Traveler's Guide to the Learning Object Landscape

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FOREWORD

When we began our journey into the world of learning objects, we had no idea that the landscape would prove to be so rich and detailed. Hundreds of articles on the subject have been written in just the past few years, and virtually every developed country has a list of organizations either engaged in learning object development or in the distribution of objects or information about objects. The list of important projects expands daily.

Given the complexity of the learning object landscape, the metaphor behind the title of this report is apt. Try as we may, given the numbers of people and organizations working in the areas of elearning and learning objects and the hundreds of articles, chapters, and other documents written on the topic, a report such as this can provide only a glimpse into that landscape.

We took the approach of trying to assemble not a definitive report, but rather a handy guide that could serve as an introduction to policy makers and others interested in learning objects. In the same way that you might choose a guide to help you plan a trip or to make your way around a foreign country, we hope this guide will provide you enough information to gain a sense of the landscape and culture of the learning object world. And just as a real traveler's guide does not attempt to list every restaurant, destination, or monument, we have chosen only a selection of key articles, organizations, and projects to describe here. The summaries are brief by design, and the articles and organizations carefully chosen knowing that each one included meant others would have to be left out.

A note about how we approached the selection of books, chapters, and articles to summarize: In some cases, articles have been included because they are particularly well-written or succinct. In other cases, we looked for the articles that seemed to focus most clearly on learning objects as opposed to the more general category of elearning. In almost every case, the articles that we chose to summarize have been referenced over and over in the literature. And in every case, we looked for work that could apply as easily to education as it could to government, or to the corporate world. Hundreds of articles were reviewed for inclusion here, and many of them are included in an additional reading list provided at the end of the report.

Just as you would look to a real traveler's guide to give you the overview of a city, whet your appetite for exploration, and most importantly help you make choices about what to do or visit in person, we have designed our descriptions to help you quickly decide the relevance of each listing for your needs. Internet links at the end of each summary of an article will whisk you to the full text if you desire to dig deeper. Similarly, links follow each description of an organization or project that you can follow for much more detailed information.

We will be updating this work from time to time on the NMC website's area on learning objects. If you see a need for a correction, or if you know of important projects or articles you'd like to see included on the web site or in a future edition, please don't hesitate to let us know. You can reach us at travelersguide@nmc.net.

E-LEARNING AND LEARNING OBJECTS

There is no shortage of written work on learning objects. Literally hundreds of articles and papers have been produced for print or the web that focus on learning objects, learning object standards, learning object repositories, learning object pedagogy, or the need for an learning object economy. The three key papers summarized here will acquaint the reader with each of these dimensions, and together provide an excellent overview of the field. Each piece has proven very influential in the development of the thought and practice of learning objects, and each has been cited many times over. Links at the end of each summary will take you to the full text of the article.

Into the Future: A Vision Paper
Wayne Hodgins
Written for the Commission on Technology and Adult Learning, Wayne Hodgins paints a futuristic picture of technology, adult education, and what he terms "learnativity." According to Hodgins, the direction of technology, the knowledge needs of society, and global economic forces are converging in a dramatic manner. History is at a point where the seeds of "learnativity" are nascent but brimming with potential if individuals, organizations, and nations are able to keep their minds open to the possibility of the opportunities created by the direction, needs, and forces just mentioned. Learnativity "is a new way of being that fuses learning, working, creativity, and knowledge creation into a synchronous state" (p. 16). The term is meant to describe a state of affairs wherein everyone is problem solving, working, planning, communicating, and learning "all at once and all at the same time." The concept of learnativity includes this fusion of human activities, technological developments, knowledge needs, and global forces.

The paper focuses on four elements of learnativity:

1) performing tasks and measuring competence
2) capturing and utilizing knowledge
3) managing knowledge in its increasing complexity, and
4) changes in learning offerings.

The sections on capturing knowledge and managing knowledge are most relevant to learning objects and learning object repositories (see pages 26-31). Here, Hodgins covers the nature of learning objects, metadata, interoperability, standards, and various implications for the future. This section is nicely interwoven with the remaining three elements of learnativity. Of particular interest are the "Points to Ponder" asked at the end of the sections. The questions are categorized as follows: Work & Learning, Individuals, Teams, Organizations, and Policy & Practice.

In general, Hodgins' paper touches upon many of the relevant issues to be discussed in Part III of this report. It is broken up into readable chunks and written for a general audience that may or may not understand why learning objects are important or how

learning objects are connected to current developments in technology, learning, training, and human development. The vision paper's utilization of "learnativity" provides a concept by which to think about strategic measures for reaching a prime state of human, technological, and learning convergence.

For the full text, see http://www.learnativity.com/into_the_future2000.html

Learning Without Limits, Vol. 3
Informania, Inc.
David Brightman , Ed.
This monograph contains several articles providing perspective on many of the concerns articulated by Hodgins. However, the authors in this work focus on the growing demand for electronically delivered learning materials for continuous and easily accessible work force development and professional training. That is, they focus on the implications of Hodgin's learnativity from an organizational standpoint. For example, Ellen Wagner examines e-learning "as the site where knowledge management, information technology, and cognitive strategies converge" (p. 4). Like Hodgins, Wagner is interested in trends, calling special attention to an increased focus on competency-based approaches to instruction. The articles by Gena Tuso and Warren Longmire discuss the technological requisites needed to achieve competency-based learning outcomes. David Brightman provides two case studies illustrating the relationship between electronically mediated learning and performance-based learning outcomes.

Wagner's article "E-Learning: Where Cognitive Strategies, Knowledge Management, and Information Technology Converge" ties learning needs to organizational needs, and organizational competencies to individual-learner centered competencies. New technologies and work force needs, she argues, should be studied closely in order to develop organizational learning strategies. She briefly covers learning objects, metadata, and pattern templates as effective e-learning implementations. The case studies articulated by Wagner provide real-life examples of the benefits and challenges of applying new learning technologies to competency-based models for real-world needs. The case studies include initiatives for the Western Governors University and Komptansenettet: A National Competency-Based Professional Development Network (see pages 43-49).

For the full text, see http://www.learnativity.com/lwol.html

Learning Objects; Resources for Distance Education Worldwide
Stephen Downes
This article is rich and comprehensive. Downes begins with a quasi-historical analysis of the need for sharing learning materials as it has developed from an economic and technological standpoint. In discussing "older" and more "contemporary" forms of sharing learning materials, he provides a brief picture of the various efforts educators have headed to share learning resources. Discussion of learning objects covers not only

the creation of objects but also how learning objects are constrained by funding, time, and attention.

Working from a theoretical perspective, he discusses the challenges of holistic course construction, the limited use of objects contained in such systems, and the need for Rapid Application Design (RAD). In discussing object-oriented design, open standards, the IMS protocols and SCORM illustrations, he uses graphs and charts serve to flesh out the activities currently underway in the learning object, e-learning world. The second half of this sophisticated article focuses on the authoring of learning objects as it relates to data, multimedia, design, templates, and learning management systems. Especially helpful to understanding delivery of learning objects is his discussion on learning object repositories, XML, XSL, and HTML. Again, graphs and illustrations are provided to illustrate the work being done to improve electronic delivery of leaning content.

In general, Downes is concerned with the problem of how older modes of sharing instructional material pose time and funding constraints on programmers, course developers, content designers, and instructors. His main justification for streamlining the production of learning material into learning objects concerns his perspective that many subject offerings suffer from unnecessary duplication. Professors offering similar courses continually and perhaps needlessly recreate similar materials. He believes it is to the benefit of traditional instruction, teachers and students, and to the "distance learning" world that reusable, manageable, discoverable learning objects be created to promote higher quality learning objects, efficiency, and personalized learning offerings.

For the full text, see http://www.irrodl.org/content/v2.1downes.html.

SELECTED BIBLIOGRAPHY

Barron, T. (March, 2000). Learning objects pioneers. *Learning Circuits Webzine*. Retrieved July 02, 2002, from http://www.learningcircuits.com/mar2000/barron.html

Brightman, D. (Ed.). *Learning without limits, Vol. 3.* Informania, Inc. San Francisco, CA. Available via the Learnativity.com web site at http://www.learnativity.com/lwol.html

Butler, D. L. & Sellbom, M. (2002). Barriers to adopting technology for teaching and learning. *EDUCAUSE Quarterly*, 2, 22-28. Also available at http://www.educause.edu/ir/library/pdf/eqm0223.pdf

Downes, S. (2001). Learning objects: Resources for distance education worldwide. *International Review of Research in Open and Distance Learning*, 2. Retrieved July 13, 2002, from http://www.irrodl.org/content/v2.1downes.html.

Hodgins, W. (February, 2000). Into the future: A vision paper. [A white paper for the American Society for Training & Development (ASTD) and the National Governor's Association (NGA). Submitted to the Commission on Technology and Adult Learning.
Available at http://www.learnativity.com/into_the_future2000.html

Jamain, M. H. (July 2001). A critique of Stephen Downes' article, 'Learning Objects": A perspective from Bharain. *International Review of Research in Open and Distance Learning*, Retrieved July 13, 2002, from http://www.irrodl.org/content/v2.1/jamian.html

Licks, V. Feldens, F., Ourique, F., Funk, D., Correa, J. S., & de Azevedo, D. F. G. (August 2001). Learning objects: A model for collaborative content production and a case study. Paper presented in Session 7D2 at the International Conference on Engineering Education, Oslo, Norway. Available at http://www.ineer.org/Events/ICEE2001/ Proceedings/papers/524.pdf

Lin, Fuhua (Oscar). (July 2001). A critique of Stephen Downes' article, 'Learning Objects": A Chinese perspective. *International Review of Research in Open and Distance Learning,* Retrieved July 13, 2002, from http://www.irrodl.org/content/v2.1/lin.html

Mayberry, E. (June 2002). From e-learning failure to e-learning redemption. Retrieved July 25, 2002, from http://www.learningcircuits.com/2002/jun2002/mayberry.html

Shata, O. (July 2001). A critique of Stephen Downes' article, 'Learning Objects": A Middle Eastern perspective. *International Review of Research in Open and Distance Learning*, Retrieved July 13, 2002, from www.irrodl.org/content/v2.1/shata.html

Singh, H. (March 2000). Achieving interoperability in e-Learning. *Learning Circuits Webzine.* Retrieved July 7, 2002, from http://www.learningcircuits.com/mar2000/signh.html

Wagner, E. D. (Fall 2000). Emerging technology trends in eLearning. *LiNE Zine: Learning in the New Economy e-Magazine*. Retrieved July 20, 2002, from http://www.linezine.com/2.1/features/ewette.htm

Wiley, D. A. (November 1999). The post-LEGO learning object. Retrieved July 23, 2002, from http://wiley.ed.usu.edu/writings2.pl

GUIDE TO SELECTED ORGANIZATIONS

Most of the organizations selected for inclusion here are well know for their direct involvement in the development of learning object standards, theory, models, or repositories. While a number of elearning organizations are also doing work in the realm of learning objects, the ones listed below have learning objects as their core focus, as a major component of their mission, or are of such influence that their inclusion here is mandated.

