Instructional Repositories and Referatories

Joseph Hart, Eastern Oregon University

Bob Albrecht, ECAR

ECAR

Overview

This research bulletin examines the growing world of online repositories and referatories and explores their impact on faculty, students, IT support, and institutional policies and procedures.

While the number and size of these online instructional collections is growing rapidly, the nature of these relatively new tools remains a mystery to many. An instructional repository is an organized collection of online teaching materials; an instructional referatory is a gateway for locating and using repositories. At global repositories such as MERLOT,[1] the Multimedia Educational Resource for Learning and Online Teaching, and MIT's OpenCourseWare,[2] the instructional materials are freely available for evaluation, downloading, and selective adoption into local courses. Referatory sites such as the EduResources Portal[3] or the Hong Kong University Web Tools for Learning[4] contain browseable and searchable entries to a multitude of online repositories along with guidelines about how best to find and use online instructional resources.

Institutional policies may need to change to accommodate these new opportunities for importation, just as faculty may wish to reconsider notions—and even values—of local origination. Curricular control and the design of courses still rest with the individual faculty member, but pieces of redesigned courses may be drawn from multiple repositories. For some faculty, this may seem little different from importing class material from the Web during a class; for others, it may seem like an entirely new process. In any event, institutional policies regarding copyright and various forms of ownership acknowledgment must be reviewed. In institutions where even local course content is closely monitored, the importation of content may raise further procedural and control issues, if not the issue of governance itself.

What could be more important to faculty and the institution as a whole than potential changes in the sources of course content, the development of curricular material, and the ownership of the offering by the faculty to the students? Further, the importation, ownership, and delivery of such material extend the IT support functions.

In this research bulletin we will define important terms; offer examples of repository and referatory sites; demonstrate what these sites offer; discuss the potential impacts these resources have for faculty and students; and consider these resources' benefits, challenges, and opportunities for institutions and IT staff.

# Highlights of Instructional Repositories and Referatories

Definitions. The domain of online instructional resources is replete with unusual terms, abbreviations, and acronyms. Exploring terminology is a useful first step toward identifying some of the parameters, contributors, and issues in the field. Below is a glossary of terms used frequently in this research bulletin.

Table 1. Terms and Definitions

Term	Definition	Example/Reference URL
Repository	Organized collection of instructional resources	MERLOT (http://www.merlot.org/)
Referatory	Gateway and guidelines to instructional repositories	EduResources Portal (http://sage.eou.edu/SPT/) Web Tools for Learning (http://wwwtools.cityu.edu.hk/) RDN Virtual Training Suite (http://www.vts.rdn.ac.uk/)
Digital library	Topical collection of scholarly digital resources	Einstein Archives Online (http://www.alberteinstein.info) DSpace MIT (http://www.dspace.org/) California Digital Library (http://www.cdlib.org)
EduResources	Portal or referatory that focuses on links to higher education repositories and referatories	http://sage.eou.edu/spt/SPT--BrowseResources.php
iLumina	Digital library of sharable undergraduate teaching materials for chemistry, biology, physics, mathematics, and computer science	http://turing.bear.uncw.edu/iLumina/index.asp
LOs	Learning objects	C. Holden, "Global Learning Repositories Summit" (http://www.academiccolab.org/resources/FinalSummitReport.pdf)
LOM	Learning object metadata standard	IEEE Learning Technology Standards Committee (http://ltsc.ieee.org/)
LOR	Learning objects repository	CAREO—Campus Alberta Repository of Educational Objects (http://careo.ucalgary.ca/)
MLX	Maricopa Learning Exchange, a warehouse of learning "packages"	http://www.mcli.dist.maricopa.edu/mlx/about.php
MERLOT	Multimedia Educational Resource for Learning and Online Teaching (MERLOT), a global repository	http://www.merlot.org/
MERLOT TWO	MERLOT "teaching well online," a resource to assist instructors to find and use the resources within MERLOT	http://www.merlot.org/Home.po?discipline=TWO
Metadata	Information about resources formatted in eXtensible Markup Language (XML)	University of Victoria Guide to Metadata Standards (http://www.mvoice.com/metadata)
OCW	OpenCourseWare, MIT's global repository of educational resources	http://ocw.mit.edu/
RLOR	Reusable learning object repository	D. A. Wiley, "The Instructional Use of Learning Objects" (http://reusability.org/read/)
Scirus	Science-specific search engine	http://www.scirus.com/
SCORM	Sharable content object reference model	Academic Advanced Distributed Learning Co-Lab (http://www.academiccolab.org)
Scout Archives	Instructional resources search engine	http://scout.wisc.edu/Archives/
WIRs	Web instructional resources	Example: MIT's OpenCourseWare (http://ocw.mit.edu/)
World Lecture Hall	Repository organized by courses, lectures, and syllabi rather than learning objects	http://www.utexas.edu/world/lecture/

