Envisioning the Post-LMS Era: The Open Learning Network

By Jonathan Mott

- Although central to the business of higher education, the LMS has also become a symbol of the status quo that supports administrative functions more effectively than teaching and learning activities.
- Personal learning environments offer an alternative, but with their own limitations.
- An open learning network helps bridge the gap between the PLE and the LMS, combining the best elements of each approach.
- The initial implementation of an OLN at Brigham Young University represents a new learning platform model in higher education.

Learning management systems (LMSs) have dominated the teaching and learning landscape in higher education for the past decade,[1] with a recent Delta Initiative report indicating that more than 90 percent of colleges and universities have a standardized, institutional LMS implementation.[2] LMS-related decisions continue to rank among the most pressing IT issues for campus leaders and administrators, as explained in *EDUCAUSE Review*'s "Top-10 IT Issues, 2009," which lists several challenges associated with LMS implementations, including:

- Acquisition strategies
- Adapting LMSs to local needs
- Managing rising costs
- Maintaining system stability and integrity
- Integrating LMSs with other campus tools and data[3]

While the LMS has become central to the business of colleges and universities, it has also become a symbol of the higher learning status quo. Many students, teachers, instructional technologists, and administrators consider the LMS too inflexible and are turning to the web for tools that support their everyday communication, productivity, and collaboration needs. Blogs, wikis, social networking sites, microblogging tools, and other web-based applications are supplanting the teaching and learning tools previously found only inside the LMS.

The dilemma thus created is succinctly summarized in the "Top-10" report:

> *Although the LMS needs to continue serving as an enterprise CMS [course/content management system], it also needs to be a student-centered application that gives students greater control over content and learning. Hence, there is continual pressure for the LMS to utilize and integrate with many of the Web 2.0 tools that students already use freely on the Internet and that they expect to find in this kind of system. Some educators even argue that the next requirement is a Personal Learning Environment (PLE) that interoperates with an LMS.*[4]

Where the LMS is vertically integrated and institutionally centralized, the PLE is the educational manifestation of the web's "small pieces loosely joined," a "world of pure connection, free of the arbitrary constraints of matter, distance, and time."[5] Proponents assert that the PLE's greater flexibility, portability, adaptability, and openness make it far superior to the LMS as a teaching and learning platform. The PLE is not without its weaknesses, however. Potential security and reliability concerns abound. This conundrum leaves higher education with what appears to be an unsatisfying either-or choice that requires significant tradeoffs whichever path we choose.

In an increasingly sophisticated technology environment, however, I contend that we can bring together — or mash up — the best of both the LMS and the PLE paradigms to create a learning platform more ideally suited to teaching and learning in higher education — an "open learning network" (OLN). An OLN is intended to be, at the same time:

- Secure and open
- Integrated and modular
- Private and public
- Reliable and flexible

The framework outlined in this article provides a blueprint for developing what KnowledgeWorks calls a "lightweight, modular infrastructure" with built-in resilience to meet the dynamic needs of today's "learning agents."[6]

The Troublesome LMS

Significant use of LMS platforms at thousands of institutions by hundreds of thousands of faculty members and students might be taken as prima facie evidence that the technology adds value to teaching and learning. However, usage patterns suggest that the LMS is primarily a tool set for administrative efficiency rather than a platform for substantive teaching and learning activities. These concerns have been exacerbated by rapid growth in LMS-related spending over the past decade, which has led many to question whether the benefits of the technology are worth the cost.[7]

So which LMS tools do teachers and students use? Several reports confirm that instructors overwhelmingly use content distribution and administrative tools in the LMS while using interactive learning tools only sparingly.[8] These studies indicate variation in use of quiz and gradebook tools over time and across institutions. However, they are consistent in the conclusion articulated by Glenda Morgan: "Faculty use the CMS primarily as an administrative tool … rather than as a tool anchored in pedagogy or cognitive science models."[9] This is true, Colin Milligan argued, because the LMS is "fundamentally a conservative technology ... [for] managing groups, providing tools, and delivering content."[10] Niall Sclater concluded that LMSs have become little more than "storage facilities for lecture notes and PowerPoint presentations."[11]

This usage profile of the LMS is troubling because, as Lanny Arvan argued, it reinforces the status quo:

> *[T]he LMS serves as an affirming technology of traditional teaching. The instructor doesn't challenge the LMS very much, and, in turn, the LMS doesn't challenge the instructor. The student gets the convenience benefit from electronic distribution of documents (and grades) but little more.*[12]

Arvan bemoaned the fact that the LMS has come to be viewed as the educational equivalent of PeopleSoft. The problem with this perception, he argued, is that "teaching and learning are not fundamentally transactional."[13] The transactional pull of the LMS, however, draws instructors into its content-centric

tendencies. When instructors start with the LMS, Lisa Lane claimed, they are engaged in a "backward process … creating a course piecemeal" instead of thinking about their teaching approaches firsthand, and then selecting the right tools to implement them.[14] Leigh Blackall, George Siemens, and Stephen Downes have also long bemoaned the limitations of the LMS because of its emphasis on "managing," and therefore over-structuring, learning.[15]

