



CHAPTER 5

DEVELOPING AN INFRASTRUCTURE FOR ONLINE LEARNING

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INTRODUCTION

Before embarking on the development of an online learning system, in part or in whole, careful stock needs to be taken of the needs of the intended learners, the curriculum to be offered, and the context for the project. This chapter considers the various factors that must be considered for the infrastructure for online learning, including planning, structural and organizational issues, the components of a system and the interfaces among them, and various related issues, such as human resources, decision-making, and training.. Once developed, any infrastructure must be able to evolve in order to accommodate changing student needs, technologies, and curricula.

In 2003, as a result of the implementation of an e-learning plan, Athabasca University (AU) declared itself to be an online institution (Athabasca University, 2002a). As for many institutions and organizations, much had changed in a very short time with respect to the adoption

of information and communications technologies. With the advent of Web 2.0, another era of change is now underway. While distance education institutions and departments have been the vanguard of the development of online learning, campus-based teachers and students have increasingly been mixing and matching their classroom and online learning in all sorts of (often unanticipated) ways.

For AU, the selection of and engagement with *Moodle* as the institution's single Learning Management System (LMS) has acted as a catalyst in moving the university's course creation, production, and delivery processes online. The experiences of AU as it works its way through the transition have borne out many of the ideas and issues raised here; of note are governance and change issues. Without effective structures and processes, the selection, deployment, and ongoing performance of an online learning system will prove challenging, and perhaps unsuccessful.

Building the infrastructure for online learning has many interconnected components and many factors must be considered, so it is hard to provide a straightforward checklist or recipe to follow. Distance education has provided an understanding of how the entire system of course design, development, and delivery occurs, and how these link to related learner services and other components, all of which are vital aspects of ensuring effectiveness and quality. Elsewhere in this book, readers will find chapters that provide a wealth of information and detail the specifics of how to develop and deliver online learning. The focus here is on the planning and organization of an online learning system, and some of the associated issues that must be considered.

A concept often used by scientists, classifying systems as *ideal* versus *non-ideal* (more commonly understood as *real*) may be helpful. In this way, we can define the ideal, and then look at the deviations from the ideals that manifest themselves in the real (Lu, 2006).

The ideal online learning and teaching system is developed from scratch, with no restrictions on costs and staffing, and uninhibited by resistance to change from previous practices. A real system, however, is one where any or all of the following deviations from the ideal occur: limited resources; legacy systems that have loyal advocates; key staff who have to be retrained; unworkable policies and practices that require reinvention; inadequate governance processes; back-end administrative systems that may or may not be interfaceable; plus an evolving understanding of the pedagogical underpinnings of online learning. Furthermore, after these deviations from the ideal are initially factored

in, any real system must also be able to *change* constantly, specifically because curriculum, learning technologies, and approaches evolve all the time. Using this framework, the key aspects of an ideal online learning infrastructure are described and then adjusted for real situations; some ideas are also presented on how the subsequent and inevitable change can be managed.

BASIC THINKING

Any social system is built within a context. The social context of education, in general, has evolved significantly over the centuries. The increasingly open approach to educational systems, supported by global village technologies, takes the social context of education beyond the windows and into the world. As such, for any online learning endeavour, each discipline, department, faculty, institution, or company must have its own mission, mandate, goals, and values that need to be considered when planning and designing its own ideal system. For a real system, even at the conceptual level, there will be many internal and external environmental factors, such as competing priorities, budget constraints, faculty and student preparedness, professional bodies' requirements, and so on. All these factors must be well understood and accounted for from the outset.

All teaching and learning systems should be built from two vantage points: the *needs of the intended students*, and the *intended learning outcomes* of the course or program – i.e., the knowledge, skills, and attributes that students will gain. An ideal online learning system will be based on a plan that flows from a full understanding of these two fundamentals.

For intended students, it's necessary to understand their prior learning, background with technology, expectations, financial and other resources, access to the web or other online networks, bandwidth limitations, and any other pertinent information about their preparedness and ability to participate equally and fully in the online learning experience. In reality, of course, it is rare that such a complete picture is available, and a judgement call must be made on how the system balances common solutions for maximum efficiency and yet still accommodates students' individual needs. For example, how much do we employ technologies, which we know the students are already familiar with and have access to, versus those which are new and unfamiliar and/or which are expected to become widely available? A good example of this question

is the extent to which distance students have access to high-speed connectivity. Since bandwidth is expanding steadily, and depending on student demographics and other factors, a system that assumes high bandwidth might be preferred, with alternative access to certain online learning components such as CD-ROMs or DVDs for the few not yet ready.

