. This was the case for the NLOR survey scores. Frequency counts and percentages was the treatment used to describe the data during the analysis of the closed ended responses in the survey. The frequency is the total number of individuals in a sample who fit a particular category, or who match a response in the survey, while the percentage is the frequency in a category divided by the number of individuals in the sample (Gall, Gall, & Borg, 1999). The CROSSTABS frequency count and percentage analysis was performed by the SPSS (www.spss.com) program.

Work Plan and Timeline

The first step began as soon as the formal proposal was accepted. Data collection and impact assessment stage was completed by the end of April, 2005, followed by documentation of conclusions, predictions and recommendations. Final documentation was started by May of 2005 (see Figure 2).
Figure 2. Outline of NLOR work plan and timeline.
Resource Requirements

The available literature, appropriate hardware, and Internet server access were some of the resources that were required. Consultation with the local community, the language and culture departments of local government, and other educational institutions was initiated. The Nova Southeastern University Institutional Review Board (IRB) for research with human subjects assessed the study and gave approval. Formal permission to use resources from the School District was also received (see Appendix C). Assistance from language and culture instructors and Nisga’a Elders was received when required. The equipment and space required for the project was available from School District 92. A budget for the LOR project was included in a special grant available to the school.

School district technical staff and a computer engineer (as already noted) prepared the LOR server and installed the LOR platform. The NLOR used the CAREO LOR platform, and technical advice with regard to the LOR install was available from the University of Calgary (http://commons.ucalgary.ca), who also provided the initial install instructions. The CAREO LOR platform integrates the functions of a number of software programs. These software applications included ALOHA (http://aloha.netera.ca), WebObjects (http://www.apple.com/webobjects/), MYSQL (www.mysql.com), Java 1.4.1 SDK (www.sun.com), and FrontBase (www.frontbase.com). The researcher planned and deposited the learning objects, the metadata, and the web page design components of the NLOR using ALOHA and a variety of standard multimedia applications.
Chapter 4

Results

The problem identified for the study was that the Nisga’a culture is at risk and that school children did not have access to important cultural and heritage objects now in storage. Although many objects have been preserved and experiences captured in many different forms, they were not readily available for use in the schools.

The goal of the study was to create a Learning Object Repository (LOR), the Nisga’a Learning Object Repository (NLOR), and to evaluate it as a viable, dynamic school resource. Once the product was assessed as valid and reliable, its potential as a classroom tool was to be explored. The questions driving the goal were:

1. How will the repository be constructed?
2. What do the teachers and students report about the graphical user interface?
3. How reliable and valid are the classification standards?
4. How easily can teachers and students search the LOR?
5. What objects of the Nisga’a culture are available, may be digitized, and will be included in the digital repository?
6. What are the uses of Learning Objects (LOs) in the classroom?
7. How would teachers incorporate the LOs into the curriculum?
8. How could the LOR be enhanced in future versions?

Rapid prototyping (RP) methodology was used to construct the prototype repository with concurrent processes (see Figure 1) using the traditional phases of Analysis, Design, Development, Implementation, and Evaluation (ADDIE), as suggested by Jones and Richey (2000). The objective was to build a workable model of the final product using the work plan and schedule in Figure 2. This work plan was closely followed.
Step One
Design and Development
- Design and install beginning webpages
- Consult with cultural panel
- Evaluation of preliminary student panel review
- Evaluation of preliminary teacher panel review
- Choose sample learning objectives
- Digitize learning objects
- Decide on type of LOR platform
- Decide on type of metadata software
- Decide on metadata protocol to use
- Decide on operating system of LOR server
- Decide on server hardware
- Plan for connectivity with the network
- Plan for connectivity with Nisga’a web server

Step Two
Implementation
- Install metadata software
- Copy learning objects to LOR server
- Create metadata for learning objects
- Install LOR server hardware
- Install LOR server operating System
- Install LOR software and platform
- Testing all components

Step Three and Four
Evaluation and Collection of Data
- Two month observation of LOR use
- Interviews with panels as required
- Evaluation survey by panels
- Summations and analysis of data
- Conclusions and Recommendations
- Panel review
- Writing of final report

Figure 1. Four steps of the NLOR rapid prototype model with concurrent processes.
Figure 2. Outline of NLOR work plan and timeline.
A district wide professional day presentation introduced the technology and the project to interested teachers in the school district. A handout introducing the project and the technology was also provided (see appendix A). In addition, private tutorials and consultation for teachers was made available for those that were not at the workshop, or when teachers required additional information. During November of 2004, students of one senior computer science class, one senior humanities class, and one junior information technology class were introduced to the technology. Meanwhile, a computer engineer was hired to build the repository and to configure a new server.

Two panels, students and teachers, were used to evaluate the resource and to comment on potential uses of the LOR. First, a preliminary student and teacher survey was used to evaluate three existing LORs; the National Science Digital Library at www.nsdll.org/collections, the University of Calgary Learning Commons at http://careo.ucalgary.ca/, and the Resource Pool hosted by the Peace River North School District (PRN) at http://careo.prn.bc.ca/. Respondents were to focus their responses on the two CAREO platforms. Secondly, the NLOR was constructed and the LOs were added to the repository. However, the construction of the LOR was delayed an additional two months due to an incorrect part and a delay in obtaining the proper hardware. This meant that the third step, the use and evaluation of the NLOR portion of the project was pushed into the next semester starting in February of 2005. Fortunately, the majority of the participating students were also in one or two classes taught by the researcher during semester two. The new courses were Career and Personal Planning (CAPP) 11/12 and Applied Computer Skills (ACS) 11. This meant that the students who participated and completed the Preliminary Survey by the end of semester one (early February, 2005)
were able to continue participation during semester two under the direction of the researcher. Unfortunately, because the researcher was also the instructor, this introduced a potential bias in the student data. To mitigate this problem, the student and teacher data was differentiated and mainly teacher data was shown in the illustrative data tables that follow. In any case, the results that follow showed that teachers in general were more positive than students, suggesting that no bias occurred.

The NLOR was constructed and on line by the end of February of 2005. This gave the panel more than five weeks to use and evaluate the NLOR. A number of Nisga’a culture and language LOs were added for student and teacher use and evaluation. In addition, to accommodate one change of subjects (CAPP 11/12) during semester two, a number of learning objects related to that topic were also added to the repository. Objects were added and refined as the project proceeded, ending up with 65 working LOs by the end of March of 2005, in time for the final and fourth step, the final assessment, evaluation, NLOR survey completion, and data analysis. Participating students and teachers were asked to use and examine the NLOR (http://lor.nisgaa.bc.ca) and to fill out the NLOR evaluation survey by April of 2005. As noted earlier, the Preliminary survey examined existing LORs, while the NLOR survey examined the NLOR. Questions on both surveys were identical.

Surveys were collected by the end of April of 2005. The SPSS® (www.spss.com) statistical program was then used to analyze the collected data. Frequency counts and percentages were used to describe the data and results during the analysis of the closed ended responses in the survey. Answers to open ended questions and observations were also incorporated into the findings and conclusions that followed.
As noted, the study followed the RP methodology which included concurrent processes. This meant that the results could not always be discussed in logical order, or order of occurrence. Therefore, for purposes of readability, the discussion in this section, follow the questions driving the study, as noted.

Construction of the Repository

The RP methodology, as earlier noted, was used to construct the prototype with concurrent processes (as in Figure 1) using ADDIE. The objective was to build a workable model of the final product using the work plan and schedule in Figure 2. New server hardware for the LOR was ordered from the manufacturer early November of 2004.

The software portion of the LOR installation was based on the CAREO prototype platform (www.careo.org). A newer and updated version of CAREO named APOLLO (www.apollo.careo.org), to be developed by the University of Calgary was to have been available for NLOR use. However, numerous delays in implementing the new version meant that the LOR project was running out of time. Therefore, in December of 2004 a decision was made to go ahead with the original CAREO version and use the planned version upgrade path whenever that would be available. Meanwhile, the new server arrived in Vancouver, British Columbia and the hardware was prepared for the CAREO installation. As noted, a wrong part had to be returned to the manufacturer and a replacement part ordered, causing a further delay in sending the server to the Nisga’a Elementary Secondary School (NESS) located in New Aiyansh, northern British
Columbia, Canada. The server was finally received in New Aiyansh early February of 2005, and the Nisga’a School District technical staff completed the initial hardware setup.

A computer engineer, with the assistance of the district technical staff and the researcher, then completed the installation and configuration of the LOR instance by February of 2005. The NLOR, as noted, used the CAREO LOR platform. Technical advice with regard to the LOR install was available from the original developers at the University of Calgary (http://commons.ucalgary.ca), who provided the initial install instructions as found at http://careo.ucalgary.ca/documentation/installation/. A quick build installation package was also available at http://careo.ucalgary.ca/documentation/installation/CAREO_ALOHA_INSTALL.tar.gz.

The CAREO LOR platform integrates the functions of two separate components, a metadata management server called ALOHA (http://aloha.netera.ca) and the CAREO web application used as the repository interface. The CAREO web application requires WebObjects® (http://www.apple.com/webobjects/), Java 1.4.1 SDK (www.sun.com), and the FrontBase® database server installed (www.frontbase.com). The CAREO platform also required a compatible HyperText Transfer Protocol (HTTP) web server. For this, the Apache (www.apache.com) web server was used. The ALOHA Metadata Server application, with a MYSQL (http://www.mysql.com) database server, stores the LO metadata created by the ALOHA client application. With the NLOR online, the metadata could be manually entered into the MYSQL database using the ALOHA client software, followed by the copying of the learning objects to the NLOR server as required. Although a web-based utility for copying LOs to the repository is available on the CAREO application, the LOs were copied to the server manually at the time of metadata
entry. This seemed most practical as the metadata entry and the accessibility of the object could be tested at the same time, and modifications either to the metadata or the LO format could be made as required. This method ensured that users could successfully access the LO described in the NLOR.

A sample set of NLOs to be included in the repository had previously been prepared. However, as earlier noted, the extension of the project into the second semester meant that most of the student panel were in the researcher’s CAPP class. This provided the opportunity and the need to deposit and use a number of CAPP curriculum related objects, many of which were links to relevant career related sites.

