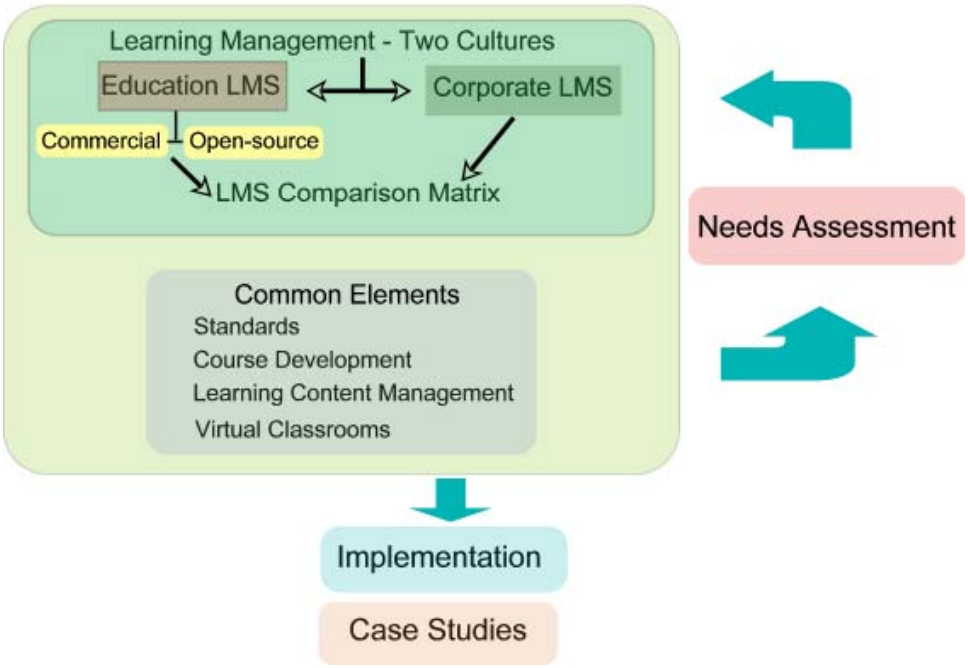
# *Part 2: Preparing Online Courses*

# 7
# *Learning Management Systems*

Don McIntosh[7]
*Trimeritus eLearning Solutions Inc.*




[7] With contributions from Kevin Kelly and Randy Labonte

# Learning outcomes

After completing this chapter, you should be able to:

- Describe the functions of learning management systems (LMS) for formal education and corporate training.
- Conduct a needs analysis, select an appropriate LMS for your environment and manage the implementation and change process successfully at least 50 percent of the time. A higher success rate will depend upon the political environment and the diligence of the needs analysis and research that is done.

# Introduction

> "I truly believe that the Internet and education are the two great equalizers in life, leveling the playing field for people, companies, and countries worldwide. By providing greater access to educational opportunities through the Internet, students are able to learn more. Workers have greater access to **e-learning** opportunities to enhance and increase their skills. And companies and schools can decrease costs by utilizing technology for greater productivity". – John Chambers, CEO of Cisco Systems (Chambers, 2002)

## WHAT ARE LEARNING MANAGEMENT SYSTEMS?

Learning management systems (LMSs) are electronic platforms that can be used to launch and track e-learning courses and enhance face-to-face instruction with online components. Some also manage classroom instruction. Primarily they automate the administration of learning by facilitating and then recording learner activity. They may or may not include tools for creating and managing course content. As the systems grow, they also add new features such as **e-commerce**, communications tools, skills tracking, **performance management** and **talent management.**

LMSs have evolved quite differently for formal education and corporate training to meet different needs. The most common systems used in education are WebCT, Blackboard (these are now effectively one) and Moodle. They often use the term **course management system** to describe themselves. The term course management system, however, is easily confused with **content management system,** so we will use the term LMS to describe the solutions for both educational and corporate environments. We will distinguish between them by discussing corporate or business LMS versus education LMS. Education LMSs are also known as **virtual learning environments** (VLE).

This chapter will be a non-technical look at the features of these systems and the processes of selecting and implementing them. It will address the different functionalities of the systems and consider **open-source** systems as an option to commercial proprietary ones. It will discuss needs analysis to help you begin the process of selecting an appropriate system, and the change management process to address the implementation issues. Case studies will be provided for illustration. Open source systems will be discussed in Chapter 8, Exploring Open Source for Educators.

Occasionally certain vendors and products or services are mentioned by name. These are not intended to be endorsements in any way but simply to serve as familiar examples. We do not endorse any products or services. Vendors and products that are mentioned are usually the best known or the ones with the greatest market penetration. There is no single "best" solution. The ideal solution is the one that fits your needs and environment.

# Learning management: the two cultures

There are two main thrusts in formal learning: academic education, and corporate training (including government and the non-profit sector). In educational institutions, the learning model uses courses of fairly long duration (weeks to months) for the long-term educational benefit of the learner. In corporate training, the model is usually short courses (hours to days) for immediate updates, with specific focus on job functions and objectives. Some corporations try to emphasize the importance of their training services by calling them "universities" such as McDonald's University and General Motors University. As part of their long-term development plans, many businesses also provide support for their employees to attend educational institutions for longer courses and degree programs. For centuries, both systems have relied upon classroom-based, instructor-led facilitation in which a live teacher leads the process.

Distance learning by correspondence has been with us now for many decades. When e-learning became a reality over 10 years ago (first on CD-ROM and then over the Internet), it extended the opportunities for distance learning, and new options and models became possible. The education and corporate training models have evolved separately and somewhat differently.