There is also the need for clear identification of the intended learning outcomes of any course, program, or training event in order to, for instance, design a learning assessment system, determine the degree of prior learning that may be accepted, measure the quality of the offering, or use as a basic determinant of an online learning system. In applied and professional fields, describing the intent of the educational experience in terms of the knowledge, skills, and attributes expected of the successful completers is typically routine, and a curriculum and associated teaching and learning system can be devised and cross-referenced with those ends clearly in mind (Red River College, 2004).

In academic fields – the real world in this context – such outcomes are not so well, nor very often, explicitly stated. All programs claim to develop critical thinking skills, for instance, without much definition of what these are, what taxonomy is used to determine the extent of students' achievement, or how exactly the content and program design link to them. If the outcomes include the ability to work in groups, to undertake independent research from a wide range of resources, or to critically analyze case studies, these will drive the design and functionality of the online learning system needed to deliver that curriculum. Having comprehensive and clearly stated intended learning outcomes, as well as a curriculum and associated teaching approaches designed accordingly, makes the task of building the ideal online learning system so much easier. In addition, at least some understanding of and linking with good principles of teaching and learning should be in place (Chickering & Ehrmann, 1996).

Closely related to these two fundamental educational design perspectives – student needs and the learning outcomes – are the size, scope, and scalability needed for the online learning system. Whether the program is to be delivered to a well-defined and selected cohort of students once a year, or made available to all comers at all times (as driven by mandate or a business plan predicated on growth) will have a strong impact on how the system is designed.

The real situation, of course, is much less rational. Online learning initiatives often spring from the well-intentioned experimentation of an individual or small group of educators and/or technologists, oftentimes

with no clear idea of what the benefit to the learning experience will be (or not be). Sometimes, the addition of a new functionality, piece of content, or tool does not add value and is ignored by students; in other cases, a simple enhancement can reap great educational and other rewards for all concerned, sometimes in ways which were unanticipated. The degree to which an organization (department, faculty, company, or institution) wants to foster and allow more random experimentation versus keeping tight control over a single online learning system will be driven by that organization's mission, mandate, core values, technological capabilities, systems architecture, and financial resources. There are interesting case studies of how institutions have adopted various strategies – intentionally or unintentionally – along this centralization/decentralization spectrum (see the *International Review of Open and Distance Learning*, 2001, 1(2)). This is a very important decision, however, since it will determine how the online learning system should be designed, developed, resourced, and governed.

Even where the student market is well understood and learning outcomes clearly defined or prescribed, the implementation of online learning often involves a good deal of trial and error. With the best information and intentions, the results and experience rarely meet expectations, and thus the ability to adapt and refine the online learning system is crucial.

OVERALL STRUCTURE AND ORGANIZATION

The ideal case is based upon a good understanding of an institution's or company's core business and values, the nature of the intended student market, and the needs of the curriculum. This understanding is expressed through the learning outcomes of the program to be developed and delivered. On this basis, an overall online learning framework can be developed. This framework shows the organization of the various components of the proposed system, after which a relatively complete business plan for the endeavour can be developed. Figure 1 describes one such framework for a post-secondary institution, on which the discussion of the various components is based.

Ideally, the learning outcomes (1) are translated into course content and resources plus appropriate strategies for the teaching and learning process that will enable students to achieve those intended outcomes. Once these basic parameters have been determined, the