The site map provided at the EduResources[5] portal referatory (see Figure 1) and the 15 browsing categories describe the variety and prolixity of sites and terms that make up the world of Web instructional resources. EduResources focuses on links to higher education repositories and referatories: as of this writing, 35 general repositories are described, and 41 referatories are included. These numbers increase each month. The portal includes only a sampling of 40 discipline-specific repositories among the thousands available but identifies search engines such as the Scout Archives[6] and the science-oriented Scirus[7] search engine that direct potential users to discipline-specific sites. Institutional sites—built for use within institutions—have not been included in this research bulletin.

Figure 1. Site Map for EduResources Portal
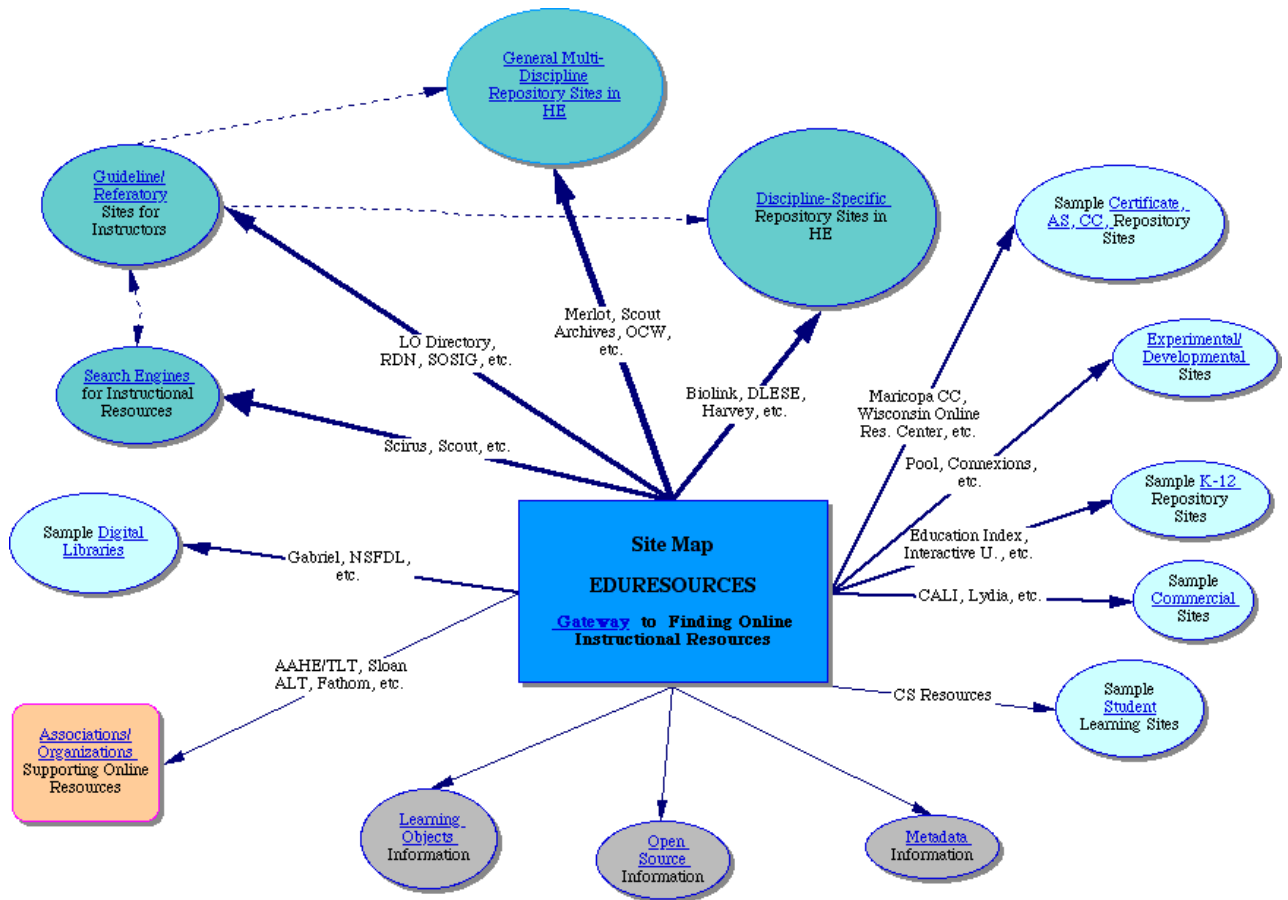
Used by permission of EduResources