The tendency to use the LMS for administrative purposes should not be surprising. Larry Cuban's exhaustive study of the effects of technology spending on K–20 education in Silicon Valley concluded that "traditional forms of teaching seem to have been relatively untouched by the enormous investment in technologies that the university has made since the 1960s. … In most cases, teachers [use] technology to maintain existing practices."[16] A recent U.S. Department of Education report echoed this conclusion: "[T]echnology has been applied to the outside of the education process, rather than as a critical tool in revamping the process itself."[17]

As important as the conveniences of the LMS might be, one can't help but sense that we've somehow missed out on the greater potential for transformational improvement that technology might have enabled.[18] Indeed, as Gardner Campbell argued, LMSs are "massive turnkey online systems" that have resulted in little more than a "digital facelift" of outdated, content-centric teaching and learning approaches. Unfortunately, he concluded, LMS implementations in higher education have "largely failed to empower the strong and effective imaginations that students need for creative citizenship" in the new medium of the web.[19]

The proponents of open-source LMSs like Moodle and Sakai contend that some LMS options are more flexible and more consistent, with an open, dynamic learning model. And the for-profit LMS companies are rapidly adding what they call "Web 2.0" features to their products, integrating with Facebook, YouTube, and other applications. But the administrative center of gravity of the LMS continues to impede significant teaching and learning innovations in three specific ways:

- First, LMSs are generally organized around discrete, arbitrary units of time — academic semesters. Courses typically expire and simply vanish every 15 weeks or so, thereby disrupting the continuity and flow of the learning process.
- Second, LMSs are teacher-centric. Teachers create courses, upload content, initiate threaded discussions, and form groups. Opportunities for student-initiated learning activities in the traditional LMS are severely limited.
- Finally, courses developed and delivered via the LMS are walled gardens, limited to those officially enrolled in them. This limitation impairs content sharing across courses, conversations between students within and across degree programs, and all of the dynamic learning affordances of the read-write web.[20]

The PLE and Personal Learning Networks

Institutions, teachers, and learners are increasingly turning to the open architecture and customizability of the web. In doing so, they are leveraging the tools and resources of the larger PLE to create their own personal learning networks (PLNs) to manage information, create content, and connect with others.[21] Whether termed PLEs or PLNs, these approaches "represent a shift away from the model in which students consume information through independent channels such as the library, a textbook, or an LMS, moving instead to a model where students draw connections from a growing matrix of resources that they select and organize."[22] Scott Leslie's impressive collection of PLE diagrams reminds us that PLNs are infinitely configurable to meet individual needs and preferences. They are, after all, "personal."

The vision of individually constructed PLNs and their potential to transform learning extends beyond merely aggregating and using a smorgasbord of web-based tools and content. Gardner Campbell advocated the cultivation of "personal cyberinfrastructures" that teachers and learners can leverage to become the "system administrators of their own digital lives."[23] Instead of implementing tools that simply help instructors "manage learning," Campbell argued that we should embrace technologies that enable co-learners to frame, curate, share, and direct learning "engagement streams." John Seely Brown and Richard Adler argued that learning with Web 2.0 tools is so different that we ought to call it "learning 2.0." They asserted that, unlike old passive forms of learning, the new learner-centric paradigm (facilitated and reinforced by new tools) emphasizes participation over presentation, encourages focused conversation over traditional publication, and "facilitates innovative explorations, experimentations, and purposeful tinkerings that often form the basis of a situated understanding emerging from action, not passivity." The net result is an "open participatory learning ecosystem."[24]

The efficacy of PLNs is due to their existence within the larger PLE ecosystem. When multiple individuals create PLNs using overlapping and integrated web-based tools, they benefit from the "network effect," which magnifies the value of their PLNs. According to Metcalf's Law, the value of the network "is proportional to the square of the number of users of the system." Stated another way, "Value accrues to the system as a whole because the more users or 'nodes' there are in a network, the more possible connections there are."[25]

Choosing Between the LMS and the PLE

While these factors might seem to make the LMS versus PLE choice an obvious one, several significant weaknesses and challenges associated with PLEs have limited their implementation, particularly on an institutional level. For example, because every learner's PLN is different, providing training and support is much more complex and expensive than providing support for an LMS with its vertically integrated stack of common tools. Moreover, CIOs and others with responsibility for institutional IT worry about FERPA-governed privacy issues, system reliability, and data continuity. Additionally, the "free" nature of web-based applications is a double-edged sword: Although not charged to use them, institutions and individual users have very little leverage with application providers when performance degrades, applications crash, or data is exposed or lost. High-profile web application service disruptions (for example, the January 2009 outage of bookmark-sharing site Magnolia) and the complete disappearance of other applications (the shuttering of Lively, Google's virtual world platform) have further dampened the appetite for PLEs.

Teaching and learning technology decisions should be driven, first and last, by the potential and measurable impact on learning of particular tools and platforms. As we weigh the potential contributions of the LMS and the PLE to learning, we face a Gordian Knot. If we choose one, we give up the advantages of the other while simultaneously taking on its weaknesses. Table 1 summarizes the relative strengths and weaknesses of LMSs and PLEs. This list was, appropriately, compiled through Twitter and my blog with the assistance of individuals in my personal learning network (see my post "The CMS and the PLN").