Authors Note: Brief and carefully worded descriptions like those that often appear on websites about organizational purposes and missions are difficult to summarize without changing the intended meaning of the words. To ensure each organization here was represented accurately, the information in this section was collected directly from the websites of the selected organizations, and barring any errors we may have inadvertently introduced in transcribing or condensing the text, is the work of the various authors of that content.

Advanced Distributed Learning Initiative (ADL): The Advanced Distributed Learning Initiative is a collaborative effort between government, industry and academia to establish a new distributed learning environment that permits the interoperability of learning tools and course content on a global scale. Sponsored by the U.S. Department of Defense (DoD) in coordination with the White House Office of Science and Technology Policy (OSTP), ADL's vision is to provide access to the highest quality education and training, tailored to individual needs, delivered cost-effectively anywhere, anytime. See http://www.adlnet.org.

AICC: The Aviation Industry CBT (Computer-Based Training) Committee (AICC) is an international association of technology-based training professionals. The AICC develops guidelines for aviation industry in the development, delivery, and evaluation of CBT and related training technologies. The objectives of the AICC are as follows:

- Assist airplane operators in development of guidelines which promote the economic and effective implementation of computer-based training (CBT).
- Develop guidelines to enable interoperability.
- Provide an open forum for the discussion of CBT (and other) training technologies.

The AICC wants the aviation training community to get the best possible value for its technology-based training dollar. The only way that this is possible is to promote interoperability standards that software vendors can use across *multiple* industries. With such standards a vendor can sell their products to a broader market for a lower unit cost. AICC recommendations are fairly general to most types of computer based training and, for this reason, are widely used outside of the aviation training industry.…The AICC also actively coordinates its efforts with broader learning technology standards organizations like IMS, ADL, and IEEE/LTSC. See http://www.aicc.org/pages/aicc_faq.htm

Educational Object Economy Foundation (EOE): The Educational Object Economy Foundation investigates the growth and propagation of online learning communities, via the development of component-based tools for the creation and sharing of learning objects.

Founded by Dr. James Spohrer as part of a National Science Foundation-funded project, hosted by Apple Computer, and including industry, university, and government collaborators, the EOE develops and distributes tools to enable the formation of communities engaged in building shared knowledge bases of learning materials. Today, EOE tools and content have been used by thousands of people around the world. See http://www.eoe.org.

IMS Global Learning Consortium: The IMS Global Learning Consortium, headquartered in Burlington, Massachusetts, is a specification authoring organization, with its membership drawn from distributed computer learning system vendors, publishers, digital content vendors, government agencies, universities, schools, training organizations, and other interested parties. IMS specifications are intended to evolve into globally adopted open standards for Learning Management System (LMS) vendors and content authors. All IMS specifications are made available to the public without charge and are realized in eXtensible Markup Language (XML), to facilitate unrestricted understanding and adoption.

One of IMS' central objectives is to facilitate working relationships among LMS vendors, content authors, and learners to foster a mutually beneficial and thriving marketplace around open Internet standards.

See http://www.imsproject.org/imsdr_whitepaper_v1p6.html#1225538

Learning Technology Standards Committee (LTSC): The Learning Technology Standards Committee (LTSC) is chartered by the IEEE Computer Society Standards Activity Board to develop accredited technical standards, recommended practices and guides for learning technology. The LTSC coordinates formally and informally with other organizations that produce specifications and standards for similar purposes. Standards development is done in working groups via a combination of face-to-face meetings, teleconferences, and exchanges on discussion groups.

The LTSC is governed by an executive committee consisting of working group chairs and elected officers. The IEEE promotes the engineering process of creating, developing, integrating, sharing, and applying knowledge about electro and information technologies and sciences for the benefit of humanity and the profession.

For additional information, see the web sites at http://ltsc.ieee.org/ and http://www.ieee.org/organizations/corporate/vision.htm

Learnativity.com. **"**Learnativity," as defined by the organization that carries its name, "is an idea, a practice, and a bringing-together of concepts important to most everyone wanting to succeed in the new century. Learnativity.com is an organization created by

Marcia Conner and Wayne Hodgins to convey these concepts beyond Learnativity.com and to help foster an alliance for the new learning economy." The Learnativity website is a rich treasure trove of materials related to these concepts and ideas. See http://www.learnativity.com/about.html

Macromedia Inc. Macromedia Inc. provides software that empowers millions of developers and designers to efficiently create the most effective user experiences on the Internet. Its integrated family of tool, server, and client technologies enables the delivery of a wide range of Internet solutions from websites to Rich Internet Applications across platforms and devices.

With an installed base of three million developers and designers, rich client software deployed to 98 percent of web users, and a broad network of industry partners, Macromedia is a strategic IT supplier to customers in the business, government and education markets. The company has operations in more than 50 countries worldwide, and headquarters in San Francisco, California.

See http://www.macromedia.com/macromedia/

The MASIE Center. The MASIE Center is an international e-lab and ThinkTank located in Saratoga Springs, NY. The Center is dedicated to exploring the intersection of learning and technology, and focuses on these key areas:

- How will people and organizations leverage technology as a tool for learning, knowledge and performance?
- What are the best practices for implementing e-Learning and other models of digital collaboration?
- How do people REALLY learn? And, what are the behavioral and cultural assumptions behind learning?
- How does learning change around the globe?
- How do organizations absorb technology into their culture?
- What makes technology work from a behavioral point of view?

The MASIE Center provides its services to major corporations and technology providers throughout the world. The Center provides research, perspectives, training, learning products and consulting on these key issues. The MASIE Center was formed to provide a clear-thinking leadership hub for the next generation of learning and technology solutions.

See the website at http://www.masie.com/masie/default.cfm?page=centerinformation.

University for Industry (Ufi). Ufi is one of the UK government's key partners in delivering the workforce development and lifelong learning agenda. Ufi is bringing about a revolution in learning by taking forward the government's concept of a 'university for industry.' learndirect is Ufi's nation-wide network of online learning and information services. Ufi aims to drive up demand for learning, help adults improve their employability by acquiring new knowledge and skills, and help businesses become more

competitive. It is using Information Communications Technology, (ICT) to revolutionize where and how people and businesses learn. It is developing learning materials which allow people and businesses to learn in 'bite-sized chunks' on line through the Internet at a pace and at times that suit them and wherever they have access to the Internet - at learning centers, at home or at work.

See: http://www.ufiltd.co.uk

LARGE SCALE INITIATIVES & PROJECTS

The initiatives and projects listed below are all well-regarded and influential, and each takes its own particular approach to defining, creating, and disseminating learning objects. To give the reader a sense of the international aspects of learning object development, the efforts taking place in a variety of countries are highlighted here. At the same time, it should be noted that a great many countries have work of some sort taking place with learning objects, and our list is not meant to be a comprehensive listing. The projects and initiatives listed here are rather intended to be representative of the major kinds of efforts taking form in countries around the globe.

Authors Note: Brief and carefully worded descriptions like those that often appear on websites about project purposes and missions are difficult to summarize without changing the intended meaning of the words. To ensure each initiative here was represented accurately, the information in this section was collected directly from the official websites. Barring any errors we may have inadvertently introduced in transcribing or condensing the text, the descriptions are the work of the various authors of those websites.

AUSTRALIA

COLIS: The COLIS Consortium is an alliance of five universities — Macquarie University (lead institution), University of Newcastle, University of New England, University of Southern Queensland, and University of Tasmania. The initial project is funded by DETYA, as part of the education technical standards interoperability agenda. The goals of COLIS are:

- To share knowledge and expertise in developing the functional and technical architectures necessary for institutional systems interoperability.
- To engage in national and international research programs aimed at developing systems interoperability.
- To share systems development where appropriate.
- To share the purchase of commercial systems components, where appropriate.
- To develop strategic alliances with other universities and with industry partners to further the interests of the COLIS agenda.

For additional information, see http://www.colis.mq.edu.au/

EdNA: The EdNA collaboration (Education Network Australia) is pursuing a range of activities on technical standards to support effective use of information and communications technology in education and training. The AICTEC has established a Standards Sub-Committee to coordinate these activities.

The charge to the Standards Sub-Committee is to:

- Develop and maintain a strategically focussed approach to technical standards in support of effective use of information and communications technology (ICT) in education and training;
- Draw together existing work on ICT-related standards in education and training, thereby avoiding duplication, fragmentation and inconsistency in current and future work;
- Work with other bodies as appropriate, to develop, implement and promote specific technical standards to support the effective use of ICT including in all action areas identified in the Education and Training Action Plan for the Information Economy;
- Provide expert advice to AICTEC (and through AICTEC, to MCEETYA) on the development and implementation of national standards to facilitate interoperability, at the ICT level, of education, resource access and usage;
- Ensure that it is seen by education and training stakeholders as being representative of their interests, and that all relevant expertise and stakeholder interests are considered in regard to particular matters as they arise;
- Build coherent linkages with standards efforts in other areas of the Australian community and internationally, working closely with Standards Australia.

For additional information on EdNA, see http://www.edna.edu.au/
For the standards' project, see: http://standards.edna.edu.au/committee.html

ICT-Based Learning Designs: Funded by the Australian Universities Teaching Committee (AUTC), the aim of this two-year project is to maximize opportunities for university teachers to create engaging learning opportunities for students within high-quality, flexible learning environments. This is to be achieved by conducting the following:

- identifying a range of learning designs that have been demonstrated to contribute to high quality learning experiences in higher education and which can be applied in other contexts;
- selecting those which are suitable for development as re-usable software, templates, exemplars and/or frameworks;
- undertaking their necessary development; and
- developing a series of guidelines for good practice in the use of the software, templates, exemplars and/or frameworks in new contexts.

For additional information, see http://www.learningdesigns.uow.edu.au/index.html

Le@rning Federation: The Le@rning Federation, currently the largest learning object project in Australia, is an initiative of the state and federal governments of Australia and New Zealand. Over the period 2001-2006, the Initiative aims to develop online interactive curriculum content specifically for Australian and New Zealand schools. The Initiative will support teachers in enhancing student learning thereby greatly improving educational outcomes for students.