In this bulletin, we use the broad phrase Web instructional resources (WIRs) to encompass all kinds of online teaching resources; anything digital that can be applied to instruction can be considered a WIR and be included in a repository. The narrower term learning object (LO) refers to a specific learning instrument or module that can be placed within various instructional contexts. Learning objects are digitally stored in learning object repositories (LORs); RLORs emphasize the reusability of the objects. Some professionals emphasize the interchangeability of learning objects according to certain metadata specifications (such as SCORM) and do not recognize learning objects that

are not constructed according to those standards or learning object repositories that do not follow such standards. Other repositories such as MIT's OpenCourseWare[8] (OCW) or the older World Lecture Hall[9] organize their collections around more traditional units such as courses, lectures, and syllabi rather than learning objects. At MIT's OpenCourseWare, a course may contain specific teaching units that meet learning object standards, but the organizational principle of the OpenCourseWare repository is the course, not the learning object.

Another often-used term is digital library. A major effort of the National Science Foundation in the United States is the NSF Digital Library Project designed to construct repositories of exchangeable instructional resources in the sciences and related areas. But not all digital libraries are intended to be collections of instructional resources. Some are, but most are banks of collected scholarly resources such as the Einstein Archives Online at Cal Tech.[10] Of course, the contents of any digital library may be adapted for instructional purposes, but only those resources specifically constructed to aid instruction are included in instructional repositories. A piece of chalk is not something that could be included in a digital library or in an online instructional repository, but a digital picture of a piece of chalk might well be included, especially if it were contextualized within a module about the growth of instructional technologies or about communication.

Even the terms repository and referatory are used somewhat differently by different authors; some writers restrict the term repository to online collections that contain the learning materials and use the term referatory to describe online collections of links to learning materials. Within this definition, MERLOT would be a referatory, not a repository, because it contains no learning materials itself, only pointers to sites where materials are stored. In this bulletin we use the term repository more broadly to include sites that contain pointers, while using referatory to describe sites that contain guidelines and links to repositories. Users may not care whether they are taking one or two steps in locating an instructional resource, as long as the resources can be quickly located, are pedagogically valuable, and are easily adapted to their needs. The best repository is the one that contains what an instructor is looking for; next best is the repository that leads an instructor to consider something of value that she wasn't looking for. Repositories need to satisfy both the need for efficiency (with searching) and the need for serendipity (with browsing).

These theoretical concerns about definitions are important, as are the many concerns about metadata standards for identifying learning objects,[11] but repositories and referatories are growing at a rapid rate without waiting for these theoretical disputes and practical issues to be resolved. Faculty members are using online instructional resources right now and are likely to use them much more as repositories and referatories proliferate and as the existing ones multiply their holdings. We examine some of these issues by sampling what is already available.

Four Selected Examples of Web Instructional Resources

The variety of online instructional resources that can be located within the available repositories is dazzling and enticing. The digital materials in repositories include

software, multimedia packages, textbooks, syllabi, quizzes, simulations, lesson plans, lecture notes, audio/video lecture archives, and more.

Example 1: Calibrated Peer Review (CPR). MERLOT offers the Calibrated Peer Review (CPR) software[12] developed at UCLA. "CPR is based on the model of peer review in science. The student reads a document, either online or hard copy, then writes about it. When the student has demonstrated competence as a reviewer, the program delivers three peer documents on for review. The student answers content and style questions and assigns scores. Finally, the student does a self-review. The student grade comes from writing and reviewing. … Although CPR was designed for use in large chemistry classes, experience has shown that it can serve in many other disciplines, as well. Currently, business, chemistry, economics, English, and life science instructors are using CPR in college, graduate and professional, high schools and middle schools. CPR was developed in the Chemistry Department at U.C.L.A. with funding provided by the National Science Foundation and Howard Hughes Medical Institute."[13]