Table 1. Strengths and Weaknesses of the LMS and the PLE

LMS Strengths	**LMS Weaknesses**
Simple, consistent, and structured	As widely implemented, time-bound (courses disappear at the end of the semester)
Integration with student information systems (SISs), with student rosters automatically populated in courses	Teacher, rather than student, centric
Private and secure (FERPA compliant)	Courses walled off from each other and from the wider web, negating the potential of the network effect
Simple and inexpensive to train and support (compared to supporting multiple tools)	Limited opportunities for students to "own" and manage their learning experiences within and across courses
Tight tool integration (such as quiz scores populated in gradebooks)	Rigid, non-modular tools
Supports sophisticated content structuring (sequencing, branching, adaptive release)	Interoperability challenges and difficulties[26]
PLE Strengths	**PLE Weaknesses**
Almost limitless variety and functionality of tools, customizable and adaptable in multiple configurations and variations	Complex and difficult to create for inexperienced students and faculty members

Inexpensive — often composed of free and open source tools	Potential security and data exposure problems (FERPA issues abound)
No artificial time boundaries: remains "on" before, during, and after matriculation	Limited institutional control over data
Open to interaction, sharing, and connection without regard to official registration in programs or courses or particular institutions	Absent or unenforceable service-level agreements; no ability to predict or resolve web application performance issues, outages, or even disappearance
Student-centric (each student selects and uses the tools that make sense for their particular needs and circumstances)	Lacks centrally managed and aggregated group rosters (such as class rolls)
Learning content and conversations are compilable via simple technologies like RSS	Difficult and potentially expensive to provide support for multiple tools and their integrations with each other and with institutional systems

Bridging the Gap

Against the backdrop of debates about pedagogy and the future viability of higher education, an increasingly polarized technology argument is brewing. On the one hand, the nearly ubiquitous LMS dominates as it aids and abets the teaching-as-knowledge-transfer paradigm. It is centrally managed, hierarchical, content-focused, and teacher centric. The PLE is a looser, non-institutional collection of tools aggregated by individuals to support their own learning activities. However, a one-or-the-other choice between the two is a false choice between knowledge-dissemination technologies and community-building tools. We can have both.[27] The balance of this article provides a blueprint for doing so.

As we contemplate the future of learning and technology in higher education, the untenable tradeoff between the LMS and the PLE compels us to find an "Alexandrian solution," to cut the Gordian knot in half and find a way forward. Niall Sclater contended that web tool providers and the developers of both proprietary and open-source LMSs will "have to agree on a set of common interoperability standards" before we can make significant progress on closing the gap.[28] Instead of waiting for vendors (who might lack the necessary incentives) and individual developers (who lack resources) to settle on standards, innovators in higher education have started moving forward on their own by embracing the open architecture of the web. Doing so, Lanny Arvan suggested, is a "natural path" toward "dis-integrating" the LMS.[29] Teachers and learners should be encouraged and supported in their efforts to find and use the most appropriate and effective best-of-breed tools outside the LMS. For example, they can post slide presentations on SlideShare, create group collaboration sites on Google, stream and archive lectures on UStream, and build shared resource collections with Delicious. Such tools can be aggregated via course blogs, wikis, or mashup sites like Netvibes.

Some institutions have made significant, pioneering efforts to bridge the gap between the institutional network and the web by integrating Web 2.0 tools with administrative systems. For example, three years ago the University of Mary Washington deployed an instance of WordPress MultiUser (WPMU) as an alternative teaching and learning platform (UMW Blogs). UMW's blog platform blends the LMS and PLN paradigms by integrating their WPMU instance with the university directory, enabling the creation of blogs that automatically enroll students in courses as "members" of class blogs created by instructors. Today, UMW Blogs hosts more than 50 course sites each semester. In addition to course-specific blogs, it also hosts more than 3,500 faculty and student blogs, which have been viewed by more than 250,000 unique visitors from more than 250 countries in the past six months alone.

Several other institutions are likewise experimenting with blogging platforms as an alternative to the traditional LMS. These include the University of British Columbia (http://blogs.ubc.ca), the College of Wooster (http://voices.wooster.edu), and the City University of New York (http://commons.gc.cuny.edu). The instructor of one CUNY course informs his students that the course blog is intended to be an "open LMS," configured to "give students **both** a protected private ('walled garden') space, **and** an open, shareable, wide-audience for collaboration ('free range') space."

A pilot currently under way at Duke University (http://blogs-dev.oit.duke.edu) is aimed at assessing the viability of WPMU as an alternative platform for instructors teaching undergraduate and graduate courses. The list of potential uses on the pilot site includes using a WordPress blog as "the central course administrative tool" instead of Blackboard.

Washington State University's "harvesting gradebook" project is another significant innovation in the effort to close the gap between the institutional need to gather assessment and learners' needs for feedback in the PLN. As students complete assignments and projects for courses, they are increasingly using a variety of online tools, such as YouTube, Flickr, and Google Docs. The WSU gradebook is designed to "harvest" assessments of these artifacts[30] from multiple stakeholder groups. Significant progress toward reconciling the LMS and PLE paradigms has been made through these sorts of innovations.