One of the challenges of the project was to convert existing LOs to a digital format. The sample set of Nisga’a culturally relevant learning objects partly consisted of static learning objects such as text and/or graphic materials. These objects were converted to digital format using a scanner. There were initially some problems accessing this material on the NLOR due to incompatible formats, and it was found that using the Portable Document Format (pdf) accessible by an adobe® reader® (www.adobe.com) solved this problem. In addition, it was found that the web based HTTP and related formats such as the Hyper-Text Markup Language (html) or eXtensible Markup Language (xml) appeared to work the best for all objects (www.w3.org/Protocols). For example, slideshows did not appear to work until they were published to the Internet and converted to a web format such as html or xml.

Video also presented a technical problem. While a variety of video clips were ready to be installed in the repository, the length of some of the video clips presented a technical problem due to the low bandwidth of Internet access to the school. It was
therefore decided to install the video after a school-wide broad bandwidth solution could be installed later in the year. Presently, video clips need to be downloaded for the user to play the video. For large video clips this may be time prohibiting and therefore not practical. In addition, it could use up available bandwidth and slow down Internet access by other users. One of the technical considerations was the addition of streaming video capability to the CAREO platform; however this was not addressed at this stage of the installation. Another technical question was the ability to convert the older video clip formats and film stock presently in storage, as the school district does not have the hardware components to read or copy these. This part of the project was also moved to a later date, as solutions to that question appeared to require more research in conjunction with staff at a museum or university library.

**NJOR Graphical User Interface**

The NJOR Graphical User Interface (GUI) is important from the perspective of the user. It needs to be clear, easy to understand, and instructions have to provide the users with the ability to search and use the objects in the NJOR. To assess the user interface and to provide clues for improvement, student and teacher panels were asked to evaluate the LOR interfaces using the two surveys. The panels were presented with eleven attributes (see *attributes* Table 2) of the GUI. There were five potential responses to check *poor, adequate, average, good, and excellent*. One open ended question followed. The responses to the Preliminary survey were mixed with the majority of responses spread between *average* and *good*. Exceptions were the answers to the *font and general readability of text* question, which was assessed *adequate* (5%), *average* (40%),
Table 2. User Interface Responses (attributes): Teacher Responses on the NLOR Survey Shown in Percentages (N=10)

<table>
<thead>
<tr>
<th>User interface responses (attributes)</th>
<th>Poor</th>
<th>Adequate</th>
<th>Average</th>
<th>Good</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructions for independent use were</td>
<td>-</td>
<td>-</td>
<td>20</td>
<td>50</td>
<td>30</td>
</tr>
<tr>
<td>Clarity of the page layouts was</td>
<td>-</td>
<td>-</td>
<td>20</td>
<td>50</td>
<td>30</td>
</tr>
<tr>
<td>The smooth and logical organization of access to software and web pages was</td>
<td>-</td>
<td>-</td>
<td>30</td>
<td>50</td>
<td>20</td>
</tr>
<tr>
<td>The use of clear, accurate, and concise language was</td>
<td>-</td>
<td>-</td>
<td>30</td>
<td>50</td>
<td>20</td>
</tr>
<tr>
<td>The fonts and general readability of text were</td>
<td>-</td>
<td>10</td>
<td>20</td>
<td>40</td>
<td>30</td>
</tr>
<tr>
<td>Search capability when looking for learning objects was</td>
<td>-</td>
<td>-</td>
<td>30</td>
<td>40</td>
<td>30</td>
</tr>
<tr>
<td>The effective use of color in the interface was</td>
<td>-</td>
<td>22.2</td>
<td>33.3</td>
<td>33.3</td>
<td>11.1</td>
</tr>
<tr>
<td>Ability to access the learning object of interest was</td>
<td>10</td>
<td>-</td>
<td>20</td>
<td>50</td>
<td>20</td>
</tr>
<tr>
<td>Variety of available learning objects were</td>
<td>-</td>
<td>20</td>
<td>20</td>
<td>40</td>
<td>20</td>
</tr>
<tr>
<td>The available links to other repositories or teacher resources were</td>
<td>-</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>Overall evaluation of the user interface was</td>
<td>-</td>
<td>-</td>
<td>30</td>
<td>60</td>
<td>10</td>
</tr>
</tbody>
</table>
excellent (42.9%) by teachers. Students assessed the CAREO platform overall user interface as poor (5%), average (30%), good (50%), and excellent (15%), while teachers assessed the interface as adequate (14.3%), average (42.9%), and good (42.9%).

The NLOR survey student panel ranked the overall evaluation of the user interface as poor (6.7%), adequate (20%), average (33.3%), and good (40%), while the teacher panel ranked it average (30%), good (60%), and excellent (10%). Results showed that most interface attributes were assessed as average or good by both panels. One of the more positive attributes, the fonts and general readability of text attribute was assessed adequate (6.7%), average (20%), good (33.3%), and excellent (40%) by the student panel, and adequate (10%), average (20), good (40%), and excellent (30%) by the teacher panel. The attribute, instructions for independent use was assessed as adequate (13.3%), average (46.7%) and good (40%) by students, but more positive by teachers who assessed the attribute average (46.7%), good (50%), and excellent (30%).

Classification Standards and Searching Facility

The availability of reusable and accessible LOs contained in a centralized digital LOR should reduce development time and encourage the use of LOs, and thus increase the value of the learning resource. However, to locate a LO that might be useful to a learner, or user, a description or metadata of the LO is required. Hodge (2001) noted that metadata is key to ensuring that the resource will persist and be relevant to the user. This may be particularly true in education where, as Friesen (2004) noted, the most difficult is the task of differentiating between different kinds or types of resources. One problem is
that a resource that serves in one context might also be useful in another. One solution is the use of uniform metadata standards.

Standards in educational media are seen as critical elements in the development of effective LORs, and as Sonwalkar (2001) noted, it is uniform standards that enable the basis of universal use, reuse, and sharing of learning objects. A number of organizations, like the IEEE Learning Technology Standards Committee (LTSC), were created to solve some of the problems and develop standards that enable learners or instructors to search, evaluate, acquire, and utilize LOs (http://ltsc.ieee.org). Evolving metadata standards include the Canadian Core Learning Metadata Application Profile (CANCORE) (http://www.cancore.ca/about.html), the Instructional Management System (IMS) Meta Data (www.imsglobal.org), and the Dublin Core (www.dublincore.org).

The ALOHA metadata server and client applications enables the use of a number of learning object metadata (LOM) standards including IMS, the Dublin Core, and CANCORE. To solve any potential problems with transferability and efficient search capability with the LOM in the educational context, the CANCORE standard was chosen. The objective of this subset of the IMS initiatives was to make the technology user friendly and educationally relevant (www.cancore.ca). The ALOHA client application used to enter the metadata made the entry of the metadata straightforward once the software was properly configured. None-the-less, minor errors were made entering the metadata. This was primarily caused by unclear descriptions of the CANCORE elements and inexperience entering metadata. Errors were corrected as located. The installation of a new ALOHA version, ALOHA II, may resolve some of the metadata entry problems, albeit minor, as would the development of a comprehensive manual.
The metadata written for learning objects largely determines the ability of a program to search the object. As such, metadata entry is an important step in enabling the user to locate a resource, as is the standard used. The project, as noted, used the ALOHA client application to enter the metadata descriptors using the CANCORE LOM standard. To assess the effectiveness of these descriptors and the search capability of the LOR, the student and teacher panels were asked to determine the search capability quality by responding to the question *search capability when searching for LOs* on both the Preliminary and NLOR surveys. There were five potential responses, *poor, adequate, average, good* and *excellent*. The Preliminary survey indicated that student and teacher panels thought that the quality of the search capability was *average* to *good* with the highest number of responses by students *good* 45% and by teachers, *average* 42.9%. The responses by the panels on the NLOR survey as in were more positive and ranged from *average* to *excellent*. Students assessed the search capability as *poor* (6.7%), *adequate* (6.7%), *average* (33.3%), *good* (26%), and *excellent* (26%), while the teacher panel, as in Table 2, rated the search capability as *average* (30%), *good* (40%), and *excellent* (30%).

**Nisga’a Learning Objects**

The NLOR, as noted, contains a sample set of Nisga’a Learning Objects (NLOs). Over the past two decades the Nisga’a Language and Culture Department of the Nisga’a School District has gathered and developed a large quantity of culturally based learning materials in various media, formats, and categories. To further guide the selection of objects to include in the repository, student and teacher panels were asked to evaluate
existing and potential categories of LOs in the classroom. This generated information from the perspective of both students and teachers.

The panels were presented with 19 LO categories (see categories Table 3) on the surveys with the option to fill in three additional types of objects. There were three potential responses to check, not relevant, no opinion, and relevant. The responses of both panels on the Preliminary Survey were generally positive, with the relevant responses ranging from 33.3% (NLG annual reports) to 70.4% (Nisga’a cultural items) for the combined panels. Cultural related categories were most often marked relevant. Teachers were more likely to mark a relevant response, with 100% of that panel assessing six of the categories as relevant. However, there was a difference of opinion between students and teachers for some of the categories, as less than 50% of the students assessed the school yearbooks, NLG reports, Windsong, and video clip categories as relevant, while more than 50% of the teachers thought that those categories were relevant.