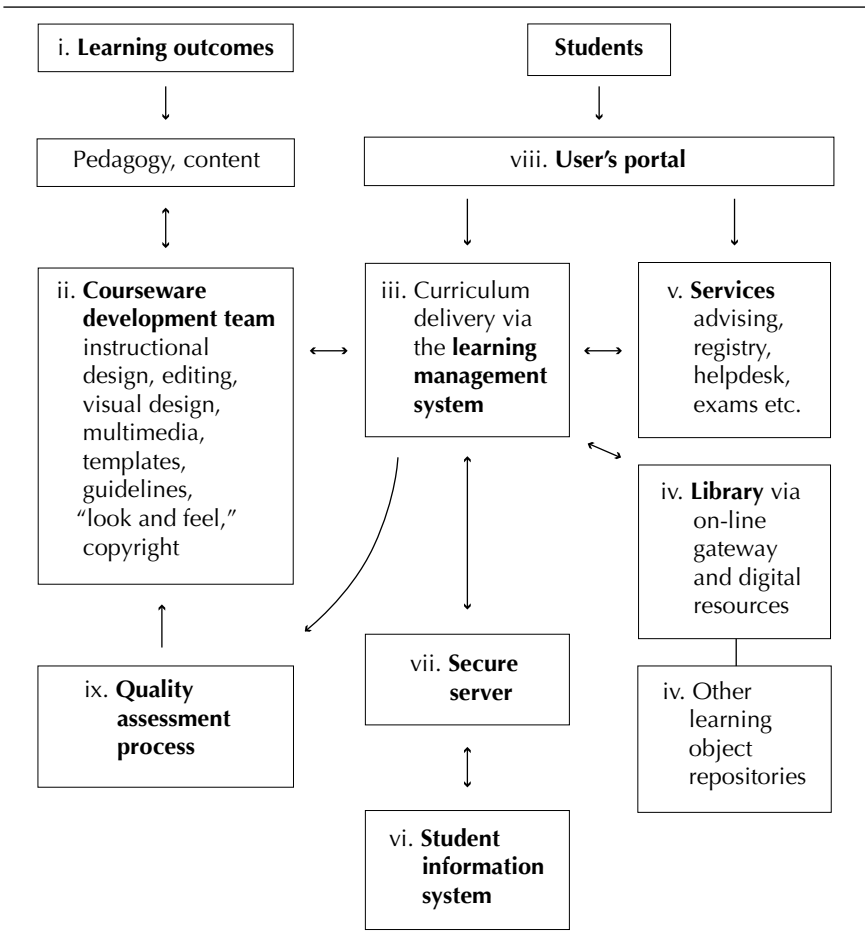


FIGURE 1. An online learning system framework

development team (2) shares the responsibility of translating the theory and intentions into practice in the form of courseware (stored on a Content Management System) and online learning functions, which are delivered by (3), the Learning Management System (LMS), which is interfaced with the library and other digital resources (4), related services (5), and the student information system (6) via a secure server (7) that can authenticate the student login.

This is but one view of an ideal system; there are increasing perceptions that LMSs in themselves may be less significant in the system.

Indeed, the context of learning is so varied or open that the confines of an LMS may be too restrictive. For our purposes here, it is enough to recognize that learning and the connection to learning resources or experiences need to be managed, and that this process can be facilitated through some sort of LMS.

The students will connect to the LMS and related services via a user-friendly portal system (8) so that, with a single login, they can also have access to their courses. Finally, to ensure ongoing improvement, an independent evaluation process for the effectiveness of the system (based on achievement of the learning outcomes and students' feedback), and an independent quality assessment process will be in place (9), which also feeds back into the development cycle.

Using this rough framework, aspects of the online learning infrastructure will be discussed, but to conclude this section on overall organization, the general relationships, particularly among the units responsible for information technology support, should be discussed. In 1990, Paul (1990) raised a number of important issues regarding the incorporation of technology into learning systems, many of which we still grapple with. Two in particular are pertinent here and are intertwined.

The first issue is the relationship between academic and administrative computing, whether they should be connected or not, and in either case, how these two information technology functions can interface with each other. These questions are a significant aspect of the centralization/decentralization issue. While the normal structure is often to have them separated and reporting through different executive officers, the online learning staff and systems need a lot of support and maintenance from the central administrative computing unit, as do key service areas such as student registration, the library, and other learning resources. The second and tightly related issue is that of centralized control versus decentralized freedom. Normally, the administrative computing units prefer a more centralized system, in order to improve integration, avoid duplication, ensure security, and minimize the divergent approaches and the subsequent complexity of support. Those involved in the design and delivery of educational programming prefer a more decentralized approach, with more freedom to innovate, and to choose platforms and applications that suit their specific needs and preferences. Of even greater possible political consequence is their deep desire for academic values and needs to have priority over those of the central administrative unit.