An Open Learning Network

In order to further narrow the LMS-PLE gap, I propose an "open learning network" (OLN) model that leverages the open architecture of the web. The OLN is not intended merely to allow the LMS and PLE paradigms to coexist in harmony, but rather to take the best of each approach and mash them up into something completely different, something better than just the sum of its parts. More precisely, the OLN aims to reconcile the apparently competing paradigms of the secure, private, proprietary institutional network and the public, dynamic, social web.

The OLN has three key features:

1. It is malleable.
2. It leverages technologies that did not exist when the LMS was born in the late 1990s.
3. It strikes a manageable balance between imperatives of institutional networks and the promise of the cloud.

First, the OLN is *malleable*: it is modular, flexible, interoperable, and open.[31] The LMS paradigm possesses the allure of one-stop-shopping — implement a single, vertically integrated technology stack that contains all of the teaching and learning tools you will ever need, and your work is done. In contrast, the OLN is *modular*, consisting of stand-alone, best-of-breed applications that perform core teaching and learning functions. This makes the OLN *flexible*. Institutions, organizations within institutions, and even individual faculty members and students can use additional modular tools or replace the default tools with ones more appropriate for their learning needs. This requires that its modules be *interoperable*, readily exchanging user information and data without the need for complicated integration projects. Finally, the OLN is *open*. While institutions, faculty members, and students retain control (at the module and even the content item level) over who can enter and participate in the OLN, there are no technology-driven, artificial barriers to openness.

Second, the OLN is built on web technologies that did not exist when LMSs were first developed more than a decade ago. While the LMS succeeded in providing tools for building simple course creation and communication sites for teachers, the technology used first-generation web technologies with proprietary databases, data schemas, and authentication protocols. The OLN is built on web services from the ground up. This facilitates authentication federation and data portability. It also allows for granular authentication and rights management within and across OLN modules. By adhering to standard web service protocols and supporting emerging standards like the IMS Learning Tool Interoperability (LTI) framework,[32] the OLN can easily "talk" to any application that does the same.

Third, the OLN is not constrained by the limited data access and user restrictions inherent in the LMS. The LMS paradigm assumes that since some data must be kept private and secure, all data must be kept private and secure. The OLN rejects this premise and instead seeks to keep data that must be private and secure as private and secure as possible. All other data — at the option and discretion of teachers and students — can exist in the cloud. As depicted in Figure 1, proprietary applications and data such as the student information system (SIS), secure online assessment tools, and a university gradebook should be situated inside the private, secure university network. Personal publishing space, social networking, and collaboration tools live in the open, flexible cloud. Technological bridges between these two domains are a key architectural component of the OLN. The OLN should be as frictionless as possible, transparently supporting authentic teaching and learning activities as they unfold.

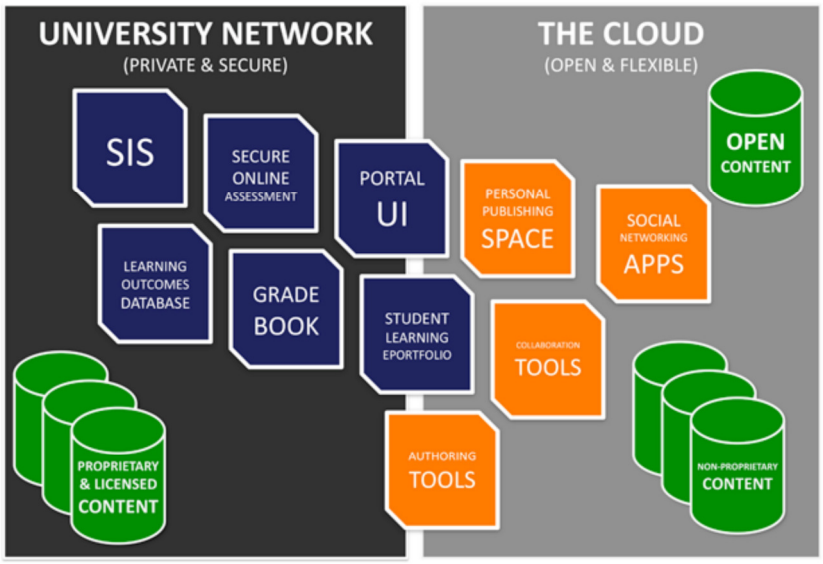

Figure 1. The University Network and the Cloud

The OLN Architecture

The OLN combines existing institutional applications, web-based tools, applications, content stores, and facilitating "connective tissue" technologies that allow them all to function together seamlessly. As such, the OLN framework presented here is more conceptual than it is a set of specifications.

First and foremost, the OLN is based on a services-oriented architecture (SOA). In the simplest terms, web services–enabled applications leverage the elegantly simple Hypertext Transfer Protocol (HTTP) that gave life to the World Wide Web. This means that applications use a common set of verbs (such as GET and POST) and nouns (standard definitions of "student," "course," "score," etc.) to share data (as XML) via HTML. A robust services architecture will also implement role-based security and authentication protocols to manage data and application access and permissions. Within such a framework, any tool can securely interact with any other tool, passing user IDs and course and role information. Activities are then logged in the second application so that data can be passed back to the originating application (via a secure HTTP POST in the browser).