The same set of questions on the NLOR survey solicited responses after individual assessments of the NLOR Teacher and student responses varied with a high number of student responses in the no opinion category. The percentage of relevant responses ranged from 36% to 76% and seven categories were rated less than 50% relevant by the combined panels (Table 4). However, teachers, as in Table 3, were more positive with relevant responses for all the categories ranging from 50% to 90%.
Table 3. Learning Object Categories: Teacher Responses on the NLO Survey

Shown in Percentages (N=10)

<table>
<thead>
<tr>
<th>Learning object categories</th>
<th>Not relevant</th>
<th>No opinion</th>
<th>Relevant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pictures of people and events</td>
<td>10</td>
<td>10</td>
<td>80</td>
</tr>
<tr>
<td>Pictures of artefacts</td>
<td>10</td>
<td>-</td>
<td>90</td>
</tr>
<tr>
<td>Text of cultural stories</td>
<td>10</td>
<td>-</td>
<td>90</td>
</tr>
<tr>
<td>School yearbooks</td>
<td>20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>NLG annual reports</td>
<td>20</td>
<td>20</td>
<td>60</td>
</tr>
<tr>
<td>Newsletters</td>
<td>-</td>
<td>22.2</td>
<td>77.8</td>
</tr>
<tr>
<td>Copies of Windsong</td>
<td>30</td>
<td>10</td>
<td>60</td>
</tr>
<tr>
<td>Video clips of cultural events</td>
<td>10</td>
<td>-</td>
<td>90</td>
</tr>
<tr>
<td>Pictures of cultural events</td>
<td>-</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>Video clips of community events</td>
<td>-</td>
<td>10</td>
<td>90</td>
</tr>
<tr>
<td>Science topics/activities</td>
<td>-</td>
<td>10</td>
<td>90</td>
</tr>
<tr>
<td>Social Studies topics/activities</td>
<td>10</td>
<td>-</td>
<td>90</td>
</tr>
<tr>
<td>Math topics/activities</td>
<td>-</td>
<td>10</td>
<td>90</td>
</tr>
<tr>
<td>English topics/activities</td>
<td>10</td>
<td>10</td>
<td>80</td>
</tr>
<tr>
<td>History topics/activities</td>
<td>-</td>
<td>10</td>
<td>90</td>
</tr>
<tr>
<td>Literacy topics</td>
<td>10</td>
<td>10</td>
<td>80</td>
</tr>
<tr>
<td>Nisga’a cultural items</td>
<td>-</td>
<td>10</td>
<td>90</td>
</tr>
<tr>
<td>Course outlines</td>
<td>30</td>
<td>10</td>
<td>60</td>
</tr>
<tr>
<td>Audio clips</td>
<td>20</td>
<td>-</td>
<td>80</td>
</tr>
</tbody>
</table>
Table 4. Learning Object Categories: Combined Student and Teacher Panel Responses on the NLOR Survey Shown in Percentages (N=25)

<table>
<thead>
<tr>
<th>Learning object categories</th>
<th>Not relevant</th>
<th>No opinion</th>
<th>Relevant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pictures of people and events</td>
<td>12</td>
<td>24</td>
<td>64</td>
</tr>
<tr>
<td>Pictures of artefacts</td>
<td>4</td>
<td>24</td>
<td>72</td>
</tr>
<tr>
<td>Text of cultural stories</td>
<td>16</td>
<td>24</td>
<td>60</td>
</tr>
<tr>
<td>School yearbooks</td>
<td>16.7</td>
<td>41.7</td>
<td>41.7</td>
</tr>
<tr>
<td>NLG annual reports</td>
<td>28</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td>Newsletters</td>
<td>12.5</td>
<td>29.2</td>
<td>58.3</td>
</tr>
<tr>
<td>Copies of Windsong</td>
<td>28</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td>Video clips of cultural events</td>
<td>4</td>
<td>20</td>
<td>76</td>
</tr>
<tr>
<td>Pictures of cultural events</td>
<td>8</td>
<td>20</td>
<td>72</td>
</tr>
<tr>
<td>Video clips of community events</td>
<td>20</td>
<td>24</td>
<td>56</td>
</tr>
<tr>
<td>Science topics/activities</td>
<td>4</td>
<td>44</td>
<td>52</td>
</tr>
<tr>
<td>Social Studies topics/activities</td>
<td>16</td>
<td>40</td>
<td>44</td>
</tr>
<tr>
<td>Math topics/activities</td>
<td>16</td>
<td>40</td>
<td>44</td>
</tr>
<tr>
<td>English topics/activities</td>
<td>16</td>
<td>36</td>
<td>48</td>
</tr>
<tr>
<td>History topics/activities</td>
<td>20</td>
<td>28</td>
<td>52</td>
</tr>
<tr>
<td>Literacy topics</td>
<td>20</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Nisga’a cultural items</td>
<td>4</td>
<td>28</td>
<td>68</td>
</tr>
<tr>
<td>Course outlines</td>
<td>16</td>
<td>28</td>
<td>56</td>
</tr>
<tr>
<td>Audio clips</td>
<td>12</td>
<td>28</td>
<td>60</td>
</tr>
</tbody>
</table>
Using Learning Objects in the Classroom

Learning Object Repositories has been defined as digital storehouses for learning objects, while LOs are defined as any entity used for learning, education, or training (http://ltsc.ieee.org/wg12/index.html). For some, LORs are seen as Digital Libraries containing organized collections of information, including text, video, and audio, along with methods for access, retrieval, selection, organization, and maintenance of the collection. Porter, Curry, Muirhead, and Galan (2002) noted that the development of LORs promises to make learning resources readily accessible to educators and learners, and, that the opportunity to reuse, or re-purpose, learning resources potentially brings further value to those learning resources. Once a LOR has been developed users (teachers and students) and LO developers can access existing learning material (see Figure 3). In some cases users and developers can then re-purpose the LO. Re-purposed or changed objects can then be restored on the repository as new objects.

To assess how LOs should be used student and teacher panels were asked to complete the surveys, and assess twelve potential uses (see LOR uses Table 5) with the option to fill in three additional uses. There were three potential responses to check, not important, no opinion, and important. The first set of questions on the preliminary survey requested responses after individual assessments of three different LORs. Seven teachers and 20 students responded to the survey for a total of 27 responses. The responses were all positive with the percentage for important responses ranging from 50% to 100% for the combined panels.
Figure 3. Examples of student and teacher use of a learning object repository.
Table 5. Learning Object Uses: Teacher Responses on NLOR Survey Shown in Percentages (N=10)

<table>
<thead>
<tr>
<th>Learning object uses</th>
<th>Not important</th>
<th>No opinion</th>
<th>Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research information access</td>
<td>-</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>Making slideshow presentations</td>
<td>10</td>
<td>-</td>
<td>90</td>
</tr>
<tr>
<td>Creating video clips</td>
<td>-</td>
<td>10</td>
<td>90</td>
</tr>
<tr>
<td>Presenting a lesson</td>
<td>20</td>
<td>-</td>
<td>80</td>
</tr>
<tr>
<td>Reading a story</td>
<td>10</td>
<td>10</td>
<td>80</td>
</tr>
<tr>
<td>Watching a video clip</td>
<td>20</td>
<td>10</td>
<td>70</td>
</tr>
<tr>
<td>Getting pictures for research</td>
<td>-</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>Developing new objects for later use</td>
<td>-</td>
<td>10</td>
<td>90</td>
</tr>
<tr>
<td>Enhancing objects and create new ones</td>
<td>-</td>
<td>20</td>
<td>80</td>
</tr>
<tr>
<td>Studying Nisga’a history</td>
<td>-</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>Studying Nisga’a culture</td>
<td>-</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>Studying Nisga’a language</td>
<td>-</td>
<td>-</td>
<td>100</td>
</tr>
</tbody>
</table>

The same set of questions on the NLOR survey solicited responses after individual assessments of the NLOR. Fifteen students and 10 teachers responded for a total of 25 responses. Both student and teacher responses were positive with the percentage of *important* responses ranging from 52% to 92%. Teachers, as in Table 5, were particularly positive with *important* responses ranging from 70% to 100%. The
items, using the LOR for studying Nisga’a history, culture, and language, gathered the highest important response, with a 100% response by teachers.

Incorporating Learning Objects into the Curriculum

The teacher and student panels, as earlier noted, were asked to use the NLOR resource as part of their normal instructional or learning activities. This included teachers incorporating the NLOR into their lessons where possible. The idea of LOR use within the classroom was to make resources available to users at one location, thus easing the development of lessons and improving the quality of the instruction. The LOR would include resources that are now ordinarily available elsewhere and new LOs that would be available because of the LOR. Ideas for using the resource were outlined in the introductory letter and the LOR information sheet provided to students and teachers (Appendix A). However, the study was not able to adequately assess whether the use of the resource extended beyond the confines of evaluation and assessment using the survey instruments due to the brevity of the project timeline and the relatively low number of LOs in the repository at the time.

To provide a snapshot of potential LOR uses by students and teachers the Preliminary and NLOR surveys requested responses to five reasons (see reasons Table 6) to use the repository. There were three response options, not important, no opinion, and important. The majority of both panels on the Preliminary Survey assessed all the reasons as important. The percentages of the important responses for all the reasons ranged from a low of 63% to a high of 100%.
Table 6. Reasons to Use the Repository: Teacher Responses on the NLOR Survey Shown in Percentages (N=10)

<table>
<thead>
<tr>
<th>Reasons to use the repository</th>
<th>Not important</th>
<th>No opinion</th>
<th>Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ready access to information</td>
<td>-</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>The ability to re-use a resource and create new ones</td>
<td>-</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>The ability to do independent learning</td>
<td>-</td>
<td>10</td>
<td>90</td>
</tr>
<tr>
<td>The ability to see or hear cultural items that would otherwise not be available</td>
<td>-</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>The ability to access resources via the computer</td>
<td>-</td>
<td>-</td>
<td>100</td>
</tr>
</tbody>
</table>

Similarly, the majority of responses by both panels on the NLOR Survey assessed all the reasons as *important*, with the exception of the reason, *ability to access resources via the computer*, which the majority of students assessed as *no opinion* at 53.3%, followed by *important* at 46.7%. The *important* responses for all the reasons by the student panel ranged from a low of 46.7% to a high of 80%. However, 100% of the teacher panel, as in Table 6, rated all the reasons *important* with the exception of the *ability to do independent learning*, which obtained a 90% response.