In the online education environment, it is generally assumed that an instructor leads the course, is available by chat (**synchronous**), via email and discussion groups (**asynchronous**), and sometimes via **virtual classrooms**. In the corporate online learning environment, there is a high degree of dependence on **self-directed** learning often using courses that have been purchased off-the-shelf from third-party vendors. Only occasionally is an instructor present. As a result, the communication/collaboration tools for email, chat, and group activity are well developed in education LMSs while they are less so in corporate LMSs.

Education LMSs are primarily for the delivery of instructor designed online learning and include course content creation (or course authoring) capability as well as some tools to manage the content. While corporate LMSs provide features to help manage classroom instruction, the e-learning is often assumed to be primarily asynchronous, self-directed courses. Many of these courses are purchased from off-the-shelf courseware vendors. As a result, corporate LMSs do not typically include course authoring or content management features. The larger corporate vendors do often offer suites of tools that do include these capabilities.

In most educational institutions, computer systems for registration already exist, so the features for this in education LMSs are limited while many corporate LMSs offer full capabilities for managing classroom learning from registration to assessment as well as e-learning. It is highly desirable that in an educational institution, the LMS can send data to and from the registration system, and in corporate training the LMS can communicate with the human resources information system.

The focus of both education and corporate LMSs often tends to be more on the administration and technical requirements of the organization rather than on the dynamic facilitation of learning. Some instructors and designers are frustrated by the constraints (both technical and learning) of using these systems and would prefer more dynamic learning support systems such as student **weblogs** and learning **wikis**. (See Chapters 25 and 26 for further discussion of these tools). Some of the open-source systems, especially when combined with social learning tools, are more student-centred than the commercial ones.

Online and classroom learning each offer different advantages for different learners. Many people argue that classroom learning is better. Some believe that the classroom offers interactivity—a dynamic exchange of information, questions and opinions between students and instructor and among students. Unfortunately interactivity in a classroom often involves a minority of students who choose to participate, and for others it may not be interactive at all. We have been conditioned since the age of five to believe that learning only happens in a classroom. The reality is that we are continuously learning in all situations. One benefit of the classroom is the social structure and support of schedule, deadlines, the physical presence of the instructor, and other learners. Self-directed online courses offer the obvious advantages of time flexibility—they can be done almost anywhere and at anytime at the convenience of the learner, and they can be repeated several times if necessary. Well-designed online courses can be more effectively interactive than many classrooms in that they require active learning on the part of each student in responding to questions, doing an activity, getting feedback—there is no back of the classroom in an online course—and give them the added flexibility of the freedom from time and place constraints.

**Tip**

There are at least 100 LMSs available for business and at least 50 available for education. Many of the latter are open-source. Although they offer different features, it is best not to ignore the LMSs from the other sector.

# Features of education learning management systems

The original educational learning management system was probably PLATO, which was developed in the early 1960s. In the late 1970s there were initiatives like the Open University in the UK Cyclops system and CICERO project, Pathlore's Phoenix software, and Canada's Telidon project. Wikipedia has an extensive listing of initiatives in its article, History of Virtual Learning Environments.

In formal education LMSs were first used to support distance education programs by providing an alternative delivery system. They are also now used as platforms to provide online resources to supplement regular course material and to provide courses for students who require additional flexibility in their schedules, allowing them to take courses during semesters when they are not physically present or are not attending on full time basis. This also benefits students who are disabled or ill and unable to attend regular classes.

Education LMSs primarily support e-learning initiatives only. Systems for regular classroom support are already in place.

The model for an LMS designed for education is that an instructor creates a course using web-based tools to upload the necessary materials for the students, and sets up collaborative tools such as:

- email
- text chat
- bulletin board presentation tools (e.g., a whiteboard for collaborative drawing and sketching)
- group web page publishing

Students access the course materials on the Web, do both individual and collaborative assignments, and submit them to the instructor.

Most education LMSs offer the following features:

**Tools for instructors:**
- course development tools—a web platform for uploading resources (text, multimedia materials, simulation programs, etc.), including calendar, course announcements, glossary, and indexing tools
- course syllabus development tools with the ability to structure learning units
- quiz/survey development tool for creating tests, course evaluation, etc.
- grade book
- administrative tools to track student activity both as individuals and in groups

**Tools for students:**
- password protected accounts for access to course materials
- course content bookmarking and annotation
- personal web page publishing
- accounts for access to the collaborative tools (email, discussion groups, collaborative web page publishing)
- access to grades and progress reports
- group work areas for collaborative web page publishing
- self-assessment tools

**Administrative tools:**
- management of student and instructor accounts and websites
- monitoring and reporting activity
- e-commerce tools for sale of courses
- communication and survey tools

Some may also offer, maybe at extra cost, some of the following features:

- **learning object** management (course content management for reusability)
- e-portfolios
- file and workflow management
- streaming audio and video
- access to electronic libraries

Blackboard now offers an e-commerce module, and Moodle integrates with PayPal to allow for customers to pay online.

Although LMSs often claim a learner-centred approach involving active collaboration between the instructor and students, both as individuals and in groups, there are some social networking tools such as wikis and weblogs (**blogs**) that most of these systems do not (as of this writing) support. There are numerous initiatives underway to develop add-on tools and to integrate social learning tools with open-source platforms.

In most cases it is assumed that the teacher provides the content, but some system vendors are now selling content as "e-Packs" or "cartridges" that can be uploaded by teachers. It is also possible to purchase course materials from other institutions. Using courses from other sources, however, may be challenging if they are not compatible with your LMS, consistent with the instructor's approach, or accessible by students with disabilities. This may improve with the development and application of operating and accessibility standards.