The project is developing systems which will allow the input and delivery of high quality curriculum online by a range of approved content developers to an agreed set of specifications. The systems will also facilitate the breakdown of content into discrete 'objects' and the reassembly and repurposing of these to suit the particular needs of teachers and students.

For additional information, see http://socci.edna.edu.au/

CANADA

Canada has a great many projects that could be listed here, a large proportion funded under the aegis of CANARIE. A few are listed here as examples.

CANARIE: Canada's advanced Internet development organization (CANARIE) is a not-for-profit corporation supported by its members, project partners and the Federal Government. CANARIE's mission is to accelerate Canada's advanced Internet development and use by facilitating the widespread adoption of faster, more efficient networks and by enabling the next generation of advanced products, applications and services to run on them.

Headquartered in Ottawa, Ontario, CANARIE employs 29 full-time staff dedicated to the research and implementation of advanced networks and applications that will stimulate economic growth and increase Canada's international competitiveness. CANARIE has already succeeded in enhancing Canadian R&D Internet speeds by a factor of almost one million since its inception in 1993. The organization has also funded numerous advanced Internet applications projects, providing some 500 companies with the opportunity to achieve business success through innovation.

CANARIE acts as a catalyst and partner with governments, industry and the research community to increase overall IT awareness, ensure continuing promotion of Canadian technological excellence and ultimately, foster long-term productivity and improvement of living standards. For more information, see http://www.canarie.ca/about/about.html.

BELLE: Over the course of two years, the Broadband Enabled Lifelong Learning Environment (BELLE) is exploring a number of critical aspects of building object repositories. Specifically, BELLE is investigating four interconnected aspects of establishing this repository.

1. Creating and Cataloguing Educational Objects BELLE is cooperating with other Learning Program projects to develop the "Canadian Core", a set of standards to describe the content of educational objects so that the repositories can be effectively searched. This standard, or protocol, is called metadata. In cooperation with the Learning Commons at the University of Calgary, BELLE is

creating tools and methods for automatically generating metadata and optimizing the digital content creation and repurposing process.

2. Pedagogical Models and Peer Review Tim Buell at the University of Calgary is leading the investigation into the pedagogical approaches that are required to establish peer reviewing and quality assessment of educational objects. This is designed to give academic merit to the production of educational learning objects.

3. Evaluation and Support Under the direction of Terry Anderson of the University of Alberta, BELLE is developing a comprehensive set of evaluation tools to assess the value and impact of its components. Netera is also developing a comprehensive structure for the support and dissemination of information about the project. This includes demonstrations, presentations, articles, and support via telephone and email.

4.Testbed Infrastructure Finally, Netera Alliance is working with all its partners to establish a testbed infrastructure of Client Learning Environments, servers and Content Repurposing Facilities. Client Learning Environments are mobile workstations that turn any classroom with a broadband connection into a distance learning centre with H.323 video conferencing, application sharing and multimedia content. Content is served from a variety of servers from companies such as SGI, Callisto and Apple. Content Repurposing Facilities are used to digitize and tag content.

BELLE has been asked to share this work with other Learning Program projects through a subcommittee that is investigating the technical requirements of object repositories.The aim of BELLE is to weave these four areas together to make a prototype for an educational object repository. While this prototype will not be a fully functional or complete repository, it is intended to test, evaluate and document the key components of such a structure. See http://belle.netera.ca.

CAREO: The Campus Alberta Repository of Educational Objects (CAREO) is a related project supported by Alberta Learning that will create a searchable, web-based collection of multidisciplinary teaching materials for educators across the province. CAREO is being undertaken jointly by the Universities of Alberta and Calgary in cooperation with BELLE, CANARIE, and as a part of the Campus Alberta initiative. See http://www.careo.org for additional information.

LearnCanada: LearnCanada's mission is to leverage the potential of CA*net 3 (CANARIE's national optical R&D Internet), to develop a broadband interactive virtual learning community for Canadian K-12 educators. With access to advanced networks and tools, members of the community will be able to collaborate in developing the requisite pedagogical expertise, which, will ultimately foster an innovative learning culture that will sustain and enhance Canada's position within the global knowledge economy.

LearnCanada will achieve these goals through the development of multimedia tools and middleware that facilitate professional development through virtual peer-learning communities and telementoring, using a broadband infrastructure. See http://www.learncanada.ca/ for additional information.

POOL: The Portal for Online Objects in Learning *(*POOL*)* Project is a consortium of several educational, private and public, sector organizations to develop an infrastructure for learning object repositories. The consortium addresses the issues of building such architectures including the metadata, software and hardware considerations and bootstrapping the system with initial content. POOL also makes its tools available for download, to help set up similar infrastructures elsewhere and to connect them to POOL. The main advantage of their solution, according to the web site, is that it can potentially embrace all nature of individuals and organizations involved in the learning object economy. See http://www.edusplash.net

EUROPEAN UNION

PROMETEUS: The objectives of the Promoting Multimedia Access to Education and Training in European Society effort (PROMETEUS) are:

- to improve the effectiveness of the co-operation between education and training authorities and establishments, users of learning technologies, service and content providers and producers within the European Community including the Commission of the European Communities (the Commission),
- to foster the development of common European and international standards for digital multimedia learning content and services,
- to give a global dimension to their co-operation, and to having open and effective dialogues on issues relating to learning technologies policy with policy makers in other regions of the world, while upholding Europe's cultural interests and specificities,
- to consider that the way to achieve these goals is by following certain common guidelines organizing their future co-operation,
- to consider that these guidelines should be based upon an analysis of the needs expressed by users of the information and communication technologies (ICT) in the education and training sector"

For a comprehensive description, see http://www.prometeus.org/index.cfm

HOLLAND

OUNL/EML: The work carried out by the Open University of the Netherlands (OUNL) on educational modeling comes from an R&D project funded by the Dutch national government through their structural funds for universities. The R&D work on learning technologies is paid from these funds with the objective of innovating education through the use of ICT.

OUNL research is academic and independent of any vendor or other commercial stakeholder. Besides work on Educational Modeling Language (EML), the OUNL's research and development activities in learning technologies include: competency based learning, new models of assessment (e.g. portfolio's), printing on demand, and others. The main outputs are: specifications, prototypes and publications.

The EML website notes that to date no comprehensive notational system exists that allows one to codify units of study (e.g. courses, course components and study programmes), in an integral fashion. EML is the first system to achieve precisely this. EML describes not just the content of a unit of study (texts, tasks, tests, assignments) but also the roles, relations, interactions and activities of students and teachers. The major EML implementation is in XML (eXtensible Mark-up Language), an internationally accepted meta-language for the structured description of documents and data.

Various kinds of specifications with which educational content may be codified are under development. Examples are initiatives taken by IMS, IEEE-LTSC, Dublin Core and ADL-SCORM. EML does not make these initiatives superfluous, nor does it run contrary to their aims. If anything, it takes many of the ideas voiced by them one step further by developing a more comprehensive notational system. For additional information, see the EML site at http://eml.ou.nl/introduction/explanation.htm.

UNITED KINGDOM

CETIS: The Center for Educational Technology Interoperability Standards (CETIS) is a national effort that:

- represents UK Higher and Further Education on international educational standards initiatives
- advises Universities and Colleges on the strategic, technical and pedagogic implications of educational technology standards, including the Further Education Managed Learning Environment Programme
- manages UK Implementation groups examining IMS specifications
- disseminates information on learning technology standards

CETIS is managed by CeLT at the University of Wales Bangor in partnership with the Open University. See http://www.cetis.ac.uk/static/about.htm

SoURCE: This project aims to explore customization as a technique for increasing the extent to which educational software is used and re-used appropriately in higher education. It is also focusing on dissemination by investigating the feasibility of setting up a "National Library of Re-usable Educational Software" (RESL). A key element of the RESL strand is looking at metadata and interoperability issues. The prototype library was based on the EOE's Generic Object Economy architecture.

For additional information, see http://www.source.ac.uk/

University for Industry: In its Green Paper, *The Learning Age*, the UK government set out its vision of "a learning society in which everyone, from whatever background, routinely expects to learn and upgrade their skills throughout life." Backed by the UK government, the University for Industry (Ufi) was created to make that vision possible. With ambitious plans to bring learning and skills into people's lives, Ufi developed the *learndirect* service to change the face of learning for hundreds of thousands of people across the UK.

There are, as of January 2002, 1,763 *learndirect* e-learning learning centers across the country. The majority of these e-learning centers are operated by local and national organizations known as Ufi hubs. Over 600 organizations are working in partnership with Ufi as part of local, employer and sector-based hubs. Partners involved with Ufi hubs and operating *learndirect* centers are typically employers, business organizations, colleges, universities and private training providers, Learning and Skills Councils, local authorities, libraries, trades unions, and sports and community organizations.

Many *learndirect* courses are eligible for public funding from the FE and HE funding bodies, which means that the e-learning opportunities being opened up through *learndirect* are affordable as well as accessible. The Learning and Skills Council designated £145.5 million for the financial year 2002-03 to support *learndirect* learners in England. In Wales, approximately £1.7 million has been designated to support *learndirect* learning in the financial year 2002-03. The Department for Employment and Learning in Northern Ireland has made up to £2.8 million available to support *learndirect* learning in Northern Ireland in the same period.

Ufi commissions its *learndirect* learning materials from Ufi qualified suppliers, which include organizations such as IBM, BBC, and Microsoft as well as colleges, universities and professional institutes. Ufi's suppliers are producers of high-quality open and distance learning materials, ranging from web, digital and multimedia products through to video, audio and traditional print.

See: http://www.learndirect.co.uk/

The Union Learning Fund: The Union Learning Fund (ULF) promotes activity by trade unions in support of the government's objective of creating a learning society, by influencing the increase in take up of learning in the workplace and boosting union's capacity as learning organizations.

2001/2 was the ULFs fourth year and 107 projects commenced. To date the ULF has supported 311 projects from over 66 unions, working in almost 3,000 workplaces. The projects have ranged from basic skills to continuing professional development. Several ULF projects have been held as examples of good practice - two projects

were included in the European Social Partners Compendium of Best Practice, one project won a NIACE (National Institute of Adult Continuing Education) award and one project won an award at Birmingham's *Learning City in Europe 2001 event.*

Union Learning Fund monies are used to open workplace learning centers, train Union Learning Representatives, run courses, and help people find learning opportunities to suit them.