Example 2: *Structure and Interpretation of Computer Programs*. At MIT's OpenCourseWare site more than 500 complete courses are available for review; MIT plans to arrive at a full listing of more than 2,000 courses within a few years. Among the many, many interesting courses is *6.001 Structure and Interpretation of Computer Programs*,[14] the first required core course for all undergraduates in electrical engineering and computer science. The resource material includes a full online version of the textbook for the course, the second edition of *Structure and Interpretation of Computer Programs* by Abelson, Sussman, and Sussman. The course is described as having "virtually all of its course materials online, including projects and supporting documentation." An online syllabus, course calendar, readings, lecture notes, recitations, exams, projects, and tools are all included for any instructor or students to examine. The purposes of the course are amply presented: "This course introduces students to the principles of computation. Upon completion of 6.001, students should be able to explain and apply the basic methods from programming languages to analyze computational systems, and to generate computational solutions to abstract problems." It is not surprising that students and instructors from all over the world are visiting OCW to take advantage of course materials such as those in 6.001.

Example 3. MLX, the Maricopa Learning eXchange,[15] is a valuable collection and entryway to the use of online learning resources; it is one of several contributions created by the Maricopa Center for Learning and Instruction (of the Maricopa Community Colleges) to assist instructors in locating and using online materials. MLX includes a tour to orient the user and a search function to locate the "packages" of learning materials. The top page of MLX can quickly display a random selection, or the newest packages, or the most popular packages to sample what is stored at the site.

One of the most popular, often-used learning packages included is item 276*, Writing HTML*, which is described as a "complete tutorial for creating web pages, which we have been providing and improving since 1994. 'Writing HTML' will walk you from the basics of HTML tags through complex concepts such as JavaScript and multimedia, and along the way you will build a web site about Volcanoes."[16] MLX is also set up to allow visitors

to read or write comments that provide feedback about the packages; additionally, instructors who adopt a package can link from their own learning site to the MLX package that they are using to provide "trackback"[3] showing other potential users how the learning materials can be adapted in different settings.

Example 4. iLumina,[17] an NSF digital library site, contains educational resources for science and mathematics. The site description for iLumina states that it is "a digital library of sharable undergraduate teaching materials for chemistry, biology, physics, mathematics, and computer science. … These resources range in type from highly granular objects such as individual images and video clips to entire courses. Resources in iLumina are cataloged with IMS-compliant metadata, which captures both technical and education-specific information about each resource." Included among iLumina's holdings is item 1600, *Forest Simulator Software and Curriculum Materials*. "The SimForest project is an NSF-funded project aimed at developing simulation-based software to support inquiry learning. The project Web site has four parts: 1) software development, 2) curriculum development, 3) teacher professional development and classroom implementation, 4) research results. The SimForest software: Students can plant trees from a pool of over 30 regional species, set environmental parameters such as rain fall, temperature, and soil conditions, and watch the forest plot grow and evolve over many years. A forest plot's sensitivity to natural and man-made disturbances can be evaluated, and emergent properties such as species succession can be observed. Graphing and analysis tools are provided to make inquiry more efficient. There are two versions of the SimForest educational simulation that you can download from this site: the 'back box' simulation and the 'glass box' simulation. In the more advanced glass box version learners can inspect and modify the underlying forest growth model."[18]

Discipline-Specific and General Repositories. All of the repositories cited in the four examples are general, multidiscipline collections, but there is another very important type of collection, the discipline-specific repository. The Scout Archives, mentioned earlier, provides a search tool for locating discipline-specific instructional resources; it currently contains almost 17,000 resources that can be browsed using Library of Congress subject categories (from A to Z) or searched. Another long-established discipline-specific repository is the Harvey Project, "An international collaboration of educators, researchers, physicians, students, programmers, instructional designers and graphic artists working together to build interactive, dynamic human physiology course materials on the Web."[19] Another excellent discipline-specific repository is HEAL, the Health Education Assets Library,[20] which is sponsored by the NSF as a National Science Digital Library project. HEAL contains resources for medical education. The site contains building-block multimedia items such as images, videos, and animations, plus textual materials such as case studies and quizzes. The current target audience includes pre-med students, medical students, and medical professionals, but the site plans to expand to include other education levels.

Blending Repository and Referatory Functions. Most general repositories number their contents in the thousands, and most discipline-specific repositories contain hundreds of resources. It is very likely that these numbers will increase rapidly during the next five to 10 years. With the number and holdings of repositories increasing,

potential users are facing a daunting problem—how to find what they need. In response to this need several of the largest repositories have added user guidelines and links to resources outside their own holdings.