## COMMERCIAL SYSTEMS

The most widely adopted commercial systems are WebCT and Blackboard. Web CT was originally developed by Murray Goldberg at the University of British Columbia, beginning in 1995. In 1999 the company was purchased by Universal Learning Technology of Boston, and became WebCT, Inc. Blackboard was originally developed at Cornell University. The company was founded in 1997 by Matthew Pittinsky and is based in Washington, DC. WebCT and Blackboard currently control about 80 percent of the LMS market in higher education (Sausner, 2005, p. 9). Blackboard purchased WebCT in 2005, making them the dominant force in the market. The WebCT products are currently being merged and re-branded as Blackboard products.

In August 2006, Blackboard received a controversial patent for certain features in its learning management technology, and, on the same day, proceeded to sue Desire2Learn (one of its main competitors) for patent infringement. Desire2Learn has denied the allegations in the law suit, and both Desire2Learn and the Software Freedom Law Center (SFLC) appealed the patent. In January, 2007 the United States Patent and Trademark

Office (USPTO) ordered re-examination of the patent. On February 1, 2007, Blackboard announced its patent pledge, which is a promise by the company to never assert its issued or pending course management system software patents against open-source software or home-grown course management systems.

It is hard to say what the effect of this will be on current and potential WebCT and Blackboard customers. Some will want to go with the market leader regardless, others will stay with what they have, and many may move to open-source solutions. Cornell University, the birthplace of Blackboard, is reconsidering whether Blackboard is the most appropriate software for Cornell professors and students.

Some other education oriented systems offered by commercial vendors:

- Desire2Learn
- eCollege
- Jenzabar
- Odyssey Learning Nautikos
- WBT Systems Top Class (now appears to be targeting the corporate sector)
- ANGEL
- Centrinity First Class (now a division of Open Text)
- Geometrix Training Partner (primarily a corporate LMS but often used by educational institutions for distance learning programs with a business orientation).

Notes:

- IBM/Lotus Learning Space no longer seems to be a viable contender in the education market. It is now called Workplace Collaborative Learning, and appears to be targeted to the business market.
- Prometheus has been purchased by Blackboard and no longer seems to be supported.

**Tip**

If you currently are using a commercial education LMS, you may find costs escalating, and a continual demand for upgrades. For these and other reasons, many educational institutions are considering open-source systems as an alternative.

## OPEN-SOURCE SYSTEMS

Open-source software is computer software whose source code is available free "under a copyright license … that permits users to study, change, and improve the software, and to redistribute it in modified or unmodified form." (http://en.wikipedia.org/wiki/Open-source_software, February 2007). Open-source LMSs are gaining ground in the education market as a reaction to increasing costs for the commercial systems, and because of the greater flexibility and more student-centred learning approaches in the open-source systems. Some instructors, particularly those with technical expertise, will prefer these systems because of fewer constraints, a greater sense of control, and and generally better communication tools. Other instructors won't like them because they prefer more rule-based systems with full administrative features.

There are numerous open-source systems available. Some of the better known ones are:

- Moodle
- ATutor
- Sakai
- Bodington
- Claroline
- Magnolia

Although the software is free, open-source solutions are not without their costs. They need continuous support and maintenance, which require either a strong and supportive internal IT group, very dedicated instructors, or a contract with outside vendors who will do it for you. Open-source software is maintained by an active community of users who are constantly upgrading the code. These code changes can affect the operability of courses unexpectedly, and require more local maintenance. The "hidden" costs of the time of the IT people and the instructors may or may not outweigh the cost of a licence for a commercial system.

There are useful discussions of open-source systems at http://www.funnymonkey.com, http://openacademic.org/ and in Chapters 8 and 12 of this book.

## OTHER ASPECTS OF LMSS

Some educational institutions have built their own LMS, and have not chosen to market them. Although it is possible for anyone to do the same, it is an expensive process, and it may be vulnerable if one person is the primary developer. Some of the open-source systems have been built by an institution or a group of institutions, and then shared. ATutor was developed at the University of Toronto. The Sakai initiative is a collective effort by 65 academic partners.

**Course development:** Course development tools (also called course-authoring tools) are an integral part of most education LMSs. Some instructors also like to use some of their own tools such as web authoring/HTML editors (e.g., Dreamweaver, FrontPage, GoLive), word processing (e.g., Microsoft Word) and

presentation tools (e.g., Flash, PowerPoint). The LMS should be capable of working with such tools.

**Virtual classrooms/web conferencing:** Virtual classrooms (also known as web conferencing tools) add audio, video, and graphics to synchronous classes over the Internet. Such tools are not usually included as part of an LMS but are available separately.

**Learning content management systems** (LCMS) provide a means of storing developed courseware in learning repositories (databases) as learning objects where it can be retrieved and used by others. Most education LMSs have at least some learning content management capabilities.

Most LMSs are primarily administrative tools, and it is up to the instructors and designers developing the courses to address the issues of the learning model, but many of the LMSs lack the tools to support more student-centred learning. The integration of social learning tools such as wikis and blogs with an LMS can help create a more dynamic learning environment.

Social learning is closely related to social networking and social computing and is the essence of what is being called Web 2.0. It is the use of wikis, blogs, podcasting, etc., by individuals and groups to create content instead of simply being the recipients. Web 1.0 was about downloading; Web 2.0 is about uploading.

Web 2.0 is defined not only by technologies (blogs, wikis, podcasts, vodcasts, RSS feeds, and Google Maps are a few examples), but also by the social networking that it enables. Web 2.0 tools can scaffold learning environments for enhanced communication among students as well as between students and the instructor. Creating learning opportunities that harness the power of Web 2.0 technologies for collaborative learning, distributed knowledge sharing, and the creation of media-rich learning objects can further the scope of what students can learn by fostering a constructivist environment, and putting learning in the control of the students. Both students and instructors are embracing these tools at a phenomenal rate. Examples are Wikipedia and YouTube. LMSs will need to catch up.

