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Open courseware and shared knowledge in online education:

The Utah open-source, Java-based learning management system

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Abstract

In sharp contrast to commercial influences in online education, vigorous shared knowledge communities, intended to facilitate teachers creating online learning contexts by sharing materials, have emerged. As part that movement, the Utah Learning Management System (U-LMS) is an open code online learning management system which uses the same architectural philosophy as the Open Knowledge Initiative. The U-LMS software infrastructure can be used to create learning contexts to support classroom courses or to create fully-online courses. Current U-LMS components are written in Java 1.1.5, dynamically driven by Oracle 8.1, and deployed on an Apache 1.3 server running on a Sun Solaris 7.

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In the face of ever-increasing competition and encroachments from both commercial knowledge vendors (Arnone, 2001; Olsen, 2001b) and electronic mega-universities (McMollum, 1998) an academic community of shared content knowledge (Young, 2001b; Malloy & Hanley, 2001) and open code software is emerging (Young, 2001b). By long-established classroom tradition, tied to academic freedom, courses are designed by individual teachers in accordance with individual pedagogies and institutional standards. The purpose the Utah Learning Management System (U-LMS) is to help any teacher or any institution, however large or small, to continue for online courses this classroom tradition of free thought and individual expression.

Commercial Learning Management Systems. Course Management Systems (CMS's), also known as Learning Management Systems (LMS's), are the software suites that form the infrastructure for online courses. Commercial examples of CMS's include WebCT ([www.webct.com/](http://www.webct.com/)), eCollege ([www.ecollege.com/](http://www.ecollege.com/)) and Blackboard ([www.blackboard.com/](http://www.blackboard.com/)). Components of LMS's minimally include communication functionality, such as email, distribution lists, discussion forums, and live chat, and capabilities for delivering written, pictorial, and video content, and administrative tools (Klobas & Renzi, 2000, pp. 47-50). LMS's allow teachers to develop and administer online courses; it is teachers who must provide course content. Nevertheless commercial LMS's are selling course content that plugs into their LMS interfaces. For example, Blackboard currently advertises 51 content "cartridges" in psychology (see [www.blackboard.com/](http://www.blackboard.com/)).

For all the services and benefits that commercial LMS's provide, they don't meet the needs of

all teachers. Online LMS's are software suites that provide and determine the pedagogical processes by which teaching and learning take place; as such they also set the constraints for the online teaching learning relationship. When teachers learn to use an LMS, these constraints become part of their mental set about online pedagogy; that is, there is no point in thinking about possibilities the tool doesn't allow. The design of a commercial LMS must be responsive to a good business plan or fail (e.g., Young, 2000). In contrast, teachers have traditionally designed courses based on an implicit or explicit pedagogy. This natural design tension is familiar. In a classroom course teachers use textbooks generated by for-profit companies. Of course, in the classroom, teachers are free to follow their pedagogical intuitions to adjust for the constraints imposed by the text. But, for an online course, the LMS in effect is the classroom so the natural adjustments based on a teacher's pedagogy are much more difficult to make; indeed, given the mental presuppositions fostered by learning the LMS design, such adjustments may not come to mind at all. The problem is compounded if course content is also being purchased by the teacher, in which case the traditional role of the teacher is vastly reduced, potentially to a course administrator.

At a more global level, the role of traditional institutions in the delivery of post-secondary education might also be reduced. In some business models, knowledge is plausibly construed as venture capital (Blumstyk, 2001a). Large private knowledge vendors are buying accredited affiliates (e.g., Young, 2001a) and in one case the accreditation process itself has come under commercial influence (Blumstyk & McMurtrie, 2000). The meaning of these commercial trends is unclear and it is difficult to forecast their ultimate impact on higher education.

### Shared Knowledge Communities

Leaving aside considerations of the potential negative impact of commercial influences on the teaching /learning relationship, it is worthwhile noting that a vigorous teacher- and pedagogy-based shared knowledge movement has emerged as a constructive way to create online courses which are designed by individual teachers to fit the needs of individual institutions. This movement has elements both at the LMS infrastructure level and, in the form of plug and play “learning objects” (Olsen, 2001a), at the level of course content and activities.