The largest of the current repositories are adding their own referatories to instruct users how to search/browse/apply their contents. MERLOT has added the referatory MERLOT TWO[21] (TWO stands for teaching well online) to assist instructors to find and use the resources within MERLOT. The United Kingdom's RDN Virtual Training Suite (VTS)[22] referatory offers tutorials about locating materials on the Internet on a variety of subjects. VTS is a gateway to a variety of U.K. resource repositories in various subject areas: BIOME for the health and life sciences; EEVL for mathematics, engineering, and computer science; HUMBUL for the humanities; PSIgate for the physical sciences; and SOSIG for the social sciences are important multidiscipline repositories. All are funded by the Joint Information Systems Committee (JISC) and by host institutions.

Boyer's *Scholarship of Instruction*. In the 1980s when Ernest Boyer was first advocating for an expansion of thinking about the meaning of scholarship and arguing for an appreciation of the "scholarship of instruction," the Internet had not yet grown in popularity, among neither the general public nor the academic community, and the Web had not yet been created.

The contemporary availability of ready communications on the Internet plus the accessibility of open instructional resources on the Web gives new meaning to the scope and impact of sharing the scholarship of instruction. Boyer argued for the importance of scholarship for teaching:

> While not all professors are likely to publish with regularity, they, nonetheless, should be first-rate scholars. We understand this to mean staying abreast of the profession, knowing the literature in one's field, and skillfully communicating such information to students…. Further the results of such scholarship should be made available for judgment…. This is the point: Scholarship is not an esoteric appendage; it is at the heart of what the profession is about. All, throughout their careers, should, themselves, remain students. As scholars, they must continue to learn and be seriously and continuously engaged in the expanding intellectual world. This is essential to the vitality and vigor of the undergraduate college.[23]

It is now possible for an instructor at one institution to carefully examine how courses that he teaches are taught at many other institutions; instructors can compare how courses are organized and evaluate what teaching materials are utilized. Part of the scholarship of instruction has become staying abreast of a wide range of resources and teaching approaches—and adopting open resources that enhance instruction. It is also now technically feasible for instructors to widely share their instructional materials in the same way that, in the past, they shared their research. Many repositories contain built-in tools facilitating the collection of peer reviews and user evaluations of shared materials; some repositories can also track how often particular items are viewed and downloaded. The scholarship of instruction can be made a more central part of the tenure and promotion evaluation process because the candidates' teaching constructions are

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published and available for review in the same way as are their research and scholarly writings.

Repositories and Referatories Are for Students, Too. Students and professionals are learning that they don't need to be enrolled in an institution's courses to use its online instructional resources. MIT has become a mecca for self-instruction as students and instructors from all over the world avail themselves of the freely available course materials from MIT's OpenCourseWare. Similarly, MERLOT and other repositories are visited by students as well as instructors. Any university that opens a repository or referatory that becomes well-known will need to prepare for sizable traffic patterns on its servers.

What It Means to Higher Education

Repositories and referatories are an important step, perhaps the next big step, in the way that technology is changing teaching and learning. Along with other new technologies, they provide the academy with opportunities for significantly altering the one faculty member/one classroom paradigm. Course management systems such as WebCT and Blackboard make it relatively easy for instructors to create Web-based courses and to blend on- and off-campus instructional tools. However, the materials stored in those systems are not readily available to users outside the system. General repositories make instructional materials shareable beyond a single course or a single institution.

Including Web instructional resources in course content does not, in itself, alter the role of the instructor. However, using instructional resources developed by others and stored in a repository can be seen as challenging the faculty definition of "my course." The role of the faculty member shifts slightly or greatly as the source or size of the objects changes. While the use of textbooks written by "outside" authors has long been accepted, the use of imported objects or courses is sometimes viewed as problematic.

Faculty and administrators, as well as accreditors, have been cautious about course content not developed by institutional faculty. Web instructional resources of any size may result in concerns over faculty control of curriculum, even though the resources are selected and adapted by institutional faculty.

The growth of repositories is likely to bring new challenges to support units. While the "early adopters" may have the expertise to import contents from repositories, many faculty members will need additional support. Furthermore, advice must be available for the faculty member who is unfamiliar with the copyright issues related to use of certain resources. As repository and referatory construction software becomes more available and easier to use, early adopters will want to construct their own repositories and referatories specific to local courses and programs.