Initiatives to include social learning into LMS include:

- Learning objects is a commercial product, and targets users of large-scale course management platforms.
- Elgg http://elgg.net/ (February 2007)—open-source
- Drupal http://drupal.org/ (February 2007)—open-source
- MediaWiki http://www.mediawiki.org/ (February 2007)—open-source

It is interesting to note that the University of Phoenix, one of the largest e-learning organizations in the world with nearly 200,000 students online simply uses *Outlook Express* newsgroups for its courses, along with other tools it has developed internally. Other early online universities like Pepperdine University use newsgroups extensively as well.

**Tip**
Adult and continuing education departments tend to follow more of a business model. If you are seeking an LMS for this application and need registration and payment features, consider some of the more reasonably priced business LMSs (see below).

# Features of corporate learning management systems

The major business-oriented LMSs manage classroom and **blended learning** as well as e-learning, and are intended to function as the full registration systems for corporate training departments. Some of the larger ones such as SumTotal Systems, Saba and GeometrixTraining Partner actually evolved from registration systems. A few very basic corporate LMSs manage only e-learning, and then usually only for pre-packaged, self-directed courses.

Corporate LMSs usually offer the following features:

**Classroom course management:**
- registration
- course scheduling and set-up (instructors, facilities, equipment)
- email status notification
- tracking.

**E-learning management:**
- registration
- delivery
- email status notification
- tracking
- interoperability with third-party and custom courseware
- testing and evaluation
- communication tools.

**Blended learning management** combines e-learning course content with classroom activities and communication tools such as discussion groups and virtual classrooms.

**Support for e-learning standards** such as **AICC** (Aviation Industry Computer-based training Committee) and **SCORM** (Shareable Content Object Reference Model) to enable interoperability between third-party courseware and the LMS and between different LMSs. These standards do not guarantee the interoperability, but they are a step in the right direction. The origin of many of these standards come from engineering, the airline industry, and the US military who operate on a corporate training model, so they are less relevant to education courseware, but may help if you are switching platforms or making courses available to others using different platforms. See Appendix D, Course Authoring Tool Features, and Chapter 17, E-learning Standards.

**Competency and performance management**:
- Identify needed competencies for individuals and groups in order to perform the necessary work.
- Track performance for both individuals and groups and identify where improved performance is needed.
- Link to human resource systems. This is another feature not directly relevant to an education environment.

**Reporting and analytics:**
- Ability to generate reports on participation, assessments, etc.
- Includes standard and custom reports.
- Reports generated in graphical form.
- Financial analysis.
- Survey generation and analysis.
- Regulatory compliance tracking.

**Multiple language support**: Multinational corporations usually require different languages. Many LMSs provide for multiple languages now, but this does not necessarily include true **localization** which requires adaptation of the content and design to fit local cultures. True localization is far more extensive than translation and requires substantial additional work.

The following functions are usually offered as separate capabilities or as part of a suite. Often the **course authoring** and web conferencing tools are supplied by separate vendors.

- **Course development/authoring:** A means of creating online courses. Many of the tools used in business are designed for creating interactive, self-directed courses complete with tests and assessments. Examples of such tools include Authorware, ToolBook, Lectora, ReadyGo, and Outstart Trainer. Other tools offer so called rapid e-learning development—conversion of Word, PowerPoint, etc. documents into interactive courseware. Examples include Articulate, Elicitus, Impatica and KnowledgePresenter.
- **Virtual classrooms/Web conferencing:** Synchronous instructor-led classes over the Web. Tools include Microsoft Live Meeting, Elluminate**,** Adobe Acrobat Connect Professional (formerly Macromedia Breeze), LearnLinc, Webex, Interwise and Saba Centra.
- **Learning content management/learning object repository:** A means of storing developed courseware in learning object repositories (databases) so that it can be retrieved and reused. In addition to suites offered by the major LMS vendors, notable others include Eedo, Chalk Media Chalkboard, and Cornerstone OnDemand.

One of the main distinguishing features between corporate and education LMSs is that for most business LMSs provide fairly complete registration systems for classroom instruction as well as e-learning. Full scale registrations usually already exist in educational institutions.

LMSs sometimes offer e-commerce capabilities that allow both internal and external people to pay for courses. These features for managing both classroom instruction and e-commerce are not usually part of education LMSs. The exceptions to this rule are Blackboard, which does offer a commerce solution for educational institutions, and Moodle, which integrates with PayPal for this purpose.

In the corporate environment, there is a great deal of reliance on pre-packaged, self-directed courses. Many of these will likely be generic courseware available from such suppliers as SkillSoft, Thomson NETg (Skillsoft now owns NETg), ElementK, and others. The off-the-shelf courseware usually covers such topics as **information technology** (IT) skills, communication skills, business processes, and sales training. In most cases there is also the need for custom courseware for training on proprietary products and solutions, and unique situations. It is extremely important that the LMS can work with all possible third-party courseware and tools used to create custom courseware.

Most corporate LMSs are limited in their use of communication tools. Unlike education LMSs, there is no assumption that an instructor will be available via email. This will probably change somewhat as businesses recognize the value of communication tools, **communities of practice**, mentoring, blogs, wikis, etc.

As corporate LMSs expand their capabilities, they begin to overlap with human resources functions, with terms like performance management, human capital

management and **talent management** becoming frequently used by the major vendors.