The separation of academic and administrative computing at an organizational level makes the implicit assumption that they can be separated on the technological level also. Such is unlikely to be the case as system interdependencies are a critical requirement of the ability to offer a seamless service to the student and, indeed, to the teacher. The growing complexity of learning systems requires a jointly developed vision for the technological architecture that provides flexibility and sustainability for both groups. Separating the activities into a bifurcated stream of development will ultimately compromise the ability of the organization to provide students with a responsive, flexible, and dynamic learning system.

In an ideal case, it should not matter how such units are organized or linked, since the overall goals and values of the institution or company surely will govern people's behaviour and attitudes, and everyone will accommodate each other's needs, responsibilities, and functions. In the real world of online learning, conflicting priorities and approaches quickly arise, and very tangible structures, clear roles and responsibilities, and processes and policies have to be established to help balance the relative needs for control/centralization and freedom/decentralization.

An additional organizational issue, more relevant to traditional institutions, is the question of discipline ownership. With much online learning emerging from the continuing/distance education departments and from the growth of online programming in other academic faculties, there is sometimes organizational conflict in who "owns" the discipline.

THE COMPONENTS OF AN ONLINE LEARNING SYSTEM

The following represent the typical components and functionality of a comprehensive online learning system.

Development of Courseware

Even at the initial stages of thinking about the development of an online learning program, it is wise to involve all those who are likely to be involved at any stage. This can be done by the sponsors of the program preparing a preliminary proposal, laying out the objectives of the program, determining the intended student market, and proposing an online learning approach. This gives various service units a chance to comment on matters that will affect them, and for fellow educators to comment on the proposed content and pedagogy. The proposal

should also identify the composition of the development and delivery teams that will be established to undertake the project. The nature of these teams can vary widely. The small team could be just one person, the content expert who is also an experienced educator and well trained to use a comprehensive web-learning platform and related technologies which are already fully supported by the institution or company. This person would just need routine support from areas such as copyright, library, and other departments.

Alternatively, a very complex team involves content experts, educators, instructional designers, editors, visual designers, multimedia designers, programmers, systems staff, and so on, in the design of a course that needs new online learning functions, connects uniquely to the other systems, and involves the creation of new multimedia digital learning objects. In either case, the preliminary proposal must have sufficient information for all concerned to understand what their likely role and responsibilities would be, and what direct and indirect costs would be involved.

For those familiar with formal project management processes and techniques, the identification and discussion around the proposal with the project team will seem redundant, but in academe, it is surprising how little attention is paid to this much needed process. Much of it is just common sense, common courtesy, and good planning. Depending on the size and scope of the task, some basic understanding and application of the principles of project management is also required to develop online learning courseware. The roles of team members can vary widely, but, as a guideline, the following types of positions and the roles they play in the team are described further in Chapters 10 (Development of Online Courses) and 18 (Developing Team Skills and Accomplishing Team Projects Online) in this volume.

Learning Management System

Another key decision to be made at the development phase is the choice of Learning Management System (LMS), which leads quickly to a discussion of using commercial, proprietary software versus developing an in-house system, which may or may not also be based on freely available, imported, open-source software. For the former, there are a host of very good and comprehensive packages, some which come as an add-on to the student information system, while others can be interfaced accordingly. Training events, conferences, and meetings allow staff to be oriented and updated on the software's development and functionality.

Assessing which of the purchased options is the best fit for a particular online learning system's needs can be an onerous task. All choices must be carefully considered and aided by some independent evaluation sources (Course Management Systems, 2007).

For the in-house system, there are many free, open-source solutions also available, which emulate the functionality of the proprietary systems and can be adapted in any manner needed. This approach may require more initial development and different skill sets among staff, to ensure the robustness of the system, provide a higher level of technical support on an ongoing basis, prepare documentation and training, and interface with other systems as necessary. Having an active community supporting and contributing to an open-source application provides considerable benefit, through access to a knowledge base and a continuing stream of developments.