Institutional policies generally reflect the academic culture, and that culture has particularly supported the individual faculty member's development of the courses that he delivers. There has been a history of shared or central development of courses, but

in recent decades the best known examples come not from research universities but from the University of Phoenix, the Open University, and other nontraditional institutions. Widespread use of learning resources taken from repositories outside the faculty member's institution might well prompt institutions to examine intellectual property policies as well as to review issues related to importation of content. Individual faculty members as well as academic departments may hold the key to the acceptance of imported objects into courses, just as they have accepted or rejected the importation of online materials into their classrooms.

Key Questions to Ask

- What are the institutional advantages and possible disadvantages in having instructors use instructional repositories?

- What are the institutional points of resistance to the use of online instructional resources?

- What centralized and decentralized support does the faculty have in locating and using instructional repositories and referatories?

- Which departments contribute to supporting the use of instructional repositories and referatories?

- What software is available to allow faculty to create their own repositories or referatories?

- How will downloaded learning objects from repositories be used in conjunction with the campus course management system?

Where to Learn More

- E. Boyer, *Scholarship Reconsidered: Priorities of the Professoriate* (San Francisco: Jossey-Bass, Inc., 1990).

- C. Holden, "From Local Challenges to a Global Community: Learning Repositories and the Global Learning Repositories Summit," the Academic ADL Co-Lab, November 11, 2003, <http://www.academiccolab.org/resources/FinalSummitReport.pdf>.

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- D. Norris et al., "A Revolution in Knowledge Sharing," *EDUCAUSE Review*, Vol. 38, No. 5, 2003, pp. 14–26.

- D. A. Wiley, ed., *The Instructional Use of Learning Objects*, AIT/AECT, 2001; online version available at <http://reusability.org/read/>.

1. MERLOT, the Multimedia Educational Resource for Learning and Online Teaching, <http://www.merlot.org/>.

2. MIT's OpenCourseWare, <http://ocw.mit.edu/>.

3. EduResources Portal, <http://sage.eou.edu/SPT/>.

4. Hong Kong University Web Tools for Learning, <http://wwwtools.cityu.edu.hk/>.

5. EduResources Portal, <http://www.eou.edu/~jhart/sitemap.htm>.

6. Scout Archives, <http://scout.wisc.edu/Archives/>.

7. Scirus search engine, <http://www.scirus.com/>.

8. OpenCourseWare from MIT, <http://ocw.mit.edu/>.

9. World Lecture Hall, <http://www.utexas.edu/world/lecture/>.

10. Einstein Archives Online at Cal Tech, <http://www.alberteinstein.info/>.

11. See the IEEE Learning Object Metadata (LOM) Standard, IEEE Learning Technology Standards Committee, <http://ltsc.ieee.org/wg12/index.html>.

12. Calibrated Peer Review (CPR) home page, <http://cpr.molsci.ucla.edu/>.

13. MERLOT's listing of Calibrated Peer Review from UCLA, <http://www.merlot.org/artifact/ArtifactDetail.po?oid=3000000000001037412>.

14. MIT course 6.001 Structure and Interpretation of Computer Programs, Fall 2002, <http://ocw.mit.edu/OcwWeb/Electrical-Engineering-and-Computer-Science/6-001Structure-and-Interpretation-of-Computer-ProgramsFall2002/CourseHome/index.htm>.

15. MLX, the Maricopa Learning eXchange, <http://www.mcli.dist.maricopa.edu/mlx/about.php>.

16. Package 276, "Writing HTML," <http://www.mcli.dist.maricopa.edu/mlx/slip.php?item=276>.

17. iLumina, <http://turing.bear.uncw.edu/>.

18. Simulation 1600: Forest Simulator Software and Curriculum Materials, <http://turing.bear.uncw.edu/iLumina/partial_metadata.asp?rid=1600>.

19. The Harvey Project, <http://www.harveyproject.org/>.

20. HEAL, the Health Education Assets Library, <http://www.healcentral.org/>.

21. MERLOT TWO, <http://www.merlot.org/Home.po?discipline=TWO>.

22. The United Kingdom's RDN Virtual Training Suite referatory, <http://www.vts.rdn.ac.uk/>.

23. E. Boyer, *College: The Undergraduate Experience in America* (New York: Harper & Row, 1987), p. 131.

Joseph Hart (jhart@eou.edu) is Director of Special Programs, Division of Distance Education, Eastern Oregon University, and Bob Albrecht (ralbrecht@idcomm.com) is an ECAR Senior Fellow.