**Recommendations for LOR Improvement**

One of the objectives of this study was to look at different ways to use the LOR technology in the kindergarten to grade 12 (K-12) setting. Four additional aspects of LOR use that were not commonly contemplated in the literature were the use of the LOR as a
Table 7. Using the LOR as a Media Distribution System: Teacher Responses on the NLOR Survey Shown in Percentages (N=10)

<table>
<thead>
<tr>
<th>Using the LOR as a media distribution system would:</th>
<th>No</th>
<th>Not likely</th>
<th>Unsure</th>
<th>Probably</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be easier to use than the present system?</td>
<td>10</td>
<td>-</td>
<td>20</td>
<td>40</td>
<td>30</td>
</tr>
<tr>
<td>Increase the use of multimedia for learning?</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Be less expensive than the manual system?</td>
<td>-</td>
<td>-</td>
<td>30</td>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>Save preparation time for teachers?</td>
<td>10</td>
<td>10</td>
<td>20</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>Enhance the ability of students to conduct independent study?</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>30</td>
<td>70</td>
</tr>
<tr>
<td>Save study time for students?</td>
<td>20</td>
<td>-</td>
<td>20</td>
<td>-</td>
<td>60</td>
</tr>
<tr>
<td>Enhance the learning environment of students?</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>Enhance the working environment of teachers?</td>
<td>-</td>
<td>10</td>
<td>20</td>
<td>10</td>
<td>60</td>
</tr>
<tr>
<td>Enhance the quality of instruction?</td>
<td>10</td>
<td>10</td>
<td>-</td>
<td>20</td>
<td>60</td>
</tr>
<tr>
<td>Enhance the quality of learning?</td>
<td>-</td>
<td>-</td>
<td>20</td>
<td>10</td>
<td>70</td>
</tr>
</tbody>
</table>

multimedia distribution system, enhancing the interface to represent a reading room, a movie room, and the use of streaming video. To explore the potential use of the LOR as a multimedia distribution system, the panels were presented with ten reasons to use the LOR this manner (see Table 7). There were five potential responses to check, no, not likely, unsure, probably, and yes. The majority of responses on the Preliminary survey were probably or yes, with a few exceptions. Both panels thought that a LOR would be easier to use than the present system with student response for probably (44.4%) and yes
(22.2%). The teacher panel responded *probably* (42.9%) and *yes* (28.6%). However, both panels were unsure whether the *LOR used as a Media Distribution System, would be less expensive* with students responding *not likely* (11.1%), *unsure* (50%), *probably* (27.8%), *yes* (11.1%), and with teachers responding *no* (14.3%), *unsure* (42.9%), *probably* (14.3%), and *yes* (28.6%).

The majority of responses to this section in the NLOR survey also were *probably* or *yes* with a few exceptions. The teacher panel on this survey thought that the NLOR would *be easier to use* than the present system with a response of *no* (10%), *unsure* (20%), *probably* (40%) and *yes* (30%). However, the student panel was unsure with a response of *unsure* (60%), *probably* (20%) and *yes* (20%) for that question. Both panels on this survey were sure that the LOR used as a Media Distribution System, *would be less expensive* with students responding *not likely* (20%), *unsure* (33.3%), *probably* (40%), and *yes* (6.7%), and teachers as in Table 7 responding *unsure* (30%), *probably* (20%), and *yes* (50%) for this question.

To explore the potential use of the LOR for the remaining three potential future improvements to the LOR the panels were presented with one question about the potential use for each of the three remaining suggestions, which were to use streaming video, and to redesign a version of the LOR as a digital reading room or as a movie room. Again, there were five potential responses to check, *no, not likely, unsure, probably, and yes*. The majority of responses on the Preliminary survey were *probably*, or *yes*. The results were positive with combined panel percentages ranging from 76% to 88% when the *probably* and *yes* responses were combined. The NLOR survey also generated positive, albeit slightly lower, responses with combined panel percentages ranging from
70.8% to 79.2% on the *probably* and *yes* responses when combined. Teachers were slightly more positive with a response rate of 77.8% to 88.9% on the combined *probably* and *yes* responses.

**Summary**

To complete the study it was necessary to assess an instance of the CAREO repository through a preliminary survey instrument; develop and implement an instance of a LOR based on the CAREO platform, the NLOR; and then assess the NLOR through a final survey instrument. Two populations were sampled in the study, a group of secondary students from NESS, and a group of teachers from the Nisga’a school district. The student sample consisted of participating students in three classes of secondary students. The teacher sample of the study was defined as the group of kindergarten to grade 12 teachers who participated in the assessment of a LOR instance, who participated in NLOR assessments, and who used the NLOR.

The student and teacher panels returned a total of 27 completed returns (20 students and seven teachers) for the preliminary survey, and for the NLOR survey a total of 25 returns (15 students and 10 teachers). All students and teachers were from NESS, with the exception of one teacher from Gitwinksilhkw Elementary School (GES). All members of the student panels were grade 10 to 12 students. All the teachers in the teacher panels taught grade eight to 12 with the exception of two teachers who taught kindergarten to grade three. As earlier noted, the student panels were drawn from two Information Technology classes and one CAPP class. Technical problems had delayed the development of the NLOR instance into a new semester and this meant that some
students who completed the assessment of the CAREO instance during the first semester were not in the same class during semester two. However, most of the students who participated in the assessment during semester one were present in one or two of the other semester two classes and therefore was able to continued their participation in the project. Two participating teachers did not hand in the Preliminary survey but completed the NLOR survey. Both student and teacher panels were asked to use the NLOR repository for learning or instructional purposes prior to their assessment.

Survey panels were positive about the NLOR resource and its role in education. Survey panels were given the opportunity to make additional comments while filling out the survey. In addition, respondents were given the opportunity to make concluding comments. Student responses to comment options were few. Teacher comments were generally positive and included helpful suggestions (see Tables 8 and 9). Other observations were noted in Table 10.

Four sets of questions looked at the integrity of the NLOR and its potential value within the instructional process. The SPSS© statistical program was then used to analyze the data collected. Frequency counts and percentages then described the findings. Finally, open-ended comments and observation followed. The first research section evaluated the LOR as a product with 11 questions. The overall assessment of both panels was positive. However, it was clear that the user interface needs some refinement, though some of the problems related to the client workstation, and not the LOR.
Table 8. Teacher Responses to Open Comments on Preliminary Survey

- Interface needs larger font, movement should be clearer, more spacing between lines needed, content was all right (this was a K-3 teacher).
- Categories should include SD newsletter, school based newsletters, and student created sites.
- Primary level topics should be included.
- This would be so awesome, hope this resource gets to us soon!
- Update the dinosaurs (older computers).
- Need a science video library, course outlines and notes.
- Need extensive/detailed topographic map information for hiking.
- This resource can be of great benefit to the people of the Nass Valley.
- Need physical education, geography topics, and Nisga’a political items such as land claims.
- Need a follow-up workshop.
- Interface not easy to understand, language needs to be clearer.
- Client computer in school not set up for viewing multimedia sites.
- Good idea! Need pictures of artefacts in three-dimensions and legends about the early Nass Valley.
- Need interviews with chiefs, matriarchs, elders and Nisga’a language programs.
Table 9. Teacher Responses to Open Comments on NLOR Survey

- Could not find things like Hoobiyee or related items. A lot of the Nisga’a pages I was unable to access. I would see the first page and then it would say error and cut me off (note: access concerns were later identified as client computer related).

- List of speakers and other resources would be helpful.

- Include special school performances.

- Classroom and teacher computers should be able to use the repository throughout the district.

- Download time may be a problem for some objects.

- More information about feasts and use of natural medicines.

- Need religious evolution from traditional to Christianity.

- Workshop on how to use resource required as soon as possible.

- Larger fonts, more articles, larger spacing needed. Excellent source.

- I want to be involved in this and a member.

- I see this site as an encyclopaedia of Nisga’a culture and other general topics.

- Need computer tutorials.

- See this as more historical, not current events.

- This is an exciting tool for use in many applications, but don’t use it to replace course learning or to distribute information for the government at any level.

- Focus needs to be defined and not spread out too much, at least not for the initial period.

- News and career related links needed.

- Access to computers with the appropriate plug-ins and software required to download or access the learning objects are required.
Table 10. Observations During the Development and Assessment of the LOR Technology

- The development of the LOR instance originally seemed technically straightforward. However, this turned out to be technically difficult and challenging. Install instructions were available from the CAREO site but the first install attempt failed. No administration manuals were available and much of the install processes were carried out through a process of trial and error.

- Many LOR users in the school had difficulty accessing the Internet and multimedia content. Many of these problems were traced to the client configuration or the lack of plug-ins in their browser. These problems were also noted on survey comments as above.

- Teaching is an extremely busy profession. Many teachers wished to participate in the project but had difficulty in finding the time, time which they would have to take away from students or marking.

- Two teachers wished to participate further in depth in the project, and requested that all their teaching resources be put on the LOR.

- Most teacher and student participants were secondary level. However, the few elementary level teachers that did participate, while positive, clearly showed that a different set of needs were present at that level.

- The Aloha metadata software installed worked well; however, a new version (Aloha II) has now been released. This version, if installed, may simplify the handling of learning objects and the creation of metadata.

- Learning Object content, other than metadata, was uploaded manually to the NLOR server. The CAREO software has an option to upload content. This may make it easier add objects to the LOR, but needs further refinement if this is to be used.

- Not all LO content formats worked when installed on the NLOR. It was found that LO content seemed to work best if first published to the Internet or converted to HTML format. Programs started through an index html file worked well.

- Errors in metadata affected the search function of the LOR. While much of this has been corrected as the project moved along, it needs to be further refined.

- Some teachers requested further training in how to use the resource.

- Some teachers noted that the NLOR could provide good safe sites for students.
The second research section evaluated the LOR as an Instructional Resource. This section had five parts that assessed LO categories, two open-ended questions related to categories, 12 potential LOR activities, and Reasons to Build a LOR. All the LO categories received high percentages as relevant, particularly those with Nisga’a culture or language. However, some categories were less popular than others, indicating a spread of opinions and needs. The assessment of 12 potential LOR activities also received positive responses and the teacher important responses ranged from a low of 70% to a high of 100%. Again, research and Nisga’a culture and language items received high positive responses with 100% of teachers responding important. The responses to the last part of this section, Reasons to Build the LOR, were equally positive. Teacher responses were 100% important for all reasons except for ability the to do independent learning, which was 90%.

The LOR as a Media Distribution System section asked 10 questions about the idea of using the LOR as a media distribution system. The responses yes and probably were high, especially by teachers. When those two responses were combined the response percentage for all questions in this section ranged from 60% to 100%. The LOR as a Future Resource section looked at three additional ways to enhance the quality of the LOR resource. Panels evaluated the idea of a Digital Reading Room, the use of Streaming Video, and the Movie Room. Again, these were positive, with the combined yes and probably responses from teachers ranging from 78 to 89%.

Concluding comments included the addition of object categories such as primary (early elementary) LOs, and improvement to the interface. Other topics included more LOR workshops and observations about the building of the LOR. Technical concerns
included the lack of instruction manuals, the need to update the ALOHA component of the LOR instance, and the difficulty in loading objects to the LOR.
Chapter 5

Conclusions, Implications, Recommendations, and Summary

This study addressed the need to provide access to cultural content by students and educators of School District 92 (Nisga’a). To complete the study it was necessary to assess an instance of the CAREO repository through a preliminary survey instrument; develop and implement an instance of a LOR based on the CAREO platform, the NLOR; and then assess the NLOR through a final survey instrument. In addition, the study examined the use of LOR technology as a viable, dynamic school resource.