In the ideal case, this choice of LMS is based on the needs of the course, without worrying about costs, the availability of qualified staff, or any limitations to using existing systems. The real case, however, is often more complicated: one is either constrained to a single solution based on previous institutional or company decisions (which some would think of as ideal), or one's choice is limited (as it should be) by practicalities, such as the costs of adopting yet another proprietary LMS or the human resources needed and other implications of building or adapting an open-source LMS. Each new solution adds considerable pressure on back-end systems, especially services such as the technical helpdesk and training, and can have a negative impact on both the students' and teacher's experience having to adapt to each LMS. Lastly, there is a lock-in factor: the costs of changing systems is very high, mainly due to the organizational relearning required to switch, and although much effort is being made to develop standards for online learning that will better enable interoperability and reusability of online content, the promise has not yet been met (Friesen, 2004).

The selection of the open-source *Moodle* LMS at Athabasca was achieved through the involvement of a broad section of experts in the community. An essential first task was the development of an evaluative criteria under the following headings:

- Mandate
- Systems Administration
- Cost
- Instructional Design
- Teaching and Learning Tools

These criteria provided guidelines to the evaluators to try out the applications under consideration and helped to establish a degree of objectivity to the process. A final report, produced for the entire Athabasca University community, outlined the reasons for the selection of *Moodle* (Stewart, 2007). The process proved effective in gaining acceptance of the selection within the institution, which has proven essential to its subsequent deployment.

Content Management System

The potential afforded by the LMS to have a more contextualized and dynamic learning environment sets in motion the need for a responsive, flexible, and potentially real-time content development system. Thus, upon deployment of an LMS, the provision of course materials or courseware using efficient and effective workflows will require the adoption of a Content Management System (CMS). There is no single description of a CMS or its functionality and there are many varieties available. In the main, these divide into two essential although not exclusive types: web content management systems and document management systems. The essential capabilities required for courseware are a system that can manage web content and provide a secure, accessible, and collaborative environment for the creation and storage of content in XML format. The importance of XML is that it allows content to be rendered through different media, such as print, web, and mobile devices.

As with LMSs, there are a considerable number of both open-source and proprietary choices available (MIT, 2006). The selection and adoption of a CMS should follow closely in both time and methodology the choice of the LMS, although the expert groups may be different. A CMS will provide the functionality for the creation, collaboration, production, and publishing of learning materials. As the delivery will be through the LMS it needs to be integrated into a seamless environment from the user's perspective, requiring that both systems be technologically compatible.

Library and Digital Resources

Linking the course or program LMS to the necessary online resources is now a key element of any online system. Institutional and public libraries have been leaders in the development of systems and protocols to acquire and share resources. Many now have electronic gateways to their own holdings; those housed elsewhere; digital databases of journals, magazines and government publications (including much in the way of

full-text materials); and specially developed supplementary databases of materials selected for a particular course. In addition, learning objects will increasingly be accessible through in-house and external digital repositories. A key contribution to the development of online delivery is the librarian's understanding of knowledge management and intellectual property issues. These components are discussed in much more detail in Chapter 16, but the key point in developing the infrastructure for online learning is that the availability of such online resources should be ensured or at least anticipated, so that the courseware is developed accordingly, the LMS is appropriately configured, and any access for the student is enabled.

Learner Services

Most attention in online learning must be paid to the courseware and delivery platform. Those who have worked in various forms of distributed learning for many years know only too well the vital importance of the non-academic learner support needed to ensure student success and satisfaction. Depending on the enterprise involved, this support would include technical help, educational advising, various forms of counseling, services for learners with special needs, and so on (see Chapter 17). In an ideal online learning system, these aspects would be given equal priority and developed in concert with the curriculum. In a real situation, such services likely already exist, but are designed for traditional educational environments, and so their conversion and enhancement for online learning is needed, with the ability to adapt and change as new options and learner expectations change.

Interface with the Student Information System

Ideally, the LMS is linked to the Student Information System (SIS) in such a manner that the right student is automatically placed in the right course at the right time with all the right student information easily available to the right instructor and to anyone else who needs it. This interface avoids the need to input student names into the LMS, with all the associated errors and wasted time. Instructors should be able to manipulate the student data as needed for the course (e.g., submitting and editing final marks), and to contact the students as a group, in subgroups, and individually.