The major vendors of corporate LMSs are:

- Generation21
- GeoLearning
- GeoMetrix Training Partner
- Intelladon
- KnowledgePlanet
- Learn.com
- OutStart
- Plateau
- Saba
- SumTotal Systems

These are the ten largest vendors in the corporate LMS market. Open-source systems are not yet a major factor in the corporate environment, but as Linux becomes more popular this may change.

As with any enterprise software system purchases, there are generally two approaches—"best-of-breed" in which companies look for the best possible tools in each category, and the single vendor approach in which all the tools are obtained from a singe vendor. The former can give the organization all the functions it needs while creating some integration challenges in getting the tools to work with each other. The latter will probably simplify integration, but may sacrifice some functionality.

**Tip**
Business LMSs typically include classroom registration features and do not include course development tools. Education LMSs are just the opposite. Education LMSs are also strong on communication tools.

For a detailed comparison of the features of education and corporate LMSs, see Appendix A, LMS Comparison Matrix.

**Tip**
Corporate LMSs tend to be very expensive for an educational environment but some of the more modestly priced ones may be suitable, particularly in a continuing education application where registration and e-commerce features may be needed.

# Standards

## E-LEARNING STANDARDS

Technical, design, and accessibility standards for e-learning are in a constant state of flux. Technical standards continue to be developed to provide for compatibility between systems and courseware, and for the definition and use of learning objects. See Appendix B, Standards Bodies and Links, for a list of standards bodies and links. Several different international organizations are working on these standards. The **AICC** (Aviation Industry Computer-based Training Committee) standard was developed more than 10 years ago when the aviation industry (one of the early adopters) recognized the problem of interoperability among systems. **SCORM** (Shareable Content Repository Reference Model) is a collection of technical standards for different purposes. It is developed by the Advanced Distributed Learning (ADL) initiative of the US Department of Defense. SCORM was begun in 1997, and the standards continue to evolve. Many LMS vendors and courseware vendors claim to be standards-conformant, but that does not yet guarantee that the systems will be interoperable. Some course designers are against standards altogether, claiming that it constrains creativity and the facilitation of learning.

## INSTRUCTIONAL DESIGN STANDARDS

At least as important as technical standards is the quality of the instructional design. Instructional design certification is offered by **ASTD** (American Society for Training and Development. "Designed for asynchronous Web-based and multimedia courses, the **E-Learning Courseware Certification** (ECC) recognizes courses that excel in usability and instructional design". (American Society for Training and Development, n.d., para. 4)

**ISPI** (International Society for Performance Improvement) offers numerous publications and awards addressing design standards for e-learning.

E-learning design can also be certified by eQcheck. "The eQcheck is designed to ensure that a product will give satisfactory performance to the consumer. The standards on which the eQcheck is based are the Canadian Recommended E-Learning Guidelines—the CanREGs, published and copyrighted by *FuturEd Inc.* and the Canadian Association for Community Education (2002)" (eQcheck, n.d., para. 2).

### ACCESSIBILITY STANDARDS

These relate directly to general Web accessibility, particularly for the visually impaired. The initiative is led by the Web Accessibility Initiative (WAI) of the World Wide Web Consortium (http://www.w3.org/WAI/). There is also the Web Standards Project, which "is a grassroots coalition fighting for standards which ensure simple, affordable access to web technologies for all." (http://www.webstandards.org/). In the US, Section 508 of the Rehabilitation Act requires access to electronic and information technology procured by Federal agencies. See Chapter 11, Accessibility and Universal Design, where this is discussed extensively.

**Tip**

Claims of standards conformance do not yet guarantee interoperability. Tools and courseware should be tested with the LMS to be sure.

## Course development

Course development is also referred to as course authoring. Courses made available on the Web are simply collections of web pages designed to help people learn. They may be a group of resources to which a learner is referred, or they may be carefully crafted sequences of learning events that include interactivity, tests and assessments, animations, screen simulations, video, and audio. It is possible to create web-based learning courses by using templates or by programming directly in HTML or Flash but there are course authoring tools available which are designed to simplify the process.

In education LMSs some course authoring capability is usually included. Some instructors may prefer to use additional tools. Course authoring is not usually included in corporate LMSs, but is available separately. as part of an LCMS or as part of a suite of products.

Course authoring tools like Adobe/Macromedia Authorware and SumTotal ToolBook have been around since before the World Wide Web, and have evolved with it. Not all the tools do everything. The more complex ones require considerable expertise and can benefit from programming experience. Simpler ones are easier to use but may be somewhat limited in capability. Some are tools for converting PowerPoint presentations or Word documents to web code. They are often referred to as "rapid e-learning" development tools. Others are specialized to produce software simulations, or tests, and assessments.

In education LMSs course development tools provide the means for teachers to perform the following types of activities:

- **Provide and organize resources related to the learning objectives**: Most education solutions allow instructors to create simple text pages or web pages. These can be used for a syllabus, a project outline, assignment instructions, grading guidelines, and much more. LMSs usually provide support for multi-media materials such as video and audio streaming or modules or simulations built in other software tools. If instructors are using tools such as Dreamweaver, Flash, or other authoring tools, it is important to obtain an LMS that supports the code generated by these products particularly for any rich media, interactivity, and for recording scores on tests.
- **Set up communication tools for the students to use**: LMSs often give instructors and students the ability to send email to one another via the LMS. Instructors can also set up group areas, discussion forums, wikis, and other tools to allow students to communicate about general topics with little to no facilitation by the instructor or teaching assistant. For example, you can use a discussion forum as a way for students to introduce themselves, to provide technical support to each other, or to continue an interesting discussion if you run out of time in the classroom. Many LMSs also provide a calendar to which students, instructors, and the LMS itself can add events. Students can schedule study groups, instructors can remind students of special events such as field trips, and the LMS itself will mark events such as quiz dates or assignment due dates.
- **Facilitate and manage online interactivity related to the learning objectives**: Those same communication tools, and several others, can be used to facilitate online interactivity related to coursework. Depending on the LMS, instructors can use single-question polls to gauge student attitudes or knowledge about a reading, discussion forums to have students analyze a lab procedure before entering the lab, wikis to have students collaboratively solve a problem or work on a project, or chat to let small groups discuss required field work in real time.
- **Assess student performance (skills, knowledge, and attitudes)**: LMSs provide avenues for students to submit assignments and for instructors to evaluate different types of student performance. For example, students can submit written essays in several ways, including, but not limited to, digital drop boxes, discussion forum threads, discussion forum attach-