See: http://www.dfes.gov.uk/ulf/

UNITED STATES

The US has a great many projects that could be listed here. The ones listed here are only illustrative of the work taking place and the list is not comprehensive.

Advanced Distributed Learning Co-Labs: The Advanced Distributed Learning (ADL) initiative created a network of three ADL Co-Laboratories (ADL Co-Labs), a hub and two functionally defined nodes, to advance the initiative and to serve distinct areas of operational responsibility. The ADL Co-Lab Network serves as the focal point and catalyst for the large-scale cooperative research, development, implementation and assessment of ADL technologies and related products.

The Alexandria ADL Co-Lab is the operational command post of the ADL Initiative and coordinates communication across the ADL Co-Lab Network. The Joint ADL Co-Lab was established to promote collaborative development of ADL prototypes and ADL systems acquisitions, primarily among the Department of Defense components. The Academic ADL Co-Lab serves as an academic partner and ADL link to test, evaluate and demonstrate ADL-compliant tools and technologies to enhance teaching and learning.

The ADL Co-Labs are the principal elements of the ADL Initiative's cooperative effort between DoD activities, other federal agencies, international organizations, academia, the private sector and international standards organizations. The ADL Co-Labs provide open collegial forums whose focus is the collaborative development of the advanced distributed learning environment that will enable interoperability and reuse of tools and learning content on a global scale. The ADL Initiative focuses on the transformation of military education and training by providing high-quality instruction and decision support that can be tailored to individual needs and provided anywhere and anytime it is needed. The ADL Co-Labs are helping to establish the structure for the new global e-learning environment.

For additional information, see
http://www.adlnet.org/index.cfm?fuseaction=colabovr&cfid=67313&cftoken=32804210

MERLOT: MERLOT [Multimedia Educational Resource for Learning and Online Teaching] is a free and open resource designed primarily for faculty and students of

higher education. Links to online learning materials are collected here along with annotations such as peer reviews and assignments.

MERLOT is also a community of people who are involved in education. Community members help MERLOT grow by contributing materials and adding assignments and comments. It is recognized that the scope of coordination activities and the requirements for sustaining MERLOT is rapidly increasing and a new, neutral coordinating organization needs to be established. To that end, MERLOT is advancing the current collaborative framework, exploring a variety of business models, and developing its sustainability plan so MERLOT can serve the current and future academic technology needs of faculty, students, staff, and institutions. See the MERLOT website at http://taste.merlot.org/history/history.html

Open Knowledge Initiative (OKI): The primary goal of the Open Knowledge Initiative (OKI) is to design and develop an open and extensible architecture for learning management systems (LMS). From this foundation, it is hoped that OKI will become a community, a process, and an evolving open source toolset. The realization of this primary objective, however, will help us and other contributors to achieve the rest. The Mellon Foundation has funded the first two years of what is expected to be an ongoing effort. MIT leads the project in close collaboration with Stanford. A number of key partner institutions are also playing important roles in defining the OKI architecture.

OKI's architecture and open source approach is designed to encourage both partner institutions and eventually a broader educational community to contribute tools and services to OKI's code-base. OKI is being designed to be spare and elegant and yet provide the hooks and services that will make it a fertile environment for academic developers.

Another goal of OKI is to promote use of this architecture in the development of pedagogical applications (often refer to as "tools" in OKI literature and discussions) that facilitate, among other things, the management of learning content.

See http://web.mit.edu/oki/product/whtpapers/whatis.html

NSDL/SMET/Digital Libraries Initiative (DLI) Phase I and Phase II: The National Science, Mathematics, Engineering, and Technology in Education Digital Library program was established by the National Science Foundation. The NSDL program solicitation notes that the

> "… NSDL program will foster the creation and development of a comprehensive infrastructure, including an integrated management structure for the digital library, standards for quality control and intellectual property management of resources, and policies and practices for the guaranteed stability and archiving of materials and products. It is expected that the library established by the NSDL

program will enable the dynamic use of materials and tools for learning supplied by cooperating providers of resource collections and services. For example, a case study at one site of how climate-change scientists employ satellite imagery to determine surface water chemistry could be combined with computational and visualization tools from another collection, and used to analyze and display archived data housed in yet another collection. In addition, services available through the library will increase the accessibility and impact of all resources, by supporting effective search and discovery of content, flexible assembly of curricular and learning modules from component pieces, and communication and collaboration among users.

This program builds on previously and currently funded work supported under the multi-agency Digital Libraries Initiative (DLI) Phase I and Phase II (see http://www.dli2.nsf.gov/), and is intended to multiply the impact of efforts supported by NSF, other government agencies, the private sector, professional societies, and others working to improve SMET [Science, Mathematics, and Technology Education] education nationwide."

See http://www.nsf.gov/pubs/2000/nsf0044/nsf0044.htm#awardinfo for additional information.

OpenCourseWare Initiative: The idea behind the MIT OpenCourseWare (MIT OCW) is to make MIT course materials that are used in the teaching of almost all undergraduate and graduate subjects available on the web, free of charge, to any user anywhere in the world. MIT OCW will radically alter technology-enhanced education at MIT, and will serve as a model for university dissemination of knowledge in the Internet age. Such a venture will continue the tradition at MIT and in American higher education of open dissemination of educational materials, philosophy, and modes of thought, and will help lead to fundamental changes in the way colleges and universities engage the web as a vehicle for education. See http://web.mit.edu/ocw/ocwfactsheet.html

SCORM: The Sharable Content Object Reference Model (SCORM), a project of the Advanced Distributed Learning Initiative (ADL), defines a Web-based learning "Content Aggregation Model" and "Run-Time Environment" for learning objects. At its simplest, it is a reference model that references a set of interrelated technical specifications and guidelines designed to meet DoD's high level requirements for Web-based learning content. These requirements include, but are not limited to, reusability, accessibility, durability and interoperability. The work of the ADL Initiative to develop the SCORM is also a process to knit together disparate groups and interests. The SCORM aims to bridge emerging technologies and commercial and public implementations.

See the description at http://www.adlnet.org/index.cfm?fuseaction=viewart&faqid=57 for additional information.

SELECTED ARTICLES AND PAPERS

In the six parts of this section, work in learning objects is examined on several levels — Standards, Pedagogy & Androgogy; Effectiveness; Policy and Digital Rights; and Learning Technologies and Tools. In some areas — Standards, for example — a tremendous amount of work has taken place that is directly related to learning objects; in others, such as Pedagogy & Androgogy, the body of knowledge that exists has only begun to be applied to learning objects.

At the beginning of each section, a working definition is provided, along with some observations on the depth of materials available on that topic that apply to learning objects. As in the previous sections, we looked for articles that seemed to focus most clearly on learning objects as opposed to the more general category of elearning. In almost every case, the articles that we chose to summarize have been referenced over and over in the literature. Also as in the previous sections, we looked for work that could apply as easily to education as it could to government or to industry.

STANDARDS *Common specifications and guidelines required for learning objects to be reusable, accessible, interoperable, durable, and affordable.*

Information on learning object standards is abundant. A great deal of work has taken place to develop effective, acceptable standards for learning objects. As a result, comprehensive standards are largely in place, and largely agreed upon.

Making Sense of Learning Specification & Standards: A Decision Maker's Guide to Their Adoption

The Masie Center

This white paper, facilitated by the S3 Working Group of the e-Learning Consortium, was created "to help the average person understand the rationale, development, and implication of learning standards and to accelerate their adoption." The first part of the paper serves as a primer for those who have little to no knowledge of learning standards.

The author points out that calls for interoperability between proprietary technology applications are often the result of frustration experienced by users wishing to maximize time, intellectual, and monetary investments in learning technologies. As with other historical technologies and tools, various sectors come together to create a set of standards. In so far as learning objects are concerned, then, the goal is to create an infrastructure whereby objects can be created, used, transferred, and reused across different application systems and platforms. Standards help to ensure e-learning effectiveness and resource investments by promoting the following goals: interoperability, re-usability, manageability, accessibility, and durability (each of these "abilities" is fleshed out in the text).

The core of the paper focuses on a holistic but detailed explanation of how standards are formed. The roles of special consortia (AICC, IMS, and ARIADNE), labs, test beds, and

markets (e.g., ADL and ALIC), and standards bodies (IEE, ISO, and CEN/ISSS) in creating de facto standards are well illustrated by a graphic illustration. Discussion includes initiatives underway in Japan, Europe, and Australia. The author is careful to point out that counter to some perceptions, "the different organizations and groups … are not in any conflict or competition with each other" because each has a special but crucial function in the development of standards (p. 10).

The US Department of Defense's Sharable Content Object Reference Model (SCORM) is also discussed. SCORM's function is related to the infrastructure illustrated by the model of standards evolution: "SCORM provides a foundational [detailed] reference model upon which anyone can develop models of learning content and delivery." SCORM's role in enabling content, technology, and systems to "talk" to each other is related to the five goals of standards initiatives mentioned at the beginning of this summary. That SCORM is not a standard itself but a mode by which to test the "effectiveness and real-life application of a collection of individual specifications and standards" is emphasized.

Appendix 1 of the Masie Institute document clarifies the distinction between compliance and conformance, and it introduces the terms certification and product self-test. Appendix 2 discusses the importance of implementing meta-data, and it discusses the terms categorization and taxonomy. Appendix 3 focuses on learning objects. Autodesk's content model is used as an illustration, and includes a depiction of the relationship between raw content items, information objects, learning objects, lessons, and courses. Included is also a brief explanation of SCO and SCORM. Appendix 4 focuses on standards and specifications groups. Brief descriptions of thirteen initiatives and projects are given. Efforts in Europe, Australia, and Japan are included in the discussion as well.

For the full text, see http://www.masie.com/standards/S3_Guide.pdf

Learning Objects and Learning Standards: Everything You Ever Wanted to Know but Were Afraid to Ask

Wayne Hodgins

In this paper, Hodgins first describes the need for standards as they are related to maximizing learning technologies, then he raises several key questions driving standardization projects:

- How will we mix and match content from multiple sources?
- How do we develop interchangeable content that can be reused, assembled, and dissembled quickly and easily?
- How do we ensure that we are not trapped by a vendor's proprietary learning technology?
- How do we ensure that your learning technology investments are wise and risk adverse?

Most of the paper is comprised of brief descriptions of those involved with standards initiatives: IEEE Learning Technology Committee, Advanced Distributed Learning (ADL), International Management System (IMS), AICC: The Aviation Industry CBT,

PROMETEUS, and the Dublin Core: Metadata for Electronic Resources. Hodgins concludes the paper by emphasizing that an official set of standards is well on its way, and advises savvy, strategic-minded individuals and organizations to familiarize themselves with the "techno-mumbo-jumbo." An action plan is provided.