As illustrated in Figure 2, the various applications or modules that comprise the OLN interoperate via the services architecture. The average user, however, is not exposed to this technical complexity. Teachers and learners simply log in to a portal (or other module mashup interface) to access, configure, and use the tools they need in particular learning contexts (courses, projects, internships, and so forth). When a user logs in to the portal, the portal is "aware" of the user's identity through integrations with the SIS and an institutional ID repository (which contains demographic data). Optionally, the portal could also be "informed" by a social networking registry, which students can, at their option, use to enable connections between the social networking tools they use (Facebook, LinkedIn, Twitter, personal blogs) and the OLN. Layers or sub-pages of the portal then present additional mashed-up views of OLN tools for courses, degree programs, group projects, or other learning interactions.

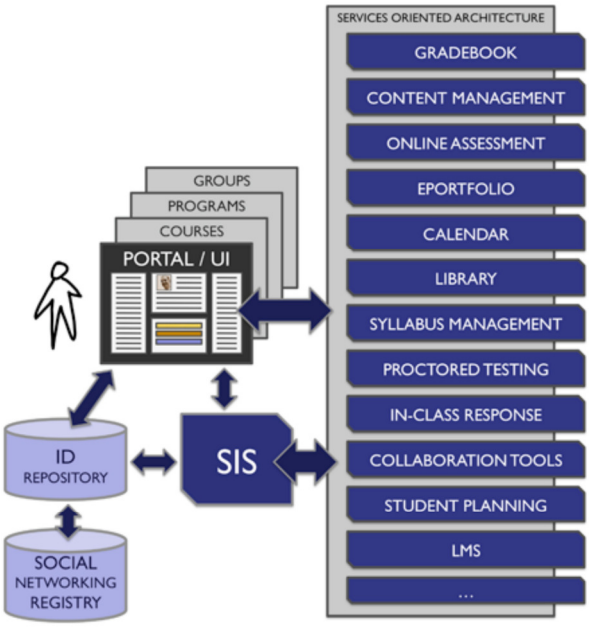

Figure 2. Web Services and the OLN

As depicted in Figure 3, the OLN's full potential is realized by implementing supporting technologies such as iCal for calendar aggregation, RSS for content aggregation, widgets and embed codes to allow granular republishing of live content, tags to support folksonomy-driven content discovery and compilations, and granular authoring codes to support collaborative content authoring and commentary. Additionally, the OLN can incorporate a virtually limitless number of web-based applications and third-party learning tools via web services, published application programming interfaces (APIs), and the emerging LTI framework. Without replicating social networking functionality readily available elsewhere, the OLN can also enable learners to manage group memberships and contact lists to facilitate connections and conversations that support their learning activities. A central notification service might also permit students to specify how they want to be notified (via e-mail or SMS, for example) when updates are made in various OLN modules. As student computing becomes increasingly mobile, OLN modules and data can be mashed up and dynamically re-presented on various devices.

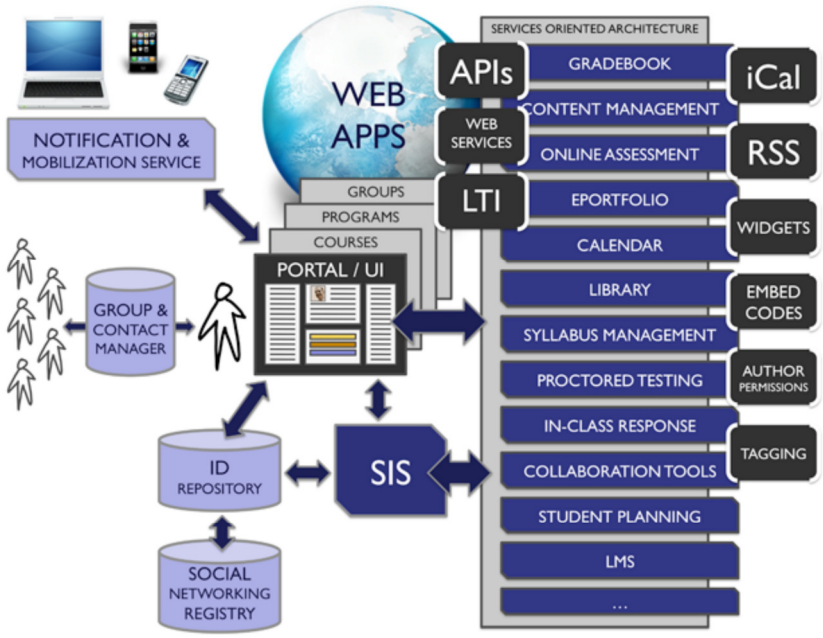

Figure 3. A Full-Featured OLN

A Nascent OLN

Brigham Young University is in the first stages of developing and deploying an OLN. The most critical enabling technology, a web services registry (licensed from SOASoftware), was implemented last year. Foundational services that provide demographic and academic data about individuals to various applications are in various stages of development. The first OLN module developed at BYU was a learning outcomes application that serves as a repository for expected learning outcomes for BYU's more than 400 degree programs. These outcomes can be consumed (via a web service) and integrated into other applications. For example, BYU has also developed a stand-alone Syllabus Builder that directly incorporates program-level learning outcomes into course syllabi (see Figure 4). Additional services currently under development will automatically incorporate semester calendar and up-to-date textbook information (including pricing and availability) into the course syllabi generated by Syllabus Builder.