ments, wikis, or "assignment" modules. Instructors can require students to use different submission pathways to create different types of assignments. You might use a discussion forum to allow peer review, wikis to engage students in collaborative writing exercises, or assignment modules to make it easy to collect all the essays. LMSs usually provide tools for creating and delivering quizzes as part of the courses. Instructors may also use other tools for this purpose such as Questionmark Perception, Respondus, Hot Potatoes, and test banks that publishers provide. If you plan to use these tools, it is important to be sure that your LMS can work with the code generated by these third-party software solutions.

- **Assess teaching effectiveness**: Many LMSs contain survey tools to allow instructors to collect feedback about specific topics, including teaching effectiveness (see Chapter 24, Evaluating and Improving Your Online Teaching Effectiveness, for more information on this topic). The different LMSs vary the possibilities for instructors and students. Some allow anonymous student responses and some contain specific survey instruments for teaching effectiveness. If the LMS does not do everything you want, you can always link to an external survey tool on the Web. For example, the Free Assessment Summary Tool (http://getfast.ca) allows instructors to use a database of more than 350 teaching effectiveness questions, to create twenty questions per survey, and to download the results as an Excel spreadsheet, all for free.

**Tip**
Be sure your LMS will work with the additional tools that instructors are likely to use for course development.

# Course development in corporate LMSs

Course authoring tools are not usually included as part of a corporate LMS, but are available separately or as part of an LCMS.

For corporate training there is a strong reliance on pre-packaged, self-directed courses. These can be purchased from third-party vendors like Skillsoft, Thomson NETg (now a part of Skillsoft, making Skillsoft the single largest vendor of such courseware by a substantial margin), ElementK (now owned by NIIT), and Harvard Business School Publishing. Generic courseware is available for learning skills in communication, business, leadership, management, finance, information technology (IT), sales, health and safety, and more specialized topics.

Most companies also have a need to develop courses on for unique situations and proprietary products and services. There are many tools available for this purpose. Most of these are designed primarily for creating self-directed online courses, but they can also be used to develop classroom materials.

Some examples of popular course authoring tools:

- SumTotal ToolBook
- Adobe Authorware, Flash, Dreamweaver, and Acrobat Connect Presenter
- Trivantis Lectora
- ReadyGo Web Course Builder
- MaxIT DazzlerMax
- Outstart Trainer

Course development can be very time consuming. There is a lot of material already available in *Microsoft* Word or PowerPoint. So-called rapid development, or rapid e-learning tools are designed to quickly convert these documents to e-learning courses. Examples include:

- Articulate
- Impatica
- Adobe Presenter (formerly Macromedia Breeze Presenter)
- KnowledgePresenter

Most of these tools (with the exception of Impatica) convert PowerPoint and Word documents to Flash because it is web-friendly and so widespread. (According to Adobe, Flash is already installed in 97 percent of browsers.)

# Software simulation tools

There are numerous tools designed specifically for the simulation of computer screens by recording screen interactions. For example:

- Adobe Captivate (formerly Macromedia RoboDemo)
- TechSmith Camtasia
- Qarbon ViewletBuilder

Many of these also do PowerPoint to Flash conversion.

# Test and assessment tools

Most course authoring tools can create and deliver tests and quizzes as part of the courses. Instructors may also want use test banks that publishers provide, and/or other, more powerful tools built specifically for testing. For example:

- Questionmark Perception
- Respondus
- Hot Potatoes

There are well over 100 available sources for software that can be categorized as course authoring tools.
When choosing an LMS, be sure that it can support any third-party generic courseware or content authoring tools being used. Particular attention should be paid to the LMS's ability to launch the courses, and track and record interactions and responses to quizzes. Support for standards helps, but it is no guarantee. You should test the LMS with the tools and courseware that you will be using. You should also determine how accessible the file formats are for students with disabilities. (See Chapter 11, Accessibility and Universal Design, for more information about accessibility.)

**Tip**
Be careful with rapid development tools. Speed of delivery can be very important but make sure you are not just making bad Word or PowerPoint documentation into even worse e-learning courses.

# Virtual classrooms/web conferencing

Web conferencing tools can bring a new dimension to your programs. They add presentations, audio, video, graphics, synchronous chat and voice interactions to meetings and classes at a distance. They can effectively complement online courses where some live interaction is called for and where there is an immediate need for new information or skills. Recordings can often be made to enhance asynchronous distance education programs. In an education/training mode, they are often referred to as virtual classrooms.

With a few exceptions, virtual classrooms are not included as part of an LMS, either for education or business, but are available separately. Some LMS vendors partner with web conferencing software vendors to integrate the products so they will work well together.