Conclusions

The panels in this study indicated that their use of a LOR as a resource in the kindergarten to grade 12 (K-12) education sector was positive. The findings to the research questions generally scored in the positive range, particularly for the use and addition of more Nisga’a cultural and language Learning Objects (LOs). Specific conclusions and discussion, based on the questions driving the research, follow below:

How Will the Repository be Constructed?

The research question, how the LOR would be constructed, was illustrated with the successful creation of a workable LOR, the NLOR, based on the CAREO platform (http://commons.ucalgary.ca). The CAREO LOR platform integrates the functions of two separate components, a metadata management server called ALOHA (http://aloha.netera.ca) and the CAREO web application used as the repository interface.
The Nisga’a Learning Objects (NLOs) partly consisted of static LOs such as text and/or graphic materials that were converted to digital format using a scanner. It was found that accessing this material on the NLOR was best accomplished by using the Portable Document Format (pdf) accessible by an adobe® reader® (www.adobe.com). It was also found that the web based HyperText Transfer Protocol (HTTP) and related formats such as the Hyper-Text Markup Language (html) or eXtensible Markup Language (xml) appeared to work the best for all objects (www.w3.org/Protocols). Slideshows worked well when they were published to the Internet and converted to a web format such as html or xml.

Video presented another problem. Excessive video downloading may use up available bandwidth and affect other services. Therefore, rather than risk adverse affects to present student services video clips should be installed in consultation with the technical department. The conversion of older video clip formats and film stock presently in storage will require the use of older technology and the assistance of staff from a museum or university library who will have some experience in this.

The communications technology described by Hatala, Richards, Eap, and Willms, (2004) should receive serious consideration. This technology could join the NLOR with other LORs and would provide student and teacher access to other LORs on a pan Canadian grid through one access point. The web-based object management utility that was available on the NLOR could potentially be useful as a tool for teachers or even students to add LOs to the repository. As noted, this tool was not subjected to any examination or testing during the study but should be a good topic for a future project.
One can conclude, based on the experience of building the repository, that while some of the technology is unfamiliar to most technicians, the actual steps in constructing the repository is straightforward. When all the software and hardware is close at hand the construction of a CAREO should take less than a day. However, CAREO platform beginners contemplating constructing a repository should have access to clear and comprehensive instructions.

Depositing the learning objects was a different problem. The Aloha metadata client software, once configured, makes it relatively easy to write and save metadata. However, depending on the type, format, and use of the objects deposited this can also be complex and require careful documentation. Like that of the CAREO platform, a comprehensive ALOHA installation manual would be beneficial to those attempting to construct metadata server. Such a manual should also include references to metadata entry and issues with format compatibility.

*What Do the Teachers and Students Report About the Graphical User Interface?*

The NLOR Graphical User Interface (GUI) needs to be clear, easy to understand, and have instructions that provide the users with the ability to search and use the objects in the NLOR. To assess the user interface and to provide clues for improvement, student and teacher panels were asked to evaluate the LOR interfaces using the two surveys.

The overall evaluation of the user interface was positive with a teacher evaluation of more than 70% on the positive end of the scale. However, it was clear that there were areas of concern. The NLOR interface itself lacked color and a few of the objects did not work due to a program internal error, incorrectly entered metadata, or improper client workstation configuration. Improvements, such as better use of color, thumbnails aside
each object, links to other resources, might make the interface more efficient. As well, the minor technical issues noted in the study that affect the use of the resource need addressing. Suggestions made by the panel in addition to those already mentioned, included more information about the repository technology, the addition of direct links to other repositories, the use of larger fonts, simpler language for the lower grades, and clearer language. While there were areas of concern, the results of the panel surveys indicated that the user had a positive experience with the interface and therefore was more than adequate at this stage of development.

_How Reliable and Valid Are the Classification Standards and How Easily Can Teachers and Students Search the LOR?_

Hodge (2001) noted that metadata is _key_ to ensuring that the resource will _persist_ and be _relevant_ to the user. This may be particularly true in education where, as Friesen (2004) noted, the most difficult is the task of differentiating between different kinds or types of resources. One problem is that a resource that serves in one context might also be useful in another. One solution is the use of uniform metadata standards. Sonwalkar (2001) noted that it is uniform standards that enable the basis of universal use, reuse, and sharing of learning objects. A number of organizations, like the IEEE Learning Technology Standards Committee (LTSC), were created to resolve some of the problems and develop standards that enable learners or instructors to search, evaluate, acquire, and utilize LOs (http://ltsc.ieee.org). Evolving metadata standards include the Canadian Core Learning Metadata Application Profile (CanCore) (http://www.cancore.ca/about.html), the Instructional Management System (IMS) Meta Data (www.imsglobal.org), and the Dublin Core (www.dublincore.org).
The ALOHA metadata server and client applications enables the use of a number of learning object metadata (LOM) standards including IMS, the Dublin Core, and CANCORE. To address the research question, *how reliable and valid are the classification standards*, and to solve any potential problems with transferability and efficient search capability with the LOM in the educational context the CANCORE standard was chosen when entering the metadata. The CANCORE classification of the educational attributes of an object appeared to be useful when creating metadata. However, it was also clear that some improvement was desirable for the elementary level which appeared to need different elements than LOs for secondary or post secondary. A closer look at generating additional classification elements for elementary level may lead to improved search capability for that level.

The ALOHA client application used to enter the metadata made the entry of the metadata straightforward. None-the-less, minor errors were made entering the metadata. This was primarily caused by some unclear descriptions of the CANCORE elements and inexperience entering metadata. Errors were corrected as located. The installation of a new ALOHA version, ALOHA II, may resolve some of the metadata entry problems, albeit minor, as would the development of a comprehensive manual as earlier noted. In addition, it would appear that the use of only a few key metadata elements may simplify the process.

NLO metadata data is used by the search engine to find NLOs, and therefore the research questions, *how reliable and valid are the classification standards*, and *how easily can teachers and students search the LOR* are directly related. To assess the effectiveness of these descriptors and the search capability of the LOR and to address the
research question *how easily can teachers and students search the LOR*, the student and teacher panels were asked to determine the search capability quality by responding to the question *search capability when searching for LOs* on both the Preliminary and NLOR surveys. The Preliminary survey, as noted, indicated that student and teacher panels thought that the quality of the search capability was *average* to *good* with the highest number of responses by students *good* 45% and by teachers, *average* 42.9%. The responses by the panels on the NLOR survey were more positive and ranged from *average* to *excellent*. As indicated by the panels, the search capability worked well. However, searching also depends on the metadata entered about an object and the NLOR evaluation showed that more search references may be required in the metadata file for some of the objects.

*What Objects of the Nisga’a Culture Are Available, May be Digitized, and Will be Included in the Digital Repository?*

Porter, Curry, Muirhead, and Galan (2002) suggested that the development of LORs promises to make learning resources readily accessible to educators and learners, and the opportunity to reuse, or re-purpose, learning resources potentially brings further value to those learning resources. To assess these suggestions, the research question in the NLOR study asked, *what objects of the Nisga’a culture are available, may be digitized, and will be included in the digital repository.* The purpose of this question was to guide the selection of objects to include in the repository and for future reference. The NLOR contained a sample set of NLOs. Student and teacher panels were asked to evaluate the existing and potential categories of LOs in the classroom.
The panels were presented with 19 LO categories on the surveys with the option to fill in three additional types of objects. The responses of both panels on the Preliminary Survey were generally positive, with the relevant responses ranging from 33.3% (NLG annual reports) to 70.4% (Nisga’a cultural items) for the combined teacher and student panels. Cultural related categories were most often marked relevant and teachers were more likely to mark a relevant response.

Teacher and student responses for the same set of questions on the NLOR survey varied with a high number of student responses in the no opinion category. The percentage of relevant responses ranged from 36% to 76% and seven categories were rated less than 50% relevant by the combined panels. However, teachers were more positive (see Figure 4) with relevant responses for all the categories ranging from 50% to 90%. One can therefore conclude that while there was some difference of opinion on value of some of the objects deposited in the NLOR, more than 90% of users thought that Nisga’a culture and language objects should be included.

It should be possible to install any object to the repository and make it accessible by clients with the proper workstation configuration. The panels, as noted, clearly indicated that Nisga’a cultural and language objects were important. User preference should be an important factor when deciding what objects are suitable. As well, all objects bear scrutiny for appropriateness and copyright issues. As such, policies and procedures for approval of learning objects on the NLOR require development and implementation. Some Nisga’a objects, such as songs, may require the permission of the house (or Wilp) to which the song belongs. In the case of current school district objects, such permission has already been obtained for the use of the school district.
Figure 4. Relevant learning object categories: Teacher responses on the NLOR survey shown in percentages (n=10).
What Are the Uses of LOs in the Classroom?

To assess how LOs in the NLOR should be used the panels were asked to complete the surveys and assess twelve potential uses. There were three potential responses to check, not important, no opinion, and important. The responses on the preliminary survey were all positive with the percentage for important responses ranging from 50% to 100% for the combined teacher and student panels. The same set of questions on the NLOR survey solicited responses after individual assessments of the NLOR. Student and teacher responses were both positive with the percentage of important responses ranging from 52% to 92%. Teachers were particularly positive with important responses ranging from 70% to 100% (see Figure 5). The uses, using the LOR for studying Nisga’a history, culture, and language, gathered the highest important responses, with a 100% response by teachers. The panels clearly indicated that while the other uses were important, the use of the repository for Nisga’a history, culture, and language were paramount in the minds of the user.

How Would Teachers Incorporate the LOs into the Curriculum?

To address the research question, how would teachers incorporate the LOs into the curriculum, the teacher and student panels were asked to use the NLOR resource as part of their normal instructional or learning activities, including incorporating the NLOR into teacher lessons where possible. One of the ideas of LOR use within the classroom was to make resources available to users at one location, thus easing the development of lessons and improving the quality of the instruction. The LOR would include resources that are now ordinarily available elsewhere and new LOs that would be available because of the LOR. However, the study was not able to adequately assess whether the use of the
Figure 5. *Important* Learning Object uses: Teacher responses on the NLOR survey shown in percentages (n=10).
resource extended beyond the confines of evaluation and assessment using the survey instruments due to the brevity of the project timeline and the relatively low number of LOs in the repository at the time.