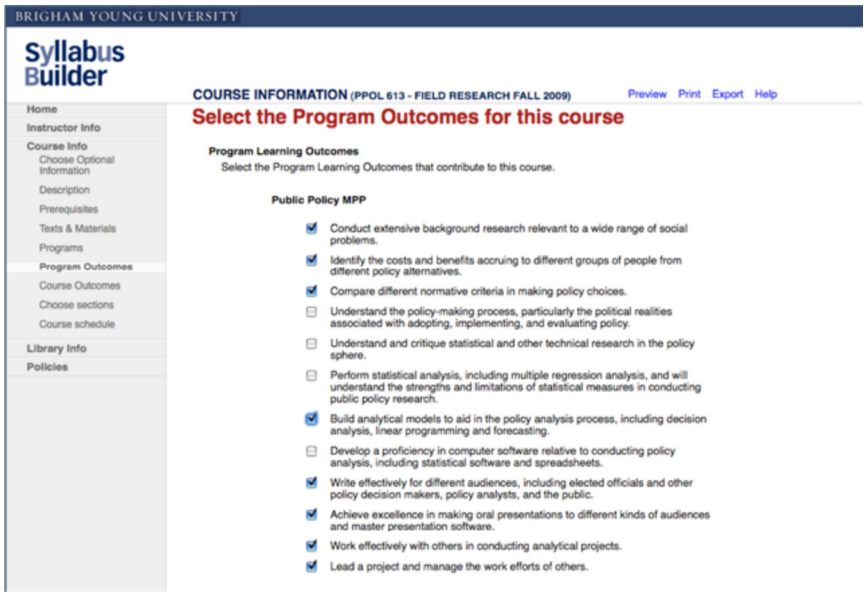

Figure 4. BYU's Syllabus Builder

The most critical modular component of BYU's emerging OLN is a stand-alone, loosely coupled gradebook,[33] which we have partnered with Agilix to develop and deploy. The gradebook is currently in limited release, and some development is still in progress. The functionality described below represents the "completed" state of the product (projected for late summer 2010).

To fully reconcile the institutional network with cloud-based PLEs, instructors and students need a private, secure way to communicate about student performance on assignments, quizzes, and tests. While depicted as one of several OLN modules, a loosely coupled gradebook is perhaps the essential module that brings all of the "small pieces" together.[34]

This gradebook is "loosely coupled" because it does not have to be tightly, vertically integrated with the tools students use to create and publish their learning artifacts. As students engage in various activities in the learning process, they create artifacts — documents, images, videos, presentations, blog posts, etc. If these artifacts are published on the web, they are individually addressable via URLs, so the OLN's loosely coupled gradebook would simply require the submission of the URL instead of requiring students to upload the artifacts to a traditional gradebook. Instructors would then see a list of student names and links to the artifacts they published on the web (see Figure 5 for a sample gradebook).

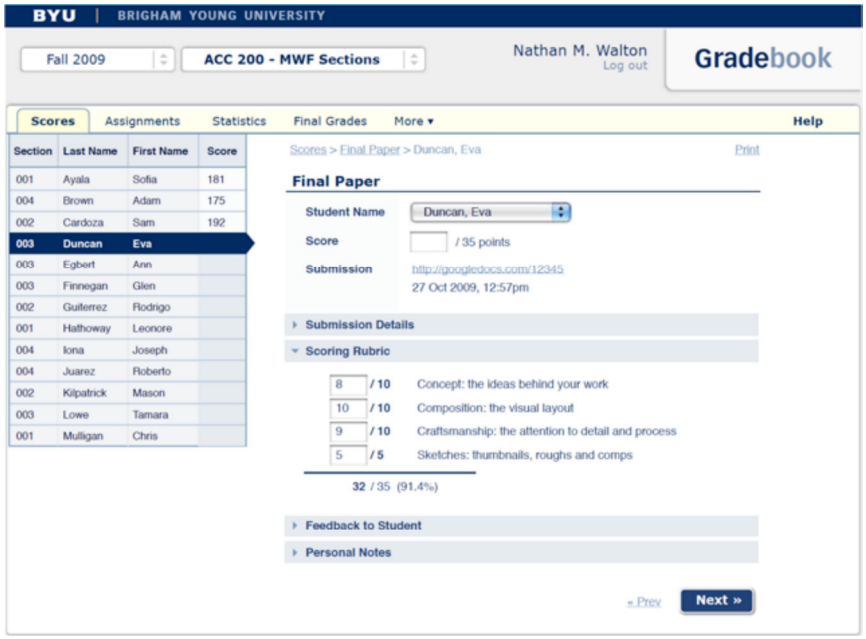

Figure 5. Gradebook with Student Names and Links to Artifacts

Using a simple split-frame interface, instructors can quickly view and provide feedback on the artifacts students have published on the web. The smaller top frame includes navigational cues, including the course, assignment, and student's name. It also includes feedback tools (a grade or score field and a drop-down rubric), as shown in the sample in Figure 6.