This is a very accessible paper that focuses on a general explanation of the concepts. A brief explanation is provided about the connection between content objects, meta-data repositories, and discoverability.

For the full text, see http://www.learnativity.com/standards.html

Learning Technology Standards: An Overview
CETIS (Center for Technology Interoperability Standards)
This document discusses the need to develop standards from the standpoint of education. It is suggested that developing standards will result in the following:

- free educational systems from barriers encountered with finding and incorporating content in learning environments
- make moving between institutions easier for students
- aid technology consultants or specialists in supporting the teachers and staff who use content for teaching and administrative purposes

The article points out not only the diverse ways interoperability will affect the creation of learning objects but also the way they are packaged and sequenced. Implications for transferability between platforms and environments are also noted. This document also emphasizes the need for administrative systems to work with one another to achieve goals of standardization. The tension between suppliers' preferences and users' preferences is noted, and the fact is pointed out that suppliers prefer to have as little standards as possible because they represent both implementation and protection costs, while users want a broad and well-defined set of standards for flexibility and choice.

A very brief but interesting history of IMS explains how an interest in standards became popular and organized. Related bodies and user-led bodies are referenced but no descriptions are given. This is a very short, introductory article to standards. What it lacks in detail it makes up in clarity.

For the full text, see http://www.cetis.ac.uk/static/standards.html

SELECTED BIBLIOGRAPHY

Center for Educational Technology and Information Systems (CETIS). (January 29, 2002). Learning technology standards: An overview. Retrieved July 23, 2002, from http://www.cetis.ac.uk/static/standards.html.

Learning Objects Network, Inc. (2001). Capitalizing on the learning object economy: The strategic benefits of standard learning objects [a white paper]. Middletown, CT: Brian Degen. Retrieved July 20, 2002, from http://www.learningobjectsnetwork.com/WhitePaper_StrategicBenefitsOfStandardLearningObjects.pdf

Hodgins, W. with Conner, M. (2002). Learning objects & learning standards: Everything you ever wanted to know about learning standards but were afraid to ask. Retrieved July 7, 2002, from http://www.learnativity.com/standards.html

MASIE Center. (March, 6 2002). Making sense of learning specifications and standards: A decision maker's guide to their adoption. [Masie Center E-Learning Consortium Industry Report]. Retrieved July, 7, 2002, from http://www.masie.com/standards/S3_Guide.pdf

PEDAGODGY/ANDROGOGY

…the art of applying learning objects to learning situations and of assessing learning…

Literature relating the concerns and issues of pedagogy to electronically mediated learning is abundant. While most of the literature focuses on the larger topic of e-learning in general, there has been some attention paid in the literature to instructional design and learning theories relevant to learning objects and learning object repositories. However, as David Wiley has also noted, there appear to be few examples of solid educational research with a pure focus on the dynamics between learning and learning objects. Several themes are evident in the literature, including the importance of contextualization and reusability; androgogical versus pedagogical approaches to object design and delivery; and the need for content design to incorporate both learning theory and instructional design theory

Connecting Learning Objects to Instructional Design Theory: A Definition, Metaphor, and a Taxonomy

David A. Wiley, II

This oft-referenced piece is actually the first chapter of a book co-authored and edited by Wiley entitled *The Instructional Use of Learning Objects*. The book itself provides a substantive treatment of instructional issues affecting learning object design and delivery. In this chapter, three concerns are fleshed out:

- the confusion created by various definitions of "learning object" and the lack of attention to instructional design theory in the learning object enterprise
- a critique of the Lego metaphor and the recommendation of a new metaphor
- the construction of a neutral taxonomy to facilitate successful learning experiences

In the first section, Wiley critiques some definitions as being too broad and others as being too narrow. He hesitantly provides the following working definition for the purposes of his discussion: "any digital resource that can be reused to support learning" (p. 6). He argues that his definition avoids many of the pitfalls and confusion created by those offered by others working in this arena. Furthermore, and more importantly to Wiley, the definition highlights the "purposeful use of learning objects to support learning" (p. 7).

Next, Wiley critiques the lack of attention to instructional design theory in the design, development, and delivery of learning objects. For Wiley, it is not simply that instructional strategies and criteria for the application of learning objects must be included in the learning object discussion, but that they must play a *large* role. He is especially critical of the lack of discussion in the efforts of the Learning Objects Metadata (LOM) Working Group, which is associated with the Learning Technology Standards Committee. He notes that while it was stated that the goal of the group was to facilitate delivery of learning objects to learners, "no instructional design information was

included in the metadata specified by the current version of the LOM Working Group" (p. 9). Wiley believes that questions about what it means for "a computer to 'automatically and dynamically compose personalized lessons" requires consideration of what it means to take individual learning objects and combine them in such a way that the learning objects and their sequencing make "instructional sense" (p. 9). Concerned about a possible trend that may leave out instructional design theory, Wiley argues that effective object mediated learning requires instructionally grounded sequencing decisions.

The discussion summarized to this point could be characterized as fairly negative. By the latter third of the article, Wiley offers a more positive view. Citing Richey (1986), he notes the role of taxonomies in helping to "identify and organize the relevant variables; defining, explaining, and describing relationships among the variables" (p. 10). Citing a lack of a general learning object taxonomy compatible with multiple instruction design theories, he provides one of his own, and a table illustrating a *Preliminary Taxonomy of Learning Object Types*. A detailed discussion explains the chart's content: learning object types (of which he distinguishes five) and learning object characteristics (of which he identifies eight). For Wiley, the connection between instructional design theory and learning objects is that a neutral taxonomy can facilitate meaningful learning experiences because it allows for the linking of learning objects through multiple instructional design theories. Hence, the object combination delivered to the learner will have a sense of coherence and purpose.

In the midst of his critique, Wiley provides one of the best discussions of metadata using clear illustrations. He also provides a cost-benefit analysis of granularity from both an efficiency point of view and an instructional point of view.

For the full text, see http://reusability.org/read/chapters/wiley.doc

Competency-Based Systems and the Delivery of Learning Content
Gena Tuso and Warren Longmire

The authors begin this article by distinguishing competency-based models of learning from those that are knowledge-based and course-centric. Noting the benefits of competency-based models, the authors emphasize the role of learning objects in enabling "truly adaptive, competency-based learning." The challenge, they note, is to extract learning objects from closed systems or independent systems, e.g., a proprietary course. Two hurdles regard accessing third-party content and adapting that content to fit a specific competency model and need. The authors focus most of their attention on a process model for reconfiguring "existing course content for electronic delivery on a competency-based system" (p. 34).

Four stages are noted. First, developing competency models requires that "a competency-based system define and validate appropriate competency models for desired leaning areas" (p. 35). The second stage focuses on the evaluation of content for appropriateness in deploying the defined competency-based system. Two questions that should guide evaluation of content are noted: How well does the learning material correlate with the competency model?; and does the learning material contain

performance-based content? The third stage includes the creation, chunking, and tagging of learning objects derived from content areas. Questions about the size of chunks and the kinds of tags that should be attached to the objects are raised but not explored. Discussion of the last stage focuses on the need for sophisticated and relational object databases that facilitate access to objects. Here, the authors point out that accessibility will not only make it possible for instructional designers to add, delete, or edit content and tags, but that having multiple tags attached to objects will make it easier to assemble them for multiple learning purposes and electronic delivery.

In the last section of the paper, the authors look at how a knowledge-based system of content may compliment or augment competency-based learning. What it is important to remember, they argue, is that the learning objects "should ultimately work to improve actual performance…" (p. 37).

For the full text, see http://www.learnativity.com/download/LwoL3.pdf, pages 31-38.

How Adults Learn

Learnativity.com

This useful primer contains several sections and provides a nice introduction to the theory and practice of adult learning. In the first section, a formal definition of learning and memory are provided along with physiological and neurological aspects of the learning process. The need to focus on individual learning styles and encourage life-long learning for everyone is emphasized as a must for organizations, business, and the individual who should have the conditions to "re-create" their environments and themselves. References are made to Hoarld D. Lasswell, Robert M. Smith, and Robert L. Steback regarding change and human nature, becoming effective learners, and learning strategies for adult learners respectively. Additional links include references to information on learning and continuing education; a reference guide on *Theoretical Sources on Education and Learning Theory*; Thomas C. Reeve's *The Impact of Media and Technology in Schools*; and David Jafee's paper on "Pedagogical Principles and Practices for Asynchronous Online Learning."

Other sections highlight the distinction between pedagogical and androgogical approaches to teaching and learning, and a variety of related topics. Historical perspectives are offered explaining older conceptions of teaching and the transition to contemporary ideas about effective learning. Five issues of androgogical learning are detailed as a way of illustrating the student-centered approach. The author warns that "postponing or suppressing [a move to student-centered learning] will slow our ability to learn new technology and gain competitive advantage." References are made to John Dewey, Eduard Lindeman's "The Meaning of Education," and Knolwe's *The Adult Learner*.

For the full text, see http://www.learnativity.com/adultlearning.html

Experiences with Reusable E-learning Objects: From Theory to Practice
Jenaette M. Muzi, Tanya Heins, Roger Mundell
In this article from the trenches of Royal Roads University and the Centre for Economic Development and Applied Research, the author provides a real-world picture of how one institution actually decided to implement and use "E-learning objects (ELOs) based on templates and using a particular course editing tool." After noting the difficulty of defining these new learning objects, Muzio provides a brief history of how RUU and CEDAR became involved in the ELO world, pointing out that "CEDAR's work has garnered international interest and awards."

Many features of the article make it a good reading for a general audience. First, it is written fairly clearly and requires minimal acquaintance with the technology under discussion. Second, it provides concrete examples that illustrate the creation of ELOs (the on-line version of the article provides links to ELOs that allow the reader to actually practice creating his or her own ELO based on CEDAR's template and course editing tools). Third, it touches on multiple aspects of creating ELOs, i.e., areas of concern to the summit such as standards and property rights.

Muzio conveys CEDAR's commitment to IMS standards and the need to retroactively fit metadata tags once a final standard for XML tags has emerged. The author describes how they are working to resolve issues about intellectual property rights by creating "sharable" data-bases (free-to-use materials); setting guidelines about manipulating original ELOs and preserving them; and exploring how object creators may be compensated for use of intellectual property when accessed from an external environment. The author also notes CEDAR's concern and attention to questions about size and granularity. Pedagogically, CEDAR's commitment to following sound instructional design in creating ELOs for quality learning outcomes is given careful treatment. Sketching the significance of instructional theory to the activities of subject matter specialists, they propose the use of Bloom's taxonomy for the cognitive domain of creating ELOs: "This encourages developers to check that they are developing content that encompasses higher order thinking as well as merely knowing or understanding ideas and concepts." Tools that have been used by expert skilled multimedia designers are referenced within this part of the article.