There are more than 50 vendors of these products. In most cases, these systems can support either corporate or education needs. Some of the best known include:

- Centra Live (now owned by Saba)
- Citrix GoToMeeting
- Elluminate
- Horizon Wimba
- iLinc LearnLinc
- Interwise Connect
- Adobe Acrobat Connect Professional (formerly Macromedia Breeze Live)
- Microsoft NetMeeting (free but apparently no longer supported)
- Microsoft Live Meeting (formerly Placeware)
- Tapped-In (a free text-only based conferencing system)
- WebEx Training Center

Licensing of these products varies from annual subscriptions (Elluminate) to pay-as-you-go (WebEx) to free (TappedIn). If they are only used occasionally, then the pay-as-you-go option is probably the best choice. However, that can rapidly get very expensive.

For an extensive list of features of these products, see Appendix E.

**Tip**
As with any software or instructional approach, it takes considerable skill to facilitate an online session effectively.

# Learning content management

The management of learning content involves saving developed courseware as learning objects in a learning object repository (database). It is catalogued using **metadata** (descriptive tags) so that it can be easily found and retrieved by anyone who has access to it. It supports institutional or corporate reuse of the learning objects. Systems that do this are often called learning content management systems (LCMS). They are specialized content management systems.

Most education LMSs include at least some capability for content management. Some even call themselves learning content management systems.

Learning content management is not usually a feature of the corporate LMS, but some of the major corporate LMSs include content management as part of a suite of

programs. It is also available separately. Most separate LCMSs include content authoring and some learning management features as well.

**Performance support**: Some corporate LCMSs provide for a feature called performance support. Also called JIT (just in time) learning, performance support allows employees to immediately access information (courses, units, and learning objects) that enables them to do their job better "in the moment". For example, if an employee working on a task cannot remember exactly how to do something, he or she can quickly access a course, or parts of a course, that will show how to perform the operation. This requires managing the course content as learning objects, and making them easily accessible to all learners. Such systems when available separately are often called **EPSS** (electronic performance support systems) but are now sometimes included as part of an LCMS. This is another concept which does not really apply in the education environment. See Appendix C, LCMS Features.

LMSs that include this capability as part of a suite include:

- Cornerstone OnDemand
- Generation21
- GeoLearning
- KMx
- LearnCenter
- Plateau
- Saba
- Sum Total Systems

Some examples of separate systems are:

- Chalk Media Chalkboard
- dominKnow LCMS (formerly Galbraith Media)
- Eedo
- Outstart

---

**Tip**

Be careful about learning content management. Everyone thinks, "What a great idea—save the course materials in a way that they can be reused easily." But too often it doesn't happen. Some organizational cultures do not support the value of sharing. This is a great tool if it is used but an expensive mistake if not used.

---

# Needs assessment

Choosing an LMS is not a technology decision. It is primarily a leadership and change management decision. No matter what system you adopt, it will change the way you do things. Even if you adopt a system that supports your basic learning model, procedures will change. This is a major decision that calls for a careful assessment of your needs.

Before you even talk to LMS vendors or open-source LMS community members, form an expert committee of people consisting of educational leaders and administrators and instructors—people who understand how online learning works. Be sure to include some IT personnel to enlist their ideas and support and their understanding of the technology.

Consult with end users, both instructors and students, by questionnaires, surveys, interviews, and/or focus groups to determine their needs, desires, willingness, and abilities. They can identify the desirable features of the system, and give some indication of the change management factors that need to be addressed**.** Be careful of scope creep. When asking people what they would like to see, they will tend to ask for everything. Distinguish between the things that are truly needed and the "nice-to-haves".

Consult with people in other organizations like yours that have already gone through the process. Find out what they are using and how they like it. Read the literature and attend conferences.

Are you looking at an LMS to initiate e-learning? You may not actually need to do this. Online courses are just a collection of web pages that do not require an LMS to run them. The primary purpose of an LMS is to provide a working platform and administration for tracking the results. If you don't need to track the results, or if instructors will do it manually, then you don't need an LMS.

LMSs tend to constrain people to do things in certain ways. Some instructors and designers are frustrated by the constraints (both technical and learning) of using these systems and would prefer more dynamic learning support systems such as student weblogs and learning wikis, and even just email or newsgroups. You may prefer to give them more creative freedom. Wikis and blogs don't require an LMS but they are hard to track. Instructors can track activity manually and assign grades but it limits the analysis you can do, for example to find out to what degree students participate, how students perform on individual questions, etc. Wikis and blogs can be altered easily, so are not ideal for formal assignments (other than perhaps a team assignment to build a

wiki). Individual and team essay assignments are probably best submitted to instructors via direct email messages and attachments. This would still not require an LMS to track as the instructors would be marking and tracking such assignments manually.

**Tip**
Obtaining an LMS will change the way you work. Choosing one is not a technology decision. It is about leadership and change.

## STEPS IN THE NEEDS ASSESSMENT PROCESS

### Conduct primary research

Survey, interview and conduct focus groups among your expert committee, instructors, and students to determine the primary needs of your system. Don't ask general questions like, "What do you need?" or you will get a wish list that may not be practical. See Appendix F, Needs Assessment Questions, for suggestions about questions to ask.

### Conduct secondary research

(1) What LMSs are other organizations using?
   (a) Is the organization similar to your own, or have similar needs?
   (b) What made them choose that particular solution?
   (c) How satisfied are they with it?
   (d) What features do they like and not like?
   (e) What feedback have they had from students and instructors?
(2) What does the literature say?

If you are looking for an education LMS, a good source of information is the website of the Western Cooperative for Educational Telecommunications: Online Educational Delivery Applications: A Web Tool for Comparative Analysis ( http://www.edutools.info/). This website contains reviews and comparative data on a large number of education learning management systems.

You may also wish to attend conferences where LMS are featured and profiled.