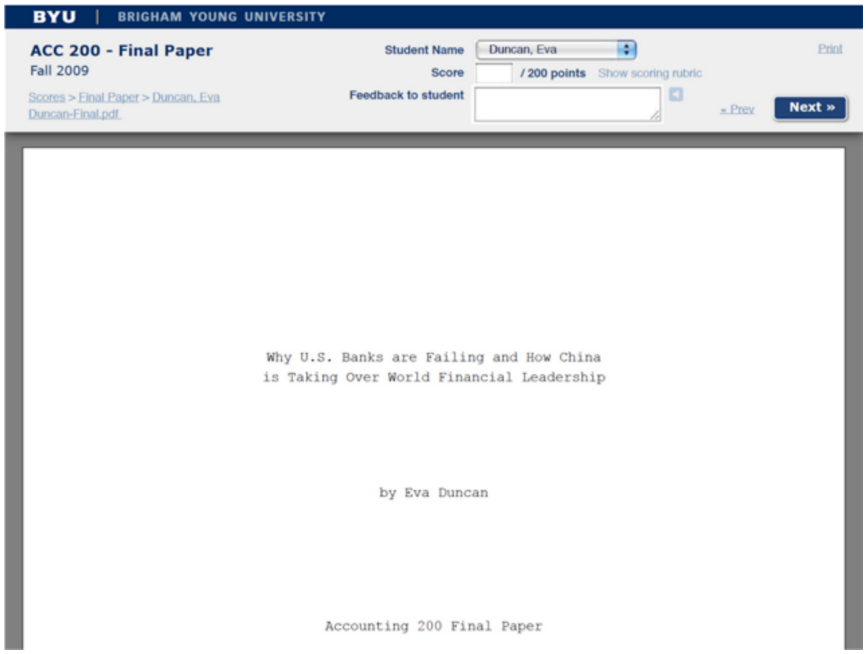

Figure 6. Split-Frame Interface for Feedback on Student Artifacts

Figure 7 shows the loosely coupled gradebook workflow. Student learning activity artifacts published to the cloud can be submitted as individual "assignments" or compiled into portfolios and submitted to degree program "gradebooks." Via web services, the gradebook populates outcomes from the

program learning outcomes repository. Faculty members use these rubrics to evaluate individual assignments and portfolios. The grades and scores given to each assignment or portfolio are captured in an assessment scores repository and aggregated for reporting and program evaluation purposes. Additional service interfaces enable the gradebook to consume and aggregate data from other sources (such as BYU's proctored Testing Center, in-class response systems, etc.). Final grades can also be securely submitted to the SIS at the end of the semester. And, since the gradebook requires faculty members and students to log in, all assessment-related communication that occurs within it is private, secure, and FERPA compliant. Additionally, because many faculty members and programs require student work to be captured and evaluated at specific points in time, the gradebook also supports the capture and archiving of artifacts submitted by URL or uploaded directly into the system.

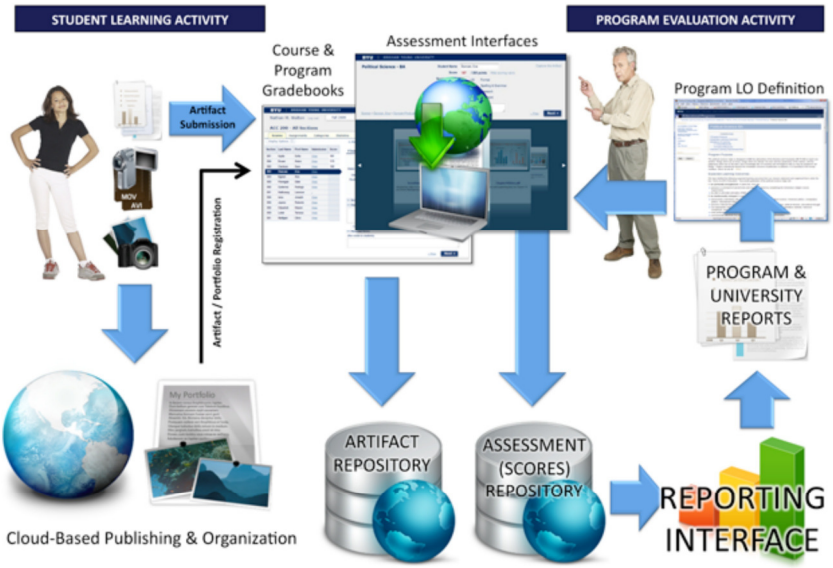

Figure 7. Loosely Coupled Assessment[35] Workflow

The loosely coupled gradebook allows learners to author and publish content where it is most natural and appropriate to do so in the learning process. It also allows teachers to provide secure, private feedback in an environment tied to applications and databases that support the programmatic and systematic assessment of learning. Accordingly, it is the most important bridging application of the OLN.

Conclusion

Teachers, students, and administrators feel stuck with the either-or choice between the LMS and the PLE. The future of technology in higher education will in large part be defined by how we strike a balance between the two. We need to embrace both the efficiencies of the LMS and the institutional network and the affordances of the PLE and the web. As Gardner Campbell argued, it is no longer adequate to use technologies that primarily excel at "pointing students to data buckets and conduits we've already made for them." Rather, he insisted, we need to help students acquire the "digital fluency" necessary for them to assume "creative and responsible leadership in the post-Gutenberg age."[35] The OLN framework depicted in this article meets Campbell's challenge — the same challenge posed by KnowledgeWorks to provide a "platform of resilience" for education, a "lightweight, modular infrastructure" that provides "responsive flexibility, distributed collaboration, and transparency."[36] The OLN can do so by embracing both the efficiencies of the LMS and the affordances of the PLN, rejecting the "tyranny of OR" in favor of the "genius of AND."