To provide a snapshot of potential LOR uses by students and teachers the panels were asked to give responses on the preliminary and NLOR surveys for five reasons to use the repository. These were; ready access to information, the ability to re-use and create new resources, the ability to do independent learning, the ability to see or hear information that would not otherwise be available, and the ability to access resources via the computer. There were three response options, not important, no opinion, and important. The majority of both panels on the Preliminary Survey assessed all the reasons as important. The percentages of the important responses for all the reasons ranged from a low of 63% to a high of 100%.

Similarly, the majority of responses by both panels on the NLOR Survey assessed all the reasons as important, with the exception of the reason, ability to access resources via the computer, which the majority of students assessed as no opinion at 53.3%, followed by important at 46.7%. The important responses for all the reasons by the student panel ranged from a low of 46.7% to a high of 80%. However, 100% of the teacher panel rated all the reasons important with the exception of the ability to do independent learning, which obtained a 90% response.

The ability to access Nisga’a culture and language learning objects was rated very high by the panels throughout the survey and it was clear that this was perhaps the most important attribute of the NLOR. Having easier access to this resource should impact the Nisga’a studies and cultural programs in the school by making new and old content
readily available. High scores were also evident for other LOR attributes such as *ready access to information* and the *ability to do independent learning*. While it appears that ready access to more relevant information tailored to the audience would impact the general learning environment in a positive way, a definitive answer would require more research.

Some teachers expressed an interest in adding all their instructional resources to the NLOR. If this happens, the instruction and learning in that classroom would move towards a greater multimedia environment. However, while the survey results are positive, they were not conclusive and more research in classrooms using a majority of their resources on the LOR should draw better statistical conclusions on this topic.

The panels also noted that easier access to good safe links and online content for research and other learning activities make it an efficient learning tool for students and teacher instruction. Greater access to multimedia content using a computer is apparent and Nisga’a cultural and language objects were favored.

*How Could the LOR be Enhanced in Future Versions?*

*How could the LOR be enhanced in future versions,* was the final research question. One of the objectives of this study was to look at different ways to use the LOR technology in the school setting. Four additional aspects of LOR use that were not commonly contemplated in the literature were the use of the LOR as a *multimedia distribution system,* enhancing the interface to represent a *reading room,* a *movie room,* and the use of *streaming video.* To explore the potential use of the LOR as a *multimedia distribution system,* the panels were presented with ten reasons to use the LOR in this manner. There were five potential responses to check, *no, not likely, unsure, probably,*
and yes. The majority of responses on the Preliminary survey were probably or yes, with a few exceptions. While both panels in this survey thought that a LOR would be easier to use than the present system, they were unsure whether the LOR used as a Media Distribution System, would be less expensive with students responding not likely (11.1%), unsure (50%), probably (27.8%), yes (11.1%), and with teachers responding no (14.3%), unsure (42.9%), probably (14.3%), and yes (28.6%).

The majority of responses to this section in the NLOR survey were also probably or yes, with a few exceptions (see Figure 6). The teacher panel thought that the NLOR would be easier to use than the present system. Both panels on this survey were sure that the LOR used as a Media Distribution System, would be less expensive with students responding not likely (20%), unsure (33.3%), probably (40%), and yes (6.7%), and teachers responding unsure (30%), probably (20%), and yes (50%) for this question.

It would appear that the replacement of the traditional media equipment (television and video players) with computer access to a LOR and a projector maybe more efficient. A single access point would eliminate the need for manual handling of the media and other student and teacher resources. On-demand access to various resources by teachers and students would significantly impact the teaching and learning paradigm. Loading all the multimedia instructional resources used by a few teachers and their students, and testing their use over a time would confirm this conclusion.

To explore the potential use of the LOR for the remaining three potential future improvements to the LOR, enhancing the interface to represent a reading room, a movie room, and the use of streaming video, the panels were presented with one question about
Figure 6. Using the NJOR as a media distribution system would: Combined *Probably* and *Yes* teacher responses on the NJOR survey shown in percentages (n=10).
the potential use for each of the remaining suggestions. Again, there were five
potential responses to check, *no, not likely, unsure, probably,* and *yes.* The majority of
responses on the Preliminary survey were *probably,* or *yes.* The results were very positive
with combined panel percentages ranging from 76% to 88% when the *probably* and *yes*
responses were combined. The NLOR survey also generated positive, albeit slightly
lower, responses with combined panel percentages ranging from 70.8% to 79.2% on the
*probably* and *yes* responses when combined. Teachers were slightly more positive with a
response rate of 77.8% to 88.9% on the combined *probably* and *yes* responses.

Technically, there does not seem to be anything stopping the addition of movies,
to the NLOR, other than the lack of broadband capability and the capacity of
workstations receiving the signal, and it would appear that LOR technology use as a
media delivery system is feasible. The panels favorably assessed the idea of a movie
room, the use of streaming video, and a reading room. A redesign of the interface as a
reading or movie room would be more user friendly, either as a separate repository, or as
separate interfaces with access to movies or text content that reside in the main
repository.

**Implications**

The study illustrated that the use of LOR technology by students and teachers has
a great number of advantages for the learning environment, particularly for Nisga’a
culture. The LOR technology has shown it has the ability to make Nisga’a cultural and
language objects available; and has the potential to incorporate many more Nisga’a
objects which are now stored in a non-digital form. This is particularly important as those
objects would not otherwise be readily available; and the ready availability of these objects will be significant in the maintenance and enhancement of the Nisga’a language and culture curriculum program in the school district. A rewrite of the lessons plans and curriculum materials around access to the repository would significantly enhance the quality of instructions by increasing the amount and quality of the material available to the students and teachers for both Nisga’a objects and non-Nisga’a objects. Access to the repository could also be made available to the general Nisga’a public and provide the opportunity for life long learning for the Nisga’a people, many of whom have been away from their culture for many years. Likewise, Nisga’a, who now reside far away from their culture could also benefit. Significantly, the availability of a Nisga’a Learning Objects Repository will be an important asset in the maintenance and revitalization of the Nisga’a language and culture.

The results also show that use of LOR technology as a viable, dynamic school resource has significant merit with possible broad impact on teaching and learning. It moves instruction and learning towards a more multimedia dependent environment and has the potential to act as a multi-resource portal for many of the resources available to students and teachers. The panels indicated that the use of LOR technology as a media distribution system has significant merit and could be further examined with a view to implementation. The panels also indicated that the idea of expanded uses of LOR technology, such as streaming video, a movie room, and a reading room has merit. Overall, one would envision a maturing of the technology for the benefit of a learning environment built for students and teachers.
This study has been a necessary stage in the implementation of LOR technology in K-12 classrooms. While the study will significantly impact the use and availability of Nisga’a objects and non-Nisga’a objects, other stages should follow. The use of the technology in this school district needs to widen and additional research would be helpful to lay the foundation for a broadening of LOR use in the classroom, for both Nisga’a and non-Nisga’a objects. The study clearly showed that the potential for this technology to influence the paradigm of instruction using repository technology is apparent and should be discussed in further work. Vogel and Klassen (2001) noted that education faces a broad range of challenges with shifts in technology, paradigms, and resources for learning. The results of this study would indicate that the introduction of LOR technology is one of those challenges.

Recommendations

The NLOR project has the support of the school district, and many of the teachers. The project will go ahead in its present form, adding objects when possible. The potential of the technology depends on the further development and use of the technology. To capitalize on this potential a number of recommendations can be made in four areas; the broadening and increased use of the LOR in the classroom, the refinement and implementation of the LOR technology, the use of LOR technology as a media distribution system, and the future use of the LOR in the classroom.

*The Broadening and Increased Use of the LOR in the Classroom*

The success of the LOR resource depends largely on the quality of the resource. The panels gave support for the LOR project, made suggestions for improvements, and
suggested the addition of more objects, in particular Nisga’a culture and language objects. There is now a need to plan and implement projects to improve the LOR project.

These projects could include:

- Improvements to the present NLOR interface with the addition of more color, improvements in the metadata scripts, addition of thumbnails, addition of links, the addition of more graphics, easier upload of objects, greater user interaction with the NLOR administrator, and the elimination of the few errors generated when using the technology.
- Plan and develop a project to update the NLOR with the newer ALOHA II metadata server and client software.
- Further prepare existing Nisga’a culture and language objects and load them on to the NLOR. For much of this material, this will mean reformatting or scanning the content in preparation for uploading the content to the NLOR.
- Plan and prepare teacher workshops in the use of LOR technology in the classroom.
- Prepare a test project with two teachers incorporating all instructional resources for their curriculum needs on the LOR.

The Refinement of and Implementation of the LOR Technology

The installation, implementation, and use of the LOR technology was a complex task, not just because the process itself was complex, but because the lack of support reduced the project to a trial and error process. A comprehensive illustrated installation or administration manual would likely have made the project advance more quickly. The development of such manuals would greatly assist the LOR administrator and any other institution contemplating installing a LOR instance. The use of metadata needs to be revisited and the updated version of ALOHA, ALOHA II, may serve to improve the functions of both the client ALOHA application and the NLOR instance. The use of communications technology that joins other LORs to the NLOR may increase the utility of the repository. As well, the development of a turn-key system for distribution to other
organizations merits investigation as a potential project the might benefit other school districts.

*The Use of LOR Technology as a Media Distribution System*

The panel indicated that the use of LOR technology as a media distribution system would be a positive development. A number of teachers in the panel indicated an interest in installing all their resources onto the NLOR. The development of a case study of two teachers who will maximize NLOR use as a repository and as a media distribution system in the classroom would add to the literature and verify the panel’s conclusions.

*The Future Use of the LOR in the Classroom*

The study also suggested that the potential of the resource goes beyond the basic use of the interface as it is now. Suggested improvements include the use of the NLOR as an educational portal, the development of a movie room, the use of streaming video, and the development of the reading room. All of these improvements are meaningful projects, particularly after the use of the basic interface has had a chance to mature into a common learning tool.