This article reflects the careful thinking of CEDAR ELO developers and concludes that a medium should be used for learning purposes because it is the best medium for that particular learning need: "Good instructional design is more important than the specific technology."

For the full text, see http://www.cedarlearning.com/CL/elo/eLearningObjects_sml.pdf

SELECTED BIBLIOGRAPHY

Banks, B. (July 2001). Learning theory and learning objects [an FD Learning Ltd. research paper]. Available at

http://www.fdlearning.com/fdlearning/html/company/features/l- theory-l-objects.pdf

Brogan, P. (1999) Using the Web for Interactive Teaching and Learning: The Imperative for the New Millennium (White Paper). San Francisco, California: Macromedia, Inc. Available on the Internet at: http://www.macromedia.com/resources/elearning/whitepapers/whitepaper_interactive.zip

Carnevale, D. (May 3, 2001). Some online educators turn to bite-sized instruction. The *Chronicle of Higher Education*. Retrieved August 6, 2002, from http://chronicle.com

Islam, K. (May 1, 2002). Is e-learning floundering? e-learning Magazine. Retrieved July 25, 2002, from http://www.elearningmag.com

Learnativity.com. How adults learn [some of the text is drawn from a Wave Technologies white paper cited below]. Available at http://www.learnativity.com

Learnativity.com. An introduction to Androgogy + Pedagogy. How adults learn [some of the text is drawn from a Wave Technologies white paper cited below]. Available at http://www.learnativity.com

Merrill, M. D. (1996). Instructional transaction theory: An instructional design model based knowledge objects. *Educational Technology*, 36(3), 30-37. [Also available at http://www.id2.usu.edu/id2/; articles referenced in summary are also available at this web site.]

Muzio, J., Heins, T. & Mundell, R. (January 2002). Experiences with reusable E-learning objects: From theory to practice. *The Internet and Higher Education*, 5(1), 21-34. Retrieved July 11, 2002, from ScienceDirect database. Also available on the Internet at http://www.cedarlearning.com/CL/elo/eLearningObjects_sml.pdf

Najarr, L. J. Principles of educational multimedia user interface design. Retrieved July 28, 2002, from Georgia Tech, Georgia Tech Institute Web site: http://wearables.gatech.edu/Papers/paperslist.html

Tuso, G. & Longmire, W. (2000). Competency-based systems and the delivery of on-line learning. In D. Brightman (Ed.), *Learning Without Limits, Vol. 3*. (pp. 33-38). San Francisco, CA: Informania, Inc. [See Informania, Inc. citation above.]

Young, J. R. (June 1, 2000). Merlot project brings peer review to web materials for teaching. *The Chronicle of Higher Education.* Retrieved July 11, 2002, from http://chronicle.com

Wave Technologies International, Inc. (1995, 1996). Learning: The critical technology [a whitepaper on adult education]. St. Louis, Missouri: M. L. Conner. Available at http://www.learnativity.com/download/Learning_Whitepaper96.pdf

Wiley, D. A. (2000). Connecting learning objects to instructional design theory: A definition, a metaphor, and a taxonomy. In D. Wiley (Ed.), *The Instructional Use of Learning Objects.* Available at http://reusability.org/read/ [A condensed version of this article, "Learning objects need instructional design theory," is also available at this web site.]

Zielinski, D. (September 2000). Objects of desire. *Training,* 37(9), 126-131. Retrieved July 07, 2002, from Business Source Premier database.

EFFECTIVENESS

… the application of the science of measuring learning and learning-related outcomes to the use of learning objects …

The summaries below may be indicative that more attention is being paid to the particular needs of and questions about measuring the effectiveness of electronically mediated learning. There appeared to be more literature about the effectiveness of design and delivery of learning objects than about actual learning outcomes.

Evaluation of Learning Objects and Instruction Using Learning Objects

David D. Williams

In this paper Williams links questions about evaluation with questions about the use and design of learning objects. The first three pages raise a number of stimulating questions that are then discussed within subsequent pages of the paper. The questions are relevant to issues, problems, practices, and theories that may hinder successful design, implementation, and evaluation of learning objects. Williams has the reader use an actual learning object, a pan balance, as an object for learning about evaluating learning objects. He observes that "once the questions regarding audience and their values and criteria are addressed, evaluation methodology is relatively straight forward." Assuming that this can be done, he focuses on steps of an evaluation sensitive to particular audience needs and values.

To set the stage for this discussion, Williams explores current thinking about evaluation; its relations to learning objects; and the nature of participant-oriented evaluation. Some of his basic points include the following: All evaluation boils down to the same end: "…comparing what something is to what it ought to be, in order to facilitate a judgment about the value of that thing" (p. 4). The challenge is to define the values of dimensions by which to describe or to decide "what" the object "ought to be." After values to be used in the evaluation process have been clarified, standards or principles need to be set for the evaluation process.

One approach to a contextualized evaluation is the participant-oriented approach; basic to all models within this category is that they address diverse values in a fair and systematic way. Williams proceeds from this latter point to show how blending Stufflebeam's CIPP (context, input, process, product) model with Patton's user-focused approach creates a powerful meta-model by which to design evaluations that meet the greatest needs of the most people at each stage of William's proposed evaluation model. The implications for application of the combined model are fleshed out with a hypothetical example employing the aforementioned pan-balance-as-learning-object. Shortly stated, Williams argues that the history of solid work in the field of evaluation suggests that the following three steps always be components of the design process for evaluation learning objects:

1) identify who will use and evaluate the learning objects;
2) assess how users define relevant learning objects and the criteria by which users judge them;

3) collect and use data about how the learning objects measure up to those criteria to make evaluation judgments in accordance with established meta-evaluation standards.

Shifting from questions about evaluation methodologies, Williams connects the developed themes to questions about learning objects. The concerns of instructors, students, and instructional support persons are discussed. While it is recognized that most research and development resides in the domain of instructional support services (including the work of instructional designers, librarians, technical specialists, etc.), Williams emphasizes that learners are "key users of evaluations of learning objects" (p. 14) and it is with this in mind that his paper continues.

He notes that at the heart of the evaluation task is figuring out 1) the users' interest; 2) the user's criteria for judging "evaluands;" and 3) the questions the evaluation might be organized around. Williams observes that one of the central reasons for attending to how diverse audiences define learning objects comes from a principle that context determines the value of a given learning object. Context makes learning objects meaningful to users; thus, evaluation must attend to this fact about learning objects and their judges.

Williams recognizes that value and interests conflicts may come into play, and for that reason, he notes that an evaluation process should allow users to make their decisions in concert with those of fellow users. The remainder of the paper provides guidelines for achieving such an outcome. An elaborate discussion of two alternative approaches to evaluating of learning objects based on a participant-model is provided: one is external and comprehensive and the other internal, immediate, and continuous.

For the full text, see http://reusability.org/read/chapters/williams.doc

Measuring E-Learning: The Third Wave
Josh Bersin
Bersin argues that e-learning is no longer simply a question of implementing or building content or an e-learning infrastructure but of finding and utilizing measurable business performance tools. In order to justify e-learning investments, Bersin encourages organizations to think of the investments not as training solutions but as performance solutions: What business problem needs to be solved? How can strategies be measured to assess whether or not you are solving the problem? Without asking what it is you want to achieve, measuring effectiveness or performance is difficult.

Examples of different performance goals are provided to show how different problems require different types of content, different levels of infrastructure, and different measurements. Bersin holds that decisions about measurement should be made at the outset so that evaluation is an on-going and formative process entailing attention to dynamic media, tracking, reporting, and other evaluation tools as needed. He concludes by noting that "today's e-learning infrastructure is still immature in the tools to analyze and measure results."

For the full text, see:

http://www.elearningmag.com/elearning/article/articleDetail.jsp?id=9554

Approaches to Evaluation of Training: Theory & Practice
Deniz Eseryel
In this article, Eseryel focuses on the evaluation of training programs from a broad, organizational perspective. He lists several barriers to successful and thorough implementation of evaluation: costs, time and commitment, lack of expertise, blind trust in training solutions, and lack of methods and tools. After listing six general approaches to evaluation, he continues with the pros and cons of systems-based and goals-based approaches to evaluation of training. A table relates the levels of evaluation to the various evaluation models. Citing several US and European studies, Eseryel notes a lack of systematic, thorough, and consistent application of evaluation models to look at the effectiveness of instructional interventions.

The author makes the case that automated expert systems could be applied to the creation of instructional evaluations. Automation might include not only the planning process but the data collection process as well. After receiving input from the evaluator, the expert system could guide the expert through the purpose of the evaluation, type of objectives, level of evaluation, type of instructional objectives, type of instructional delivery, and size and type of participant groups. Esyrel notes that in such a system it will be important to tag evaluation data, individual performance data, and revision items to learning objects in a training program to realize an effective expert evaluation system. In other words, course design, learning objects, and evaluation design and processes should be fully integrated to properly measure training or learning effectiveness.

For the full text, see http://ifets.ieee.org/periodical/vol_2_2002/eseryel.pdf

New Directions in Evaluation of the Effectiveness of Educational Technology
Walter F. Heineckde, Lara Blasi, Natalie Milman, and Lisa Washington
An outgrowth of the 1999 Secretary's Conference on Educational Technology, this white paper focuses on the evaluation of technology-based instruction in primary and secondary schooling. The following are listed as fundamental questions:

- How does technology impact student learning?
- What can we know about the relationship using data and tools available?
- What can we learn about the relationship in the future with new tools and strategies?

The authors argue that what should be measured should not be limited to experimental standards-based models but may need to include more complex, contextual performance-based evaluation methods: "Perhaps we should be developing technologically based performance assessments to measure the impact of technology on student learning." The goal is to think about broader and deeper learning outcomes that technology may facilitate such as higher order or metacognitive thinking skills. What needs to be worked out then is the purpose of education technology, so that those involved can decide what it is that will be measured, how it will be measured, and when.

They note that "just as technology has caused us to reevaluate the nature of knowledge and instruction, it prods us to reevaluate the forms of evaluation that are brought to bear when examining educational technology." In short, the authors argue that the question is not whether educational technology works but when and under what conditions it works. This leads to questions about when and by which methods learning technologies should be evaluated for learning outcomes. The paper concludes with recommendations for increasing formative practices.