All these capabilities require integration between the LMS, CMS, portal, and the SIS, allied to strong identity and access management that will authenticate students to enter their individual learning space. An

integrated SIS/LMS system may seem attractive if one is building an online learning system from scratch. However, in many real situations, there are one or more LMSs, each of which needs to be interfaced as needed to the SIS, and any or all of these may be proprietary, imported, or home-built systems.

The User's Portal

As for most sophisticated online enterprises (travel, banking, shopping, and so on), the nature of the portal provided to the learner (and indeed to staff in various ways) is important. At minimum, the portal should allow the learner, with one secure login, to access everything that is of interest to them: the LMS (and from there to other essential links), their grades, other applicable documentation on their student file, and related learner services and accounts. The portal environment should also be open for students to exhibit their preferences through the customization of the interface and the information and user communities they choose to access or give access to.

The growth in portal sophistication represents a major improvement in student services that is only achievable through online delivery. The ability to personalize a student's experience is not economically or practically conceivable in the off-line world. Further, the involvement of students in the creation of their own personal spaces provides a level of control and convenience that, by itself, adds significantly to the student's understanding of their learning environment.

Initial forays into this portal-enabled space include social networking, e-portfolios, and course support applications. On the horizon are automated support capabilities, such as e-advising and e-counselling, that would review the information provided through the institution's SIS to provide students with advice as to choice of programs, course schedules, and related communities of practice. The network ability of portals enables an interconnected and real-time analysis of Internet-available information to be used in the provision of such services. Although such services will not provide a complete picture or replace the higher-level counselling or advising functions, they can provide real-time assistance to students that will improve both their learning experience and learning outcomes.

Quality Assessment

Most institutions and organizations have a unit dedicated to providing thorough and independent evaluation of any enterprise, as part of the

routine process of quality assurance and improvement. Ideally, the development of an e-learning system should include a plan for the independent evaluation of all aspects of the system, but especially the degree to which it enables or enhances the achievement of the stated learning outcomes (especially in the opinion of its users). Furthermore, such an evaluation would also provide information about the system's return on investment, especially the unanticipated or unseen costs of implementation from back-end systems, staff attitudes, infrastructure, and so on.

In the real situation, where there may be a variety of systems in place, the tendency will be for each group to undertake its own research, which can often be biased (intentionally or not) and difficult to compare with others, unless a strict and common framework is in place. Even if only one system exists, larger corporate pressures may ensure that a project is "doomed to succeed." This is an aspect of online learning where a strong and centralized approach is preferred. The type, scope and framework for evaluation must be independent and structured if the results are to lead to real improvement in systems and good decisions on whether to scrap the systems or build on them with new resources.

RELATED ISSUES

Many institutions and organizations who have shifted significant areas of their core business to an online environment may have noticed the predicted and unanticipated effects on all aspects of their enterprise. For online learning, some of these impacts are straightforward and can be factored in early on, with systematic updates.

- Back-end hardware (servers, switches, etc.) and connectivity will need to be estimated up front, then routinely adjusted as the number of users grows and the system evolves, as well as standards and expectations for up-time (usually 24 hours, seven days a week). With the expectations that video will be increasingly used routinely in online learning, this back-end element will be under ever-increasing demands.
- Policies related to access to servers, security, and the use of the online learning system need to be in place, to balance the need for stability and security with the need to innovate (Athabasca University, 2003).
- Technical help and helpdesk support needs to be in place, possibly linked to a training, orientation, and documentation function,

which can provide support to students and staff on the online learning system. Since this function can be spread among the core information service and the teaching units, clear mandates and lines of responsibility must be in place to avoid duplication of effort or gaps in support.