Endnotes

1. Some authors prefer the term "course management system" (CMS) or "virtual learning environment" (VLE). While I use the term LMS throughout this article, I leave intact other authors' terminologies when quoting them.
2. Delta Initiative, "The State of Learning Management in Higher Education Systems," report for the California State University System, 2009, see p. 5.
3. Anne Scrivener Agee, Catherine Yang, and the 2009 EDUCAUSE Current Issues Committee, "Top-Ten IT Issues, 2009," *EDUCAUSE Review*, vol. 44, no. 4 (July/August 2009), pp. 44–59.
4. Ibid.
5. David Weinberger, *Small Pieces Loosely Joined* (Perseus Books, 2002).
6. The KnowledgeWorks Foundation's "2020 Forecast: Creating the Future of Learning" (2008) declares that "system shocks and disruptions … are key forces of destabilization in this century. Institutional strategies that focus on resisting disruption and maintaining the status quo will not offer sufficient responses." The response to this disruption should be the development of "platforms for resilience" that enable "responsive flexibility, distributed collaboration, and transparency."
7. According to a recent study, LMS support costs, including licensing and hardware infrastructure, increased by 150–667 percent between 2000 and 2009 (Delta Initiative, "The State of Learning Management in Higher Education Systems," p. 9).
8. Glenda Morgan, "Faculty Use of Course Management Systems," ECAR Research Bulletin (vol. 2, 2003); Joanne L. Badge, Alan J. Cann, and Jon Scott, "e-Learning versus e-Teaching: Seeing the Pedagogic Wood for the Technological Trees," *Bioscience Education*, vol. 5 (2005); Colin Milligan, "The Road to the Personal Learning Environment?" CETIS, 2006; Nils Peterson, "Abandon the LMS — What Must a University Change?" Ning-based discussion forum College 2.0, posted December 1, 2008; and Jon Mott and David Wiley, "Open for Learning: The CMS and the Open Learning Network," *In Education*, vol. 15, no. 2 (2009).
9. Morgan, "Faculty Use of Course Management Systems," p. 11.
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16. Larry Cuban, *Oversold and Underused: Computers in the Classroom* (Cambridge, MA: Harvard University Press, 2001), pp. 129, 138.
17. U.S. Department of Education, "Harnessing Innovation to Support Student Success: Using Technology to Personalize Education," November 2008, see p. 9.
18. Michael D. Bush and Jonathan D. Mott, "The Transformation of Learning with Technology: Learner-Centricity, Content and Tool Malleability, and Network Effects," *Educational Technology*, vol. 49, no. 2 (March/April 2009), pp. 3–20.
19. Gardner Campbell, "A Personal Cyberinfrastructure," *EDUCAUSE Review*, vol. 44, no. 5 (September/October 2009), pp. 58–59.
20. Mott and Wiley, "Open for Learning."
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22. EDUCAUSE Learning Initiative, "7 Things You Should Know About … Personal Learning Environments," May 2009.
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24. John Seely Brown and Richard P. Adler, "Minds on Fire: Open Education, the Long Tail, and Learning 2.0," *EDUCAUSE Review*, vol. 43, no. 1 (January/February 2008), pp. 16–32, see pp. 30, 31.
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26. Significant progress is being made on this front, but the ability to easily move data in and out of the LMS and to plug in alternative tools to replace or enhance native tools remains to be seen.
27. Institutions and instructional technologists are stuck with what they perceive as a choice between either content delivery or community building, the LMS or the PLN. Such a framing of the debate amounts to what Jim Collins calls the "tyranny of OR," an arbitrary limitation on the choices available to organizations because they are cast as dichotomous choice sets. Instead, he argued, we should seek "the 'genius of AND,' opportunities to combine the best of two apparently mutually exclusive choices to create something that has the best of both." Jim Collins, *Built to Last: Successful Habits of Visionary Companies* (Boulder, CO: Collins Business Essentials, 2001), see pp. 43–45.
28. Sclater, "Web 2.0, Personal Learning Environments, and the Future of Learning Management Systems," p. 6.
29. Arvan, "Dis-Integrating the LMS."
30. Mary Grush, "The Future of Web 2.0: An Interview with WSU's Gary Brown," *Campus Technology*, February 27, 2008.
31. Bush and Mott, "The Transformation of Learning with Technology."
32. IMS Global Learning Consortium, Learning Tools Interoperability v1.0 Project Group, 2010.
33. The importance of authentic, web-enabled learner assessment is clearly behind Caulfield's notion of "loosely coupled assessment" (first coined in a blog post by Mike Caulfield July 31, 2007) and WSU's harvesting gradebook project, with which we claim shared intellectual roots.
34. Campbell, "A Personal Cyberinfrastructure."
35. See Mike Caulfield, "Loosely Coupled Assessment."
36. KnowledgeWorks Foundation, "2020 Forecast: Creating the Future of Learning."

Jon Mott
Asst. to the Academic VP - Academic Technology
Brigham Young University

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