*Summary*

The problem identified for the study was that the Nisga’a culture is at risk and that school children did not have access to important cultural and heritage objects now in storage. Although many objects have been preserved and experiences captured in many different forms, they were not readily available for use in the schools. The goal of the study was to create a Learning Object Repository (LOR), the Nisga’a Learning Object Repository (NLOR), and to evaluate it as a viable, dynamic school resource. Once the
product was assessed as valid and reliable, its potential as a classroom tools was to be explored.

The Nisga’a Language and Culture Department of the Nisga’a School District have for more than two decades amassed a large quantity of culturally-based learning materials in various media, including paper, audio tapes, computer files (in various formats), laserdiscs, hard drives, and video and film stock. Much of this material has not been readily available to educators or students and converting all the resources to standardized digital formats stored in a repository would enable the access and use of these materials as learning objects. Due to the availability of existing media material, the school district was an ideal location to establish and develop a local LOR, the NLOR.

Porter, Curry, Muirhead, and Galan (2002) noted that the use of information technologies to develop and manage new learning resources, to access and use learning content from a wide variety of academic and published sources has permanently changed the academic and learning environment. Porter et al. also identified a number of issues and barriers related to the development of LOR projects within Canada. The primary focus of projects to-date had been the development of infrastructure and there was a need for identification of easy-to-use LOR tools. There was also a need for automated systems for metadata creation in order to ease the burden for individuals or groups that seek to store large collections of objects. As well, Porter et al. noted that LOR project leaders had cited the need to expand their work to actual communities of practice, and that there was an increased need to focus on training and skill development in those communities. Most repository projects to-date had focused on the academic community, and given the need
for increased focus on workplace uses of LORs, constructing and using the NLOR would seem to fit that profile.

To complete the study it was necessary to assess an instance of the CAREO repository through a preliminary survey instrument; develop and implement an instance of a LOR based on the CAREO platform, the NLOR; and then assess the NLOR through a final survey instrument. The preliminary survey was used to evaluate three existing LORs; the National Science Digital Library at www.nsdl.org/collections, the University of Calgary Learning Commons at http://careo.ucalgary.ca/, and the Resource Pool hosted by the Peace River North School District (PRN) at http://careo.prn.bc.ca/. The questions on the preliminary and NLOR surveys were identical.

A workable LOR, the NLOR, was successfully installed based on the CAREO platform (http://commons.ucalgary.ca). The CAREO LOR platform integrates the functions of two separate components, a metadata management server called ALOHA (http://aloha.netera.ca) and the CAREO web application used as the repository interface. With the NLOR online, the metadata could be manually entered into a MYSQL (http://www.mysql.com) database using the ALOHA client software, followed by the copying of the LOs to the NLOR server as required. The rapid prototyping (RP) methodology was used to construct the NLOR prototype repository with concurrent processes using the traditional phases of Analysis, Design, Development, Implementation, and Evaluation (ADDIE), as suggested by Jones and Richey (2000). The installation, implementation, and use of the LOR technology was a complex task, not just because the process itself was complex, but because the lack of support reduced the project to a trial and error process. A comprehensive illustrated installation or
administration manual would likely have made the project advance more quickly. The development of such manuals would greatly assist the LOR administrator and any other institution contemplating installing a LOR instance.

The study sampled two populations, a group of secondary students from NESS and a group of teachers from the Nisga’a school district. The student sample consisted of participating students in three classes of secondary students. The teacher sample of the study was defined as the group of kindergarten to grade 12 teachers who participated in the assessment of a CAREO instance, participated in NLOR assessments, and who used the NLOR.

Four sets of questions looked at the integrity of the LOR and its potential value within the instructional process. The student and teacher panels assessed the LOR resources within the parameters of the research questions using the Preliminary and NLOR survey instruments. The SPSS© statistical program was then used to analyze the data collected. Frequency counts and percentages then described the findings. Finally, open-ended comments and observation followed.

The first research section evaluated the LOR as a product with 11 questions. The overall assessment of both panels was positive. However, it was clear that the user interface needs some refinement, though some of the problems were related to the client workstation and not the LOR. The second research section evaluated the LOR as an Instructional Resource. This section had five parts that assessed LO categories, two open-ended questions related to categories, 12 potential LOR activities, and Reasons to Build a LOR. All the categories received high percentages as relevant, particularly those with Nisga’a culture or language. However, some categories were less popular than others,
indicating a spread of opinions and needs. Nisga’a culture and language items received high positive responses with 100% of teachers responding important. The response to the Reasons to Build the LOR section was equally positive. Teacher responses were 100% important for all reasons except for the ability to do independent learning, which was 90%.

The LOR as a Media Distribution System section asked 10 questions about the idea of using the LOR as a media distribution system. The responses yes and probably were high, especially by teachers. When those two responses were combined the response percentage for all questions in this section ranged from 60% to 100%. The LOR as a Future Resource section looked at three additional ways to enhance the quality of the LOR resource. Panels evaluated the idea of a Digital Reading Room, the use of Streaming Video, and the Movie Room. Again, these were positive, with the combined yes and probably responses from teachers ranging from 78 to 89%.

It was apparent that the use of LOR technology by students and teachers has a great number of advantages for the learning environment. The potential of the technology depends on the further development and use of the technology. To capitalize on this potential a number of recommendations was made in four areas, improvement in the LOR interface for use in the classroom, refinement, and implementation of the LOR technology, the use of LOR technology as a media distribution system, and the future broadening and increased use of the LOR in the classroom. The LOR technology has shown it has the ability to make Nisga’a cultural and language objects available; and has the potential to incorporate many more Nisga’a objects which are now stored in a non-digital form. The study successfully demonstrated the building of a digital object

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
repository and that the technology has the ability to preserve cultural objects. One can also conclude that the use of LOR technology as a viable, dynamic school resource has merit. It moves instruction and learning towards a more multimedia dependent environment and has the potential to act as a multi-resource portal for many of the resources available to students and teachers.

A number of teachers in the panel indicated an interest in installing all their resources onto the NLOR. The development of a case study of two teachers who will maximize NLOR use as a repository and as a media distribution system in the classroom would add to the literature and verify the panel’s conclusions. Other suggested improvements include the use of the NLOR as an educational portal, the development of a movie room, the use of streaming video, and the development of the reading room. All of these improvements are meaningful projects, coupled with better training, a number of showcase projects, and better instructional manuals, will provide the means for the technology to mature into a common learning tool.

The construction of a repository for the use of Nisga’a language, history, and culture is a significant step in the maintenance and promotion of Nisga’a educational programs in all the schools of the district. Further, access to the NLOR by the Nisga’a community will have significant impact on lifelong learning by providing access to cultural information to Nisga’a in the communities, and to those who live away from their culture.

This study has been a necessary, albeit positive, stage in the implementation of LOR technology in kindergarten to grade 12 classrooms. However, other stages need to follow. The use of the technology in this school district needs to widen. Additional
research would be helpful to lay the foundation for a broadening of LOR use in the classroom. The potential to influence the paradigm of instruction using technology is apparent. Vogel and Klassen (2001) noted that education faces a broad range of challenges with shifts in technology, paradigms, and resources for learning. The results of this study would indicate that the introduction of LOR technology is one of those challenges.
Appendixes

A. Survey Instrument Introductory Letter
B. NLOR Survey
C. Letter of Permission from School District 92(Nisga’a)
Appendix A

Nisga’a Learning Objects Repository Project Survey
PO Box 239, New Aiyansh, V0J 1A0 Phone 250-633-2225 Fax 250-633-2669
Email: dhansen@nismaa.bc.ca

Introduction
Thank you for agreeing to participate in this survey. The surveys are intended to assess the Nisga’a Learning Object Repository (NisLOR) project, to be used as a planning instrument, and to provide a forum for recommendations, improvements, and future Learning Object Repository (LOR) use by students and educators at Nisga’a Elementary Secondary School and other schools in the school district. In addition, the information can be used in the development of LORs in school districts elsewhere. The survey is completely confidential and no names should appear on the survey form. There will be two surveys to complete, a pre-treatment and a post-treatment survey. The Pre-treatment survey will form the basis of a needs assessment and an evaluation of current LORs and assess potential uses in the Elementary and Secondary School System. The Post-treatment survey will assess the Nisga’a Learning Objects Repository and its uses in the Elementary and Secondary School System.

Participants should refer to the information about LORs on the following page before completing the survey. Training and orientation sessions will be available for users before completing the pre-treatment survey.

Please note that school or school district learning materials loaded onto the repository may not be shared outside the school district without the express permission of the Board of Trustees of School District 92 (Nisga’a). Access to the repository may be restricted to students and staff with school district web accounts and passwords.

Any questions about this project or the use of the Nisga’a LOR should be directed to Mr. Ken Hansen, based at Nisga’a Elementary Secondary School. Phone 250-633-2225, home at 250-633-2943, or email at dhansen@nismaa.bc.ca.

Again, thank you for participating in this project.

Ken Hansen, Ed.S., M.Ed.
Learning Object Repositories Information Sheet

Learning Object Repositories have been defined as digital storerooms for learning objects, while learning objects are defined as any entity used for learning, education, or training. For some, Learning Object Repositories are really Digital Libraries containing organized collections of information, including text, video, and audio, along with methods for access, retrieval, selection, organization, and maintenance of the collection.

The Purpose of Learning Object Repositories

The development of LORs promises to make learning resources readily accessible to educators and learners. The opportunity to reuse, or re-purpose learning resources potentially brings further value to those learning resources. The development of Educational LOR prototypes are prerequisites to making resources available online. Once an LOR has been developed, users (teachers and students) and developers can access existing learning material, and in some cases re-purpose the learning object. Re-purposed or changed objects can be re-stored on the repository as new objects.

A LOR can be seen as a media distribution system that could eventually eliminate the need for slides, tapes or CD media. The learning objects (digital resources) concerned might be in the form of video, printed matter, or pictures converted to an electronic format. Once the objects are moved to the repository users may access and incorporate them in a paper, a presentation, or a lesson. The repository technology enables users to use computers to create and store media resources to the repository, after which users (teachers or students) can then use the resources to store locally, project video, text, or pictures through a television or projector. Users can also watch lessons independently on a computer, or send text to a printer. This could eliminate the need for a VCR, or a manual overhead projector, or a slide projector, or plastic slides, or similar equipment. Users could essentially need a computer, access to the resource, and a means to deliver the information (e-mail, projector, television, printer). In effect, the information (including video) would all be delivered electronically by using the mouse and the keyboard (no more moving trolleys from classroom to classroom).