- A host of human resource issues need to be addressed. Some are tied to collective agreement and employment contract terms and conditions, especially those related to service standards and expectations (which go beyond the normal working day) and the automatic flexibility that online learning provides not only to the student, but also to the staff in terms of the place and times that they work. By way of examples, online activities such as chatting, discussion within forums, blogging, pod-casting, and wiki editing, will likely be new to many faculty and need to be integrated into accepted practice. Such integration may require new policies on attendance and standards for being in touch with the central office for administrative matters.
- Another human resource issue is the constantly shifting nature of the work that staff undertake. Many individuals working in online learning have had no official (or dated) training, but have learned and adapted successfully to new approaches and new technologies. There are many stories of staff who entered organizations at a junior level and worked their way into key roles in online learning, often quite unexpectedly, as organizational needs and their abilities evolved. Traditional approaches to hiring, appointment, promotions, position classification, access to training and professional development have to be adapted in order to maximize the opportunity to invest in and reward staff in such a dynamic environment, and/or to avoid exploiting staff who may be working well above the level for which they are paid. The long-term sustainability of the online learning system will depend, to a large extent, on how this new human resource environment is addressed, if only to retain valuable staff. The online learning system itself should inspire new types of flexible training for staff, with inter-institutional and intrainstitutional support groups and learning communities, information links, and so forth.
- Lastly, the process for decision-making and resource allocation related to online learning in an institution or organization must be carefully considered. If new committees are to be established to provide recommendations on direction and investments, care

must be taken to balance the discussion between those who know and understand a lot (but may proselytize one approach in favour of another), central technical staff, decentralized technical staff who directly support the online system (and who often want more freedom), the central administration (who likely do not know as much, but are accountable for the success and effectiveness of the system), and the users (teachers and learners). The role of independent and thorough evaluation becomes very important in this process.

Organizational Change

Any educational endeavour, if it is of any credibility, is dynamic in nature, responding to new knowledge, understanding, and approaches to the disciplines, to new employment market needs, to changing student demographics, and so on. In a traditional campus or classroom environment, the expectation is on the teachers and/or curriculum developers to ensure this currency, and the same is true in online systems. In the online system, however, change is more complicated, because any change in content or approach can have wide impact on a number of aspects of the system. Online learning technologies themselves evolve just as quickly as the curriculum, as do students' expectations, their level of connectivity, and so on (sometimes in unexpected ways). In short, the organization's capacity and capability of effectively managing change is of vital importance.

Assuming that the organization as whole respects and encourages change in such systems, there still remains the matter of how it is to be managed within the context of online learning. The first issue is balance: specifically, between every time a new idea or product comes into view (including those good for students) versus sticking with an established system (typically for administrative ease and staff convenience). In short, such changes often take place long after they have been superseded by better, proven systems.

The degree of centralization or decentralization of a system (or systems) also drives the change process. To what extent will some units be free to explore and try new systems, and to what extent will those lagging behind be forced to update their approaches? Such questions, since they relate to core aspects of an organization's business and culture, can only be answered within that context. Thus, following the dimensions of an online system infrastructure would appear to be the key to handling change well.

Leadership

As for any organizational issue, effective change starts with leadership. Having the right attitude towards change, its importance and value, is essential. Change should be embraced, and not seen to be just another headache to be dealt with. Kotter (1996) gives a concise explanation of why change is inevitable and crucial in modern business, and provides specific ideas on how change can be led. Organizations have different mandates, cultures, leadership styles, and competitive positions. Universities, for example, have consensual cultures, and therefore leaders of change in such environments require the ability to understand the needs of the broad group of stakeholders before implementing change initiatives.

Scouting Reports

Some staff, as part of their work, must look around for emerging trends and ideas in online learning systems, and provide a place for others to feed information they come across. These scouting reports need to be compiled and shared. In addition, staff members who support online learning applications, particularly in cases where open-source software is used, need to incorporate themselves into the communities that plan and develop applications. By so doing, they may influence and contribute to the applications' development roadmaps, while providing a knowledge base for the organization's community. This function is well supported by regular reports such as the annual Horizon Report (2007).

Governance

A governance body is needed that deals not only with current issues related to online systems, but also provides a forum for discussion of emerging trends, organizes meetings and events to share and demonstrate new ideas, and revisits the vision for the online learning system regularly (e.g., every year or two). This vision should be detailed enough to allow affected managers to adjust their plans and budgets accordingly, within the context of the organization's regular cycle. The terms of reference and reporting relationship of this body should be commensurate with the importance of online learning to the organization.

Membership in such a body can be difficult to determine. The first impulse is typically to include those most intimately involved in online systems – technical experts and educational technology champions – simply because their opinions are valuable. A more important

criterion for membership for such an expert, however, is an individual's willingness to consider a wide variety of alternatives, and to not stubbornly defend their own particular preferred approach. In addition, users of the online systems, neophyte teachers, students, and user support staff, provide an important balance to discussions which otherwise can degenerate into purely technical banter. Finally, this body should be chaired by the highest possible level of relevant management.