For the full text, see:
http://www.ed.gov/Technology/TechConf/1999/whitepapers/paper8.html

SELECTED BIBLIOGRAPHY

Bersin, J. (March 1, 2002). Measuring e-learning's effectiveness. *e-learning Magazine.* Retrieved July 20, 2002, from http://www.elearningmag.com/

Bersin, J. (February 1, 2002). Measuring e-learning: The third wave. *e-learning Magazine.* Retrieved July 25, 2002, from http://www.elearningmag.com/

Eseryel, D. (2002). Approaches to evaluation of training: Theory and practice. *Educational Technology & Society*, 5(2). Available on the Internet at http://ifets.ieee.org/periodical/vol_2_2002/eseryel.pdf

Heinecke, W. F., Blasi, L., Milman, N., & Washington, L. (1999). New directions in the evaluation of the effectiveness of educational technology. Whitepaper presented at The Secretary Conference on Educational Technology, Washington, D.C. Retrieved July 27, 2002, from http://www.ed.gov/Technology/TechConf/1999/whitepapers.html

Kulik, C-L. C. & Kulik, J. A. (1991). Effectiveness of computer-based instruction: An updated analysis. *Computers in Human Behavior*, 7, 75-94.

Phipps, R., Merisotis, J. & Harvey, M. (2000). Quality on the Line: Benchmarks for Success in Internet-Based Distance Education. Washington, D.C.: The Institute for Higher Education Policy. Available on the Internet at http://www.ihep.com/Pubs/PDF/Quality.pdf

Ringstaff, C. & Kelley, L. (2002). The Learning Return on Our Educational Technology Investment: A Review of Findings from Research 2002. San Francisco, CA: WestED RTEC. Available on the Internet at: http://www.wested.org/online_pubs/learning_return.pdf

Stufflebeam, D. L. The relevance of the CIPP evaluation model for educational accountability. *Journal of Research and Development in Education*, 5(1), 19-25.

Williams, D. D. (2000). Evaluation of learning objects and instruction using learning objects. In D. Wiley (Ed.), *The Instructional Use of Learning Objects.* Available at http:///reusability.org/read/

POLICY & DIGITAL RIGHTS

…national or institutional policies, rules, and practices that encourage or inhibit the development of learning objects and repositories…

The documents and articles in this section may be useful in considering national or institutional policies, rules, and practices that could affect the development of learning objects and repositories. Considerable information exists on copyright law and intellectual property rights, as well as a good amount of literature on the implications of technology for traditionally conceived authoring rights. Literature focusing specifically on the policy implications of learning objects and learning object development, however, has proved very hard to find.

Who Owns On-Line Courses and Course Materials? Intellectual Property Policies for a New Learning Environment

Carol A. Twigg

This article is the result of a symposium comprised of faculty, administrators, lawyers, and business representatives and focuses on two questions: 1) who owns learning materials? and 2) how can institutions encourage faculty to create learning products of the highest quality that can be marketed in such a way that both the university and the faculty benefit at some level? Twigg begins her discussion of intellectual property rights of electronic material with four case studies to bring out current legal and policy issues. The article concludes with its recommendations for resolving issues about faculty and institutional property rights over knowledge products and processes.

The first case is about super-star faculty and describes a Harvard professor who placed one of his courses on a CD ROM for sale to a virtual university. The central issue is whether the faculty or the institution owns the product. The second case is about the use of an institutional brand name; this study focuses on the case of UNext.com, a company that pays universities for the authorization to use their name and the names of the professors to sell their product. The central issue concerns whether any academic values might be threatened. The third case is about CaseNET, a university-based project providing colleges, universities, and school districts a resource from which to purchase scenario-based materials and case studies. The significance of this case is that faculty or departments can run knowledge-based businesses from within the structure of the host institution. The question is raised about the integrity of the institution as it relates to faculty and department quality. The fourth case study concerns the Math Emporium, a Virgnia-Tech computer facility that teaches calculus to larges numbers of students at one time. Through this instructional use of technology, the need for instructors is reduced, with fewer "facilitators" needed to complement the individualized computer sessions.

In the latter half of the paper, a helpful distinction is made by the symposium between what constitutes a "course" and what constitutes "course material," a distinction that is consonant with debates about the nature of learning objects and their components. Two myths are dispelled. First, contrary to much of the literature available on knowledge economics, profit forecasts about the lucrative possibilities of knowledge products are

dismissed. Second, the concern that faculty will be replaced by CD ROM-based courses they themselves create is also dismissed.

Of interest in this article is the symposium's argument about the law on intellectual property rights. Simply stated, their view is that there is no real overriding precedent for either faculty rights to intellectual property or institutional rights under the *works made for hire* law. The consensus among those in the symposium is that faculty intellectual property rights should remain in the power of the faculty, the knowledge product creators, while allowing the ability of the hosting institution to exercise certain rights, without obtaining permission from the copyright owner. A list of the recommended rights is provided on the last page. It is worth underscoring the consensus among the symposium participants that faculty and their institutions will be best served by working things out among themselves, using the law only as a means to goals established before legal or policy consultation.

For the full text, see http://www.center.rpi.edu/ResMono.html

The Teacher's Outrageous Claim of Intellectual Property
David Wiley
In this article, the author argues that the very idea of intellectual property is incompatible with the idea of teaching. Citing a recent California law prohibiting unauthorized posting of class lecture notes, he argues that the Internet is an egalitarian facilitator of education opportunity through resource distribution. His point is that learning is a social activity and that old fashion notions of learning are outdated. Wiley's clear position is that teaching is synonymous with sharing, and as evidence that he "walks the walk," he posts all of his work for immediate access on the Internet.

For the full text, see http://wiley.ed.usu.edu/docs/teachers_claim.html

Fair Use Guidelines for Educational Multimedia
Chris Dalziel
In this article, the author, Executive Director for the Instructional Telecommunications Council, discusses the problem of faculty use of copyright material in educational multimedia presentations. The solution he offers is a set of guidelines developed by a working group of representatives from college and university media centers.

The guidelines allow for the following:

- an instructor may use copyrighted material for instructional purposes for up to two years before he or she must ask for permission to use it (this may be thought of as a kind trial period or free-use period); there are some limitations on the amount of copyright material one can use in a given presentation
- those wishing to commercially reproduce multi-media objects must first obtain permission
- whether a commercial or educational interest, those wishing to use copyright material should seek permission to do so as early possible for practical purposes

- when the instructional presentation is unfinished and contained in a limited access system, copyright permission is not required (i.e., so long as the instructional presentation is still in development and set within a closed system, copyright permission need not be obtained)

For the full text, see http://www.libraries.psu.edu/mtss/

Report on Copyright and Digital Distance Education.
US Copyright Office (1999)
The focus of this special report required under the Digital Millennium Copyright Act (DMCA), was on Section 403 (Limitations on exclusive rights; distance education) of the DMCA. Both the Act (95 pages) and the report (well over 300 pages) are lengthy and highly technical. This summary highlights topics from the Report's executive summary that may be of relevance to learning objects and repositories.

The report looked at problems in licensing copyrighted works, including locating copyright owners; the inability to obtain responses from copyright owners; and unreasonable prices. A related section focused on solutions to licensing problems, including using technology to protect works; using electronic copyright information systems; and creating an on-line licensing system. Additionally, technological security for distance education was discussed, and strategies such as creating a viable protection technology and having some way of limiting student access to information are included in the report.

The report notes that an example of creating a viable protection technology device would be a secure container. This device would allow the copyright owner to set rules for use of the work, and the rules would be attached to the copies of objects being accessed. (One example currently in use is the "view-only" access mode; many publishers let clients access materials via this mode before products go on the market.) Another example is the digital watermark. Watermarks provide a means by which copyright owners can track the use of their product along the chain of its use.

A major focus of the report centers on applications of the Copyright Law to distance education. The authors point out that decisions to use copyrighted material may be based on explicit consent from authors or may simply invoke an exemption policy. Relevant sections of the law are Sections 107 and 110. The intention of the law reflected in Section 110 is "to cover all of the methods by which performances or displays in the course of systematic instruction take place." Review of Section 110 indicates two exemptions from copyright law. The first concerns use of materials in a face-to-face, traditional classroom situation. The Section indicates that this use of copyrighted material does not require authorization. The second concerns performance or displays in instructional broadcasting. Both have certain limitations in the law. These limitations are primarily concerned with pre-digital forms of communication and instruction. Because only acts of performance and display are addressed, it does not authorize acts of reproduction or distribution. This is significant given the ease of such activity with digital technology and new concerns with the design, development, and reconfiguration

needs of ideal learning objects. Section 107 covers fair use, which is a broad and general limitation.

It should be noted that the international context of copyright policy is even more unclear given that legal jurisdiction had not been settled at the time that this document was written. However, the United States has signed two major treaties with respect to copyright: The Berne Convention and the TRIPs Agreement.

While most of the analysis in the Report was speculative at the time it was written, one very encouraging statement included the following:

> *As a fundamental premise, the Copyright Office believes that emerging markets should be permitted to develop with minimal government regulation. When changes in technology lead to development of new markets for copyright works, copyright owners and users should have the opportunity to establish mutually satisfactory relationships. (xiv)*

Other points of interest regarding the Report include the following. First, the Copyright Office recommended that exemptions of performance and display be broadened to include digital transmission and the rights of reproduction and distribution. Another point of interest regards the centrality of mediated instruction. This is the idea that the law protects copyright owners by making access to their work analogous to the manner in which such works are accessed in a live classroom. Indeed, one requirement that the Copyright Office recommended for elimination concerns policy on the physical classroom. An additional recommendation is that the scope of copyright policy be expanded to include categories of works covered beyond nondramatic and musical works.

For the full text, see http://www.loc.gov/copyright/disted/

Propagate Project

Education Network Australia

The Propagate Project (now completed) was established in late 1996 by two Australian Cooperative Multimedia Centres (Access CMC and Impart Corporation) with a grant from DETYA to work on ways to solve the many issues surrounding copyright and multimedia. The Propagate project team collaborated closely with counterparts working on the Imprimatur Project, supported by the European Union, which had done pioneering work in developing consensus-based abstract classifications for the various roles involved in trading intellectual property. Imprimatur had also developed a number of business and process models for various markets using these classifications.

Propagate aimed to solve the rights management problems of multiple media types in a digital environment and the reuse issues that is emerging in sectors such as education, science, and research. Propagate built on the Imprimatur project's abstract language and market business models, and in a coordinated effort, developed an architecture for managing and trading rights and the assets to which such rights are attached.