Here are some examples students using the LOR:

* Student conducting a research paper on the Nisga'a treaty might access the electronic form of the treaty and use it as a resource/reference.
* Student conducting research on a Nisga'a topic might access pictures and incorporate the picture into his/her presentation or essay.
* Student developing a slide show presentation incorporates pictures and a video clip into the presentation.

Nisga'a Learning Objects Repository Project
PO Box 205, New Aunash, British Columbia V0J 1AO • (506) 693-2225
Fax (506) 693-2245 • email library@nisaacvbrb.on.ca Website www.nisgaap.sca.ca

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
Examples of Students and Teachers using a Learning Object Repository

- Locate Pictures
- Conduct Research
- Watch Videos

- Create slideshow or video
- Get Course Outlines
- Teach a lesson
- Save curriculum material to repository

Student

- Make a Presentation

Learning Object Repository

Teacher

- Show a video
- Get Lessons for course

NOVA SOUTHEASTERN UNIVERSITY
Graduate School of Computer and Information Sciences
Kim Harara, B.S., M.Ed.
Doctoral Candidate

Nega's Learning Objects Repository Project
PO Box 255-5 New Approach, British Columbia, V8T 1A9, (250) 637-2215
Fax: (250) 637-2233; email: phmc@nera.com Web site: www.nera.com
Here are some examples of teachers using the LOR:

- The art teacher uses video clips and pictures to introduce carving techniques to senior carving students.
- A teacher incorporates a video clip into a lesson about making cedar bark baskets and other bark utensils.
- A music teacher incorporates a video clip illustrating Nisga'a musical instruments into his/her lesson.
- A teacher incorporates a multimedia Nisga'a Lisims annual report into his/her lesson on local government.
- A new teacher downloads a course outline (or unit assignments) and uses a word processor to change it to accommodate his/her class.
- Nisga'a language and culture developer accesses and downloads a series ofmpeg2 video clips and incorporates them into a new video about the history of the four main villages. He/she then uploads the new video onto the LOR for student and teacher use.
- A Nisga'a language and culture teacher accesses and downloads a video clip about a Nisga'a wedding to use as part of a lesson.
- A NENS based SFU literacy project video clip is downloaded for teacher viewing as part of a professional development workshop.
Appendix B

Survey Instrument

NOVA SOUTHEASTERN UNIVERSITY
Graduate School of Computer and Information Sciences

Nisga’a Learning Object Repository Survey
Box 239, New Aiyansh, BC V0J 1A0
Phone 250-633-2233 Fax 250-633-2669 Email khansell@nisga.ca

Instructions for NLOR Evaluation Survey
The purpose of the post-treatment survey is to assess the Nisga’a Learning Object Repository. It is assumed that you have accessed and used the repository over the last few months.

Section I refers to the Nisga’a Learning Repository found at www.nisga.ca. You may wish to access this resource as the survey is completed. Section II relates repositories as an instructional resource, and Section III relates to proposed uses of repositories. Section IV will ask you the number of times you have used the repository. If you are completing this survey in a classroom please feel free to ask the researcher for clarification of any aspect of the survey as you are completing it. The time required for the survey will depend on the level of computer literacy. In most cases the survey will be completed in less than half an hour. If you are completing the survey independently and clarification is required, please send an e-mail to khansell@nisga.ca leaving your phone number if necessary. E-mail and messages will be checked daily. Most of all enjoy the experience.

Tell us about yourself (circle the appropriate answer)

I am a: student teacher teacher assistant administrator
Other (state)____________

I am mainly located at: NESS NBES GES LES
Board Office Other ________

I consider my knowledge and use of computer technology as:

1 excellent 2 good 3 average 4 adequate 5 poor

I am a: Student ___ Staff (teacher or administrator) ___

Grade level(s): K 1 2 3 4 5 6 7 8 9 10 12 University yr1 yr2
I. The LOR as a product
This portion of the survey provides information about the Nisga'a Learning Objects Repository resource as it is today.

**User Interface**
Please evaluate and indicate the best answer regarding the following aspect of the user interface.

<table>
<thead>
<tr>
<th>Please circle the best answer from 1 to 5.</th>
<th>1 poor</th>
<th>2 adequate</th>
<th>3 average</th>
<th>4 good</th>
<th>5 excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Instructions for independent use were</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Clarity of the page layouts were</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. The smooth and logical organization of the access software and web pages were</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. The use of clear, accurate, and concise Language were</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. The fonts and general readability of text were</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Search capability when looking for learning objects were</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. The effective use of colour in the interface were</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Ability to access the learning object of interest were</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Variety of available learning objects were</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. The available links to other repositories or Teacher Resources were</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Overall evaluation of the user interface were</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Do you have any other comments about user interface (use back if necessary)?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
II. The Learning Object Repository as an instructional resource
Recommendations for improvement or usability

1. The Niisga’a Learning Repository will have a sample set of learning objects. Please indicate with an X, or check mark, whether you find the following categories relevant, not relevant, no opinion in your learning or instructional environment.

<table>
<thead>
<tr>
<th>Learning Object Categories</th>
<th>not relevant</th>
<th>no opinion</th>
<th>relevant</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Pictures of people and events</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Pictures of artefacts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Text of cultural stories</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. School yearbooks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. NLG annual reports</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Newsletters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Copies of Windsong</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Video clips of cultural events</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>t. Pictures of cultural events</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>j. Video clips of community events</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Science topics/activities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. Social Studies topics/activities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>g. Math topics/activities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>h. English topics/activities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i. History topics/activities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>j. Literacy topics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>k. Niisga’a cultural items</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>l. Course Outlines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>m. Audio clips</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n. Other</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o. Other</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>p. Other</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. What other categories do you think would be useful to you, if any?

3. Do you have any other comments about learning objects that should be available to you?
4. Uses of Learning Objects. Please indicate with an X, or check mark, whether you find the following repository activities important, no opinion, or not important for your learning or instructional environment.

<table>
<thead>
<tr>
<th>Learning Object Uses</th>
<th>not important</th>
<th>no opinion</th>
<th>important</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Research information access</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Making slideshow presentations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Creating video clips</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Presenting a lesson</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Reading a story</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. Watching a video clip</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>g. Getting pictures for research</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>h. Developing new objects for later use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i. Enhancing objects and create new ones</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>j. Studying Niqga’a history</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>k. Studying Niqga’a culture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>l. Studying Niqga’a language</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>m. Other</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n. Other</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>o. Other</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. Of the following reasons to build a repository, indicate how important they might be to enhance your learning environment.

<table>
<thead>
<tr>
<th>Reasons to use the repository</th>
<th>not important</th>
<th>no opinion</th>
<th>important</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Ready access to information</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. The ability to re-use a resource and create new ones</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. The ability to do independent learning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. The ability to see or hear cultural items that would otherwise not be available</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. The ability to access resources via the computer</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
III. The LOR as a Media Distribution System

Assessing LOR technology as a Media Distribution System.

Keeping in mind that new LOR web pages would be added to allow easier use as a media distribution system, please circle the best answer to the questions below on the scale from one to five.

Using the LOR as a Media Distribution System would:

<table>
<thead>
<tr>
<th>Question</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Be easier to use than the present system?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Increase the use of multimedia for learning?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Be less expensive than the manual system?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Save preparation time for teachers?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Enhance the ability of students to conduct independent study?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Save study time for students?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Enhance the learning environment of students?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Enhance the working environment of teachers?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Enhance the quality of instruction?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Enhance the quality of learning?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

III. Enhancing the quality of the Resource

Making the resource user-friendly and easier to use is an important objective. The following examples are three ways in which this resource may be further enhanced. Please assess each and answer the question that follows.

Naga’s Learning Objects Repository Project
FO Box 2194, New Haven, CT 06510-2194, USA, (203) 693-7025
Fax: (203) 693-7015, e-mail: Naga@NewHaven.edu, Web site: www.naga.edu
NOVA SOUTHEASTERN UNIVERSITY
Graduate School of Computer and Information Sciences
Kim A. Rineon, Ed.S., M.Ed.
Doctoral Candidate

A. The Digital Reading Room
The Digital Reading Room found at Athabasca University is an example where students and teachers may browse and read text-based documents. The addition of a reading room to the LOR resource would contain text-based resources. An incomplete example can be found at http://library.athabascau.ca/drr/.

Please circle the best answer. 1 no 2 not likely 3 unsure 4 probably 5 yes
1. Do you think that a digital reading room would enhance the learning environment? 1 2 3 4 5

B. Streaming Video
Large video clips consume great amounts of hard drive space and take a long to download. Streaming video allows video and audio to be sent (streamed) over a network or Internet without having to download to the receiving computer first as often is the case. With streaming video, video can be streamed live, on demand, or broadcast live events. User would see the video in much the same way they would with the video saved on a hard drive.

Please circle the best answer. 1 no 2 not likely 3 unsure 4 probably 5 yes
1. Do you think that streaming video capability would enhance the learning environment? 1 2 3 4 5

C. The Movie Room
Similar to the reading room above, the concept of the video room is to provide a space on a web page to search for and watch various video material.

Please circle the best answer. 1 no 2 not likely 3 unsure 4 probably 5 yes
1. Do you think that a movie room would enhance the learning environment? 1 2 3 4 5

Thank you for your assistance in evaluating this potential resource.

Do you have any concluding comments you would like to make about this potential resource.

__________________________

Nisga’a Learning Objects Repository Project
PO Box 239 • New Aiyansh, BC V0J 1A0 • (250) 830-3325
Fax (250) 267-3845 • email: kamine@nisga.ca Web site: www.nisga.ca
Appendix C

Letter of Permission

March 1, 2003

Kim Hansen
General Delivery.
New Ayushm, 2C
W.U 1A0

Dear Kim,

The board has approved your project and wishes you well in your studies.

You are requested to work closely with Mr. Rob Walsh and Mr. David Griffin. The Board of Trustees understands this collection will be for the use of the Niiga School District. Finally, you will need board approval to share this information with other institutions, agencies or school districts.

Sincerely yours,

Patrick A. Mocare
Superintendent of Schools

P.S. (cc)

Trustees - S.D. No. 92 (Niiga)
Reference List