The governance body also plays an important role in the allocation of resources to specific initiatives. Such decision-making ability and authority is essential to effective governance; a broad strategic perspective should be channelled through the governance body to prioritize and allocate limited resources to projects with the most potential to achieve the institution's objectives. Without effective governance, initiatives are not likely to be funded on the basis of best fit or strategic importance, but instead on more local or individual concerns.

At the same time, governance must not stifle innovation. Governance, therefore, should have three levels of decision-making: enterprise, departmental, and individual, each level with defined criteria for acceptance, and each level armed with a clear understanding of how the technology will be used. Having clear guidelines will help engender innovation while ensuring its effective usage within the larger community.

Communication

The requirement to continuously communicate at all levels of the organization cannot be overstated. From concept to commissioning, all stakeholders must be aware of what is going on. The adoption of transparent processes with effective governance provides the basis for developing trusting relationships among the greater community, and serves to lessen the inevitable apprehension that change typically engenders.

Through the governance body, there needs to a process whereby developments and ideas in online education are regularly broadcast internally through newsletters and in multiple forums, and, where appropriate, externally via journals and conferences. Simplicity of language is important, as is the opportunity to receive input and explain any apparent inconsistencies in approach.

Pilot Projects and Evaluation

An important dimension of change is the use of pilot projects for new developments, plus effective evaluation of their impact before proceeding to wider adoption. The governance body could provide the approval

for such pilots, and have pool of resources to allocate accordingly. Unfortunately, pilots often become the first phases of deployment, and actions taken eventually result in the organization scrambling to retroactively provision and support what has essentially become an operational system. Having clear expectations of the pilot communicated to the project owners in advance of the project will help to ensure that such misunderstandings are avoided from the outset. Evaluation of any pilot system should be at arm's length, and the results should be shared widely throughout the community. In this way, the organization can receive the fullest benefit and intelligence from its pilots, and the process of innovation can be seen by all involved to be open and effective.

Change Management

As implied, new ideas and approaches must be fostered, not only by words, but also by financial and in-kind resources. Moreover, these resources must be coordinated via an open and widely representative governance body. The goal here is to balance the organization's need for control over implementing innovations (which can deviate rapidly if separate units are left to their own devices) versus the organization's need to constantly explore new innovations and foster the culture of change needed to support such innovation. For the human resources involved, the same balance of recognition and rewards for individuals' contributions to implementation and innovation must be found.

A defined process must also be employed to provide a framework for any proposed changes. As mentioned above, project management provides transferable practices which can be used for this purpose, particularly as the changes are typically complex, ranging from developing a new module in-house to deploying an existing, turnkey module. The process must also allow broad input into both the approval process and the precise specifications of the desired change.

Change is a concomitant outcome of all technological developments. Indeed, even relatively minor amendments to existing work practices can have disruptive effects. As the impact is in the mind of the changed and not the changer, effective change management requires a high level of sensitivity and understanding, to help assist the group to adapt to the new environment. It should always be kept in mind, however, that any technological innovation is only as effective as the weakest user's ability to use it. An adequate technology that is well accepted will be more effective than a good technology that is not. All change initiatives therefore need to have the usability of the system as their main goal and

focus on organizational change; in other words, in the people, not the functionality of a particular piece of technological wizardry.

CONCLUSION

In order to develop an infrastructure that supports excellence in online learning, the issues to be addressed are almost all the same as for any post-secondary educational enterprise: a clear understanding of the goals of the curriculum and the characteristics of the intended students' needs, coupled with a healthy working environment with committed staff, where implementation can proceed and where constant change is understood to be the norm. Within these general areas, there are, of course, a host of technical, procedural, and policy decisions to be made. Nonetheless, online learning is now mature enough that such decisions need not be made haphazardly: there are many successful examples of online learning systems to learn from and plenty of research and information available, including this online text. As opposed to those who were the vanguard of this exciting educational development, new contributors can now focus their efforts on getting the basic principles and goals in order before proceeding to implementation. Ultimately, as with any educational system, online learning is fundamentally a human endeavour, with technology available to support the agreed-upon principles and goals, not vice-versa.

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