Open Source. A common value in shared knowledge communities is that program source code be open (Young, 2001b; Perens, 1999). It is generally assumed that when source code is open the generation of knowledge will evolve relatively rapidly because an entire community is working on it: “...the Open Source movement is an extension of the scientific method... The open sharing of scientific results facilitates discovery... Similarly, in the Open Source development model, sharing source code facilitates creativity... With the source code available, others can step in...” (DiBona, Ockman, & Stone, 1999 pp. 7, 8). The Open Source model applied to learning objects and LMS’s has two important implications. First, the knowledge base will develop rapidly. Second, developments at one institution which are created by one teacher can be customized to fit the individual context of teachers at other institutions.

Shared Knowledge Sites. Open source, and more broadly, scientific, values about sharing knowledge can be generalized to teaching online. Course content is available to the teaching community on shared knowledge sites like MERLOT ([www.merlot.org](http://www.merlot.org)), the Harvey Project (<http://HarveyProject.org/>), SMETE ([www.smete.org](http://www.smete.org)) or the Educational Object Economy (<http://www.eoe.org/>). Such sites include old media (e.g., text, visual materials, video streams) but

specialize in new media interactivity (see, for example, Malloy and Jensen, 2001) such as scientific simulations that engage students in discovery processes. This sharing of learning objects allows teachers to mix materials and activities that they develop on their own with those of other teachers to create a course.

The vigor of the shared knowledge community can be seen in the appearance of the Open Knowledge Initiative (OKI) (<http://web.mit.edu/oki/>), which is an effort by a consortium of institutions of higher education to develop a set of standards and an architecture that will enable the construction and dissemination of shared educational applications, including LMS's. It is meant to encourage and enable a collaborative community of academics who are developing online teaching software. LMS's and their architecture will play a key role. All participating LMS's will share an architecture and standards that create portability by allowing teachers, if say they move to an institution that uses a different LMS, to switch course content easily from one LMS to another. The current commercial strategy, if not actually preventing a change of LMS, does not facilitate such changes. A central element of the OKI architecture (<http://web.mit.edu/oki/>, see Components) will be the use of Java as the implementation language.

### The Utah Learning Management System

Shared knowledge communities allow a teacher to build content. LMS's allow posting of this content as well as the managing online courses. Open and shared course management tools, if combined with shared content, could provide the basis for continuing the tradition of academic freedom and individual choice in online teaching. To this end the University of Utah through the Department of Psychology and the Technology Assisted Curriculum Center has developed a set modules for an on-

line Java-based course building and management system.

Java interactivity. There are other open architecture LMS's such as Prometheus (<http://www.prometheus.com>) which is based on ColdFusion (<http://www.Coldfusion.com/>).

Prometheus has become, however, a commercial venture (reference??). The implementation language for the Utah Learning Management System is Java (applets, servlets, and applications ) rather than other programming options such as cgi. There is serious discourse about which programming approach will be more effective in the future of the web (reference??). The Utah model of shared courseware is appropriate for those who find Java, with the flexibility and freedom of a true programming language, to be the best option. The choice of Java makes U-LMS in compliance with the architectural philosophy of OKI.

Open source. The source code for U-LMS is open and available ([www.psych.utah.edu/?????](http://www.psych.utah.edu/?????)) for those who wish to alter, improve, or customize it. For those who don't program, the modules of U-LMS are available as a whole package or as individual modules. U-LMS modules can be hosted on University of Utah servers or transferred to other institutional servers. Moreover, beyond considerations of software design, the philosophy behind U-LMS values the principles of shared knowledge in the tradition of intellectual freedom.

Reinventing the wheel or evolution? With the plethora of course management systems, both commercial and in-house at various institutions, it could appear that the Utah Learning Management System is, to use the cliché, "reinventing the wheel." In one sense, though, the Utah Learning Management System is an evolution, because it is being developed in Java. While it is impossible to know every development arriving on the web, among major LMS efforts, a basis in Java is unique.