For a description of this and other Australian Intellectual Property Management Issue projects, see http://standards.edna.edu.au/reference/projects.html#ipmi

Imprimatur Project

European Union

The Imprimatur project was co-ordinated by the Authors' Licensing and Collecting Society (ALCS), an organization in Britain which represents the interests of authors. In English law, the term Author embraces a wide variety of creative disciplines. The project was launched by The European Commission DG III under the ESPRIT program and is now complete.

The Imprimatur acronym spells out: Intellectual Multimedia Property RIghts Model And Terminology for Universal Reference. This is because the project aimed to finish its life with a prototype (the rights model) that would work across all platforms together with internationally agreed standards defining its use (universal terms).

For additional information, see http://www.imprimatur.net/index.htm

SELECTED BIBLIOGRAPHY

Daziel, C. Fair use guidelines for educational multimedia. Retrieved August 2, 2002, from Penn State University, Media & Technology Support Services Web site: http://www.libraries.psu.edu/mtss/

Digital Millemium Copyright Act of 1998, H.R. 2281. Available via the Copyright Office website page on Copyright and Distance Education: http://www.loc.gov/copyrigh/disted

No author (1998). The Learning Age: A Renaissance For A New Britain. London: Department for Education and Skills. Available on the Internet at http://www.lifelonglearning.co.uk/greenpaper/

Twigg, C. A. (2000). Who owns online courses and course materials? Intellectual property policies for a new learning environment. [A report funded by a grant from the PEW Charitable Trusts under The Pew Learning and Technology Program 2000]. Available from the Rensselaer Polytechnic Institute, Center for Academic Transformation web site: http://www.center.rpi.edu/ResMono.html

U.S. Copyright Office, (May 1999). *Report on Copyright and Digital Distance Education.* Available at Available via the Copyright Office website page on Copyright and Distance Education: http://www.loc.gov/copyright/disted/ [See article for reference of pertinent documents in Appendix of Report]

Wiley, D. (October 2000). The teacher's outrageous claim of intellectual property: A response to Deflem and others. Retrieved July 4, 2002, from http://wiley.ed.usu.edu/writings2.pl

LEARNING TECHNOLOGIES & TOOLS

…software and techniques used to create effective learning objects…

The literature on tools for the development of learning objects and learning object repositories overlaps a great deal with that of standards and pedagogy. The following articles were selected for inclusion here because their focus was more directly on the creation of learning objects.

A Primer on Learning Objects

Warren Longmire

In this paper, excerpted from Informania's *Learning Without Limits, Volume 3*, Longmire discusses some of the challenges and opportunities faced by developers of "object-based" learning content. The opportunities listed center around the idea that adding layers or capability to learning objects adds value to them because they can be reused and thus provide a higher return on investment. He provides short explanations of how flexibility, ease of updates, searches, and contents, customization, and interoperability, and facilitation of competency-based learning add value to learning objects when industry wide-standards are implemented and adopted. Pointing out the link between object content and meta-data tags, he notes that the "most desirable tools [for authoring and meta-tagging] will permit scalable contextualization so that learners can control the extent to which the context is presented with context" (p. 3). After citing a list of an "RLO's" (Reusable Learning Object) ideal attributes, he comments on related challenges and opportunities.

The last part of the paper looks at the creation of "context." Recognizing the need for some context to avoid confusion, error, and complete loss of meaning, Longmire asks how context can be scalable in expanse and type, so that the learner can decide how much is needed. Pointing to constructivist theories about individual meaning-making, he provides a sketch of some approaches content developers might adopt: tailored wrappers, tailored context frames, adding context links to objects, and pattern templates. He concludes by observing the need to combine "thoughtful planning with intelligent deployment of advanced authoring tools…"

For the full text, see http://www.learningcircuits.com/mar2000/primer.html

A Component Repository for Learning Objects: A Progress Report

Jean R. Laleuf and Anne Morgan Spalter

This article may be thought of as a case study related to the mechanics and process of developing quality content objects. Laleuf and Spalter voice concerns about the complexity and challenges of creating comprehensive, quality object repositories. They stress the importance of collaboration and raise the following questions:

- How does one analyze current simulations for decomposition into reusable components?
- How can one design components to be useful for educators (as well as programmers)?

- How does one choose a proper level of granularity?

In examining these questions, the authors highlight previous work and challenges regarding programs, tools, and techniques. Special attention is given to component categorization strategy, support technologies, application technologies, and granularity strategy. The authors present a case study involving "a set of applets that teach students in an introductory graphics course about 3D camera transformations" (p. 35). Reference is made to text illustrations, in-class models, and customized software. The authors proceed to discuss how a minimally successful content object was enhanced by engaging in a formal design process linking pedagogical considerations to component design. This section of the article ends with a discussion of reusability outcomes and future work to be done on developing like content objects for the science and mathematics repository they envision. Special attention is given to the need for work on molecular visualization applets; increasing compatibility efforts; and metadata standards for harvesting.

The authors conclude on a hopeful note about the development of quality content objects and repositories but point to challenges an object-based approach to content development presents to designers, programmers, and institutional resources. As programs, applications, and tools are refined through application by and feedback from content creators (and vice versa), the authors are hopeful that the extra time and resources spent will prove most beneficial.

For the full text, see:
http://portal.acm.org/citation.cfm?id=379444&coll=portal&dl=ACM&CFID=3797848&CFTOKEN=8021677#FullText

Creating Learning Objects With Macromedia Flash MX
Tanya Heins & Frances Himes
Heins and Himes begin this whitepaper by noting the challenge of finding authoring tools to develop standards-based, on-line content that can be reused in multiple contexts; that is high in quality; and that is transferable across various platforms and devices. While it is technically possible to develop, design, deploy, and transfer content, the authors feel that a new paradigm must be adopted—one that shifts content design from the "traditional linear 'course' approach to a more granular, component approach" (p. 1).

Noting the Masie Center's work in clarifying standards, the authors describe an "anatomy" of learning object design and development. A graphic illustration highlights the connection of learning, practice, and assessment to a learning objective; it also indicates the role of metadata and the significance of interoperability with management systems and databases. Citing the need to "draw upon shared templates and development methodologies, code resources, and media assets," the authors note the need for powerful and flexible development tools. This need is linked to the quality, utility, and value of content objects.

Macromedia Flash and Macromedia Flash MX are provided as examples of tools that can address this need. Topics covered in this section of the paper include rapid development environments, libraries, movie clips, components, action scripts, and bandwidth.

Reference is also made to HTML publishing, JavaScript, and SCORM-compatible LMS products. The dynamic instructional potential of content is strongly emphasized as a benefit of using Macromedia Flash MX.

After providing a list of questions that should be asked before embarking on the development of a learning object, the second half of the paper discusses the process of developing and distributing learning objects from a systems point of view. The authors interweave discussion, graphics, and a hypothetical case study to point out the following key stages: pre-assessment; analysis and design; development; learning interactions; implementation and evaluation; and maintenance.

Hines and Himes conclude with a further but unexamined list of the possibilities an authoring tool such as Macromedia Flash MX holds. It should be noted, however, that a basic familiarity with programming or software applications may be helpful to understanding the more technical portion of the paper.

For the full text, see:
http://download.macromedia.com/pub/solutions/downloads/elearning/flash_mxlo.pdf

SELECTED BIBLIOGRAPHY

Brightman, D. (Ed.). *Learning without limits, Vol. 3.* Informania, Inc. San Francisco, CA. Available via the Learnativity.com web site at http://www.learnativity.com/lwol.html

Macromedia, Inc. (April 2002). Creating learning objects with Macromedia Flash MX [a white paper]. San Francisco, CA: Tanya Heins & Fraces Himes. Available at http://download.macromedia.com/pub/solutions/downloads/elearning/flash_mxlo.pdf

Laluef, J. R. & Splalter, A. M. (2001). A component repository for learning objects: A progress report. Paper presented at the proceedings of the ACM/IEEE Joint Conference on Digital Libraries, Roanoke, VA, USA. Available at http://portal.acm.org/citation.cfm?id=379444&coll=portal&dl=ACM&CFID=3797848&CFTOKEN=8021677#FullText

Longmire, W. (March 2000). A primer on learning objects. *Learning Circuits Webzine.* Retrieved July 20, 2002, from http://www.learningcircuits.com/mar2000/primer.html

Longmire, W. (2000). Content and context: Designing and developing learning objects. In D. Brightman (Ed.), *Learning Without Limits*, *Vol. 3.* (pp. 23-33). San Francisco, CA

FUNDING AND DEVELOPMENT LINKS

This section, while not a comprehensive listing, provides links to several of the agencies funding development work in learning objects and learning object repositories.

Australia
Commonwealth Minister for Education, Science, Training.
http://www.detya.gov.au.ministers.nelson.main.asp

Commonwealth Department of Education, Science, and Training.
http://www.detya.gov.au/

Canada
CANARIE
Funding Programs
http://www.canarie.ca.funding/funding.html
http://www.canarie.ca/about/quick-refernce.html

European Union
eLearning Initiative
http://europa.eu.int/eur-lex/en/com/cnc/2001/com2001_0172en01.pdf
Actions and programs
http://europa.eu.int/comm/education/elearning/annex_en.pdf

United Kingdom
British Education Communications Technology Agency (BECTa)
http://www.becta.org.uk

Department for Education and Skills (DES)
http://www.ufiltd.co.uk/press/facts/default.asp

Joint Information Systems Committee (JISC)
http://www.jisc.ac.uk/
Current Strategic Issues
http://www.jisc.ac.uk/curriss/index.html
Opportunities for Funding/Funding for Projects
http://www.jisc.ac.uk/general/proj_funding.html

Learning Skills and Development Agency (LSDA)
http://www.lsda.org.uk/home.asp

United States
US Department of Commerce
http://www.commerce.gov/

National Institute of Standards and Technology
http://www.nist.gov/
Advanced Technology Program (ATP)
http://www.atp.nist.gov/atp/

US Department of Commerce (continued)

Technology Opportunities Program (TOP)
http://www.ntia.doc.gov/top/index.html

US Department of Education
http://www.ed.gov/

FIPSE
http://www.ed/gov/offices/OPE/FIPSE/welcome.htm
LAAP
http://www.ed.gov/offices/OPE/FIPSE/LAAP/overview.html

National Science Foundation (NSF)
Overview of Grants and Awards
http://www.nsf.gov/home/grants.htm

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