Spurred by OKI standards, the U-LMS might act as a beta test for the evolution of LMS's to Java-based software whose code can be extended and improved by other institutions interested in a Java-based LMS.

U-LMS components. A course login and student registration applet allows students to register for a class by creating a login name and password along with secret information that they can later provide if they want to change their login/password or if they forget their password. After they are registered, the applet allows them to login to the class. A suite of communication tools include a Forum or Threaded Discussion, Live Chat with Whiteboard, a course Message Center and a Student Directory.

A Grade Book allows teachers to enter, edit and post instructor-generated grades online. A student Check-Grades applet allows students to look-up their own grades.

A Homework-Quiz-Exam applet allows instructors to build and students to take fully automated, computer graded online assignments, quizzes and exams. It has database connectivity so that student scores are automatically recorded in the grade book. It allows several different types of questions (including multiple choice among verbal or visual options, fill in the blank with numbers or phrases); it allows questions to refer to detailed story problems. It allows teachers to randomize the sequence of questions and to randomize which of several options is the correct answer so that students experience the questions in different orders and with different answers if they are allowed to redo an assignment.

An electronic Journal applet allows students to submit writing into a personal folder. The database automatically creates in the folder a list of entries submitted by the student. The teacher can

open any entry and make comments which are then seen by the student. The e-Journal has advantages over email. First, the student does not have to have email. More important, the folder organization is done automatically by the database, thereby streamlining the teacher's organizational load. The e-Journal is currently being revised to allow professors to create and students to compose writing assignments and take essay exams. In creating a written assignment, a teacher will have the option to set the number of points the assignment counts for. The teacher can also fill in form with generic feedback text indicating the ideas that the written answer should have addressed. Once a student submits a textual composition or exam answer, this applet will allow the teacher to grade by inserting differently colored and formatted text in the student's answer and (optionally) to insert the generic feedback text automatically in all student compositions or answer. The teacher still has to grade the written answer, but a great deal of the feedback can be automatic. The grade assigned, along with feedback, will appear on the student's written response in their folder; the grade will also be automatically recorded in the grade book.

Student Management Tools include applets for finding forgotten passwords, for changing login names and passwords, for checking grades, for creating and editing a personal profile for the class directory, and for uploading and deleting files from their assignment folder.

The U-LMS has three site navigation options to respect the very different learning styles and computer backgrounds that students bring to online learning. These multiple navigation strategies include an applet that presents the whole course in standard windows-type Menu structure. A second navigation option (Ducks in a Row) is clickable list of every course activity in exactly the order the activities are required to be performed. Ducks in a Row is for linear thinkers with little background in

computers who simply want to know what to do next and when to do it.: it is essentially and extended, clickable syllabus. The third navigation option is a Virtual Desk. A construction applet allow students to build an online desk and to populate it with clickable objects that take them to all the course's functions. This option is for nonlinear thinkers with lots of experience with computers, who, armed with the class with minimal direction. The Virtual Desk is the first step in developing a virtual world approach to online leaning management systems.

Under development is a My Library applet that allows a professor to create a menu structure appears as a course function. The menu will have clickable links to course-specific local and national library indexes and database resources that the professor decides are relevent to the class.

Also under development is a Course Builder applet that allows instructors to build courses and register them in a database. Most LMS's create a particular cookie-cutter template for the course structure. The U-LMS Course Builder will allow teachers to create a course structure and visual look that suits their own needs.

### Summary

The sudden appearance of multi-media technology and, even more, online technology is requiring a transformation in Higher education (Olsen, 2001a). This inevitable transformation can be defaulted to commercial enterprises (Blumstycck, 2001b) or actively pursued in academic communities that share knowledge ([www.educause.edu/](http://www.educause.edu/)) and keep source code open (Carlson, 2001). The Utah Learning Management System is part of the latter approach. It is an open source software suite, written in Java (including applets, servlets, and applications), meant to be a part of the evolving shared software for creating and managing online teaching and learning resources.



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