Good corporate conferences are:

- Learning 2007 (formerly TechLearn) (http://www.learning2007.com/)
- Training (http://www.trainingconference.com/)
- American Society for Training and Development (ASTD) (http://astd2007.astd.org/)
- International Society for Performance Improvement (ISPI) (http://www.ispi.org/ac2008/)

Good educational conferences include:

- Association for Educational Communications and Technology (AECT) (http://www.aect.org/events/)
- ED-MEDIA (Association for the Advancement of Computing in Education—AACE) (http://www.aace.org/conf/)
- Association for Media and Technology in Canada (AMTEC)/Canadian Association for Distance Education (CADE) (http://www.cade-aced.ca/conferences/2007/)
- Canadian Association for University Continuing Education (CAUCE) (http://www.cauce2007.ca)

You can expedite the process by attending virtual trade shows and online demonstrations. Check out the possibilities at http://www.virtualtechfair.com/ and vendors' websites.

**Tip**
For reviews of education LMS software, check out http://www.edutools.com.

If you are looking for a corporate LMS, you can check out the reports by Brandon Hall at http://www.brandon-hall.com, Bersin & Associates at http://www.bersin.com/ or by using the comparison tool at http://learning-management.technologyevaluation.com/.

Other good sources of information include the eLearning Guild (http://www.elearningguild.com/) and Chief Learning Officer magazine (http://www.clomedia.com/).

Once you have determined your requirements and have documented them carefully, prioritize them to determine the critical needs.

**Tip**
Be careful of scope creep. When asking people what they would like to see, they will tend to ask for everything. Distinguish between the things that are truly needed and the "nice-to-haves".

### System selection

Now you can begin to research vendors and/or open-source solutions. Looking at different products can open up new possibilities, but, again, be careful of scope creep, and of being sold something just because it is the latest hot item.

Use your documented requirements and priorities to identify a manageable list of solutions (perhaps 10) from

the more than 100 vendors. An evolving, fairly complete list of such vendors can be found at http://www.trimeritus.com/vendors.pdf.

### Request for proposal (RFP)

Requests for proposals (RFP) follow fairly standard industry forms. At http://www.geolearning.com/rfp there is a template specifically for LMS selection but be careful about templates that are just lists of features. Include only those features that you really require. Use your documented requirements and develop use case scenarios and scripts to paint a clear picture of your LMS vision so that a vendor can provide a proposal focused on your specific environment/culture. Include reporting functions in your scenarios. Poor reporting capability is a great source of customer dissatisfaction. Be sure to ask questions about post implementation customer service because it is also a key factor in customer satisfaction. Ask vendors for references especially those for organizations similar to your own.

Ask the vendors from your list to submit proposals. When you contact vendors, the more clearly you have identified your requirements, the more attention you will get from suppliers—they will see you as a qualified prospect. A full formal RFP process may not be practical in all situations unless it is required by your organization.

See appendix G for RFP questions for vendors.

### Review the proposals

Develop a rubric for scoring the proposals you receive from vendors. Make a short list of the top three to ten vendors to be invited to provide demonstrations.

### Schedule meetings and demonstrations

Ask your short list of vendors or open-source community representatives (who may be members of your own organization) to demonstrate their products either at your location or online. Ask them to demo directly to the use case scenarios and demonstration scripts you developed in the RFP. Invite students, instructors, and IT people to the demos, as well as members of your core committee.

Most vendors will have pre-packaged online demonstrations of their products, but remember that these are mostly designed to show off the good features of the product that may not be relevant in your situation.

Use your rubric to have each participant evaluate the solutions. At the meetings, discuss specific details about how the vendor provides service, maintenance, etc. Try to arrange for a free, in-house trial. If possible, run a small pilot program with a small sample before rolling a solution out to the entire organization.

Note that the needs assessment and selection strategies are also part of your change management strategy. The more input people have in the decision, the more likely they will adopt it.

### Make the selection

Meet with your review team to consolidate the rubrics and make a selection. The bottom line is selecting the LMS that meets your needs.

> "The average company doesn't get excited about buying an LMS; it gets excited about managing learning. It doesn't get excited about buying a new e-learning course; it gets excited about changing an employee's performance." (Elliott Masie as quoted by Ellis, 2004)

## Implementation issues

Some of the factors you need to take into consideration when implementing an LMS are:

(1) **Change management**: Implementing an LMS is a major change. In a corporate environment almost everyone will be exposed to it as it becomes part of the intranet portal. The change management issues—the marketing, communication, and training initiatives that will need to be put into place to gain acceptance and appropriate use—are of paramount importance. In an educational institution, the impact will be less widespread, but change management is still important for all the instructors and students who will be accessing the system.

(2) **Timelines**: How long will it take to conduct a needs assessment, to run a pilot test, to build a user community within the organization, to build the appropriate infrastructure to support it, etc.?

(3) **Cost:** Consider the total cost of ownership (TCO); not just the cost of the software but the complete implementation and maintenance costs.

(4) **Customization**: Will you want to brand the system or change it to make it conform to the way you do things? Doing this can be more expensive than the initial licensing and can delay the implementation process significantly.

(5) **Internal or external hosting of the application:**

  (a) In-house hosting requires hardware (e.g., servers for application, database, data storage, backup systems), infrastructure (e.g., high-bandwidth connectivity, uninterrupted power supply in case of power outage), and staffing (e.g., technical

support staff, training, and user support staff) to maintain the LMS. In some cases, in-house hosting can provide your organization with greater flexibility, security and responsiveness than a third-party hosting facility.

(b) With the supplier or a third party hosting it for you, it is more expensive, but you do not have to provide all of the IT support. In most cases, however, you will still need to designate or hire an in-house support person to support instructors and learners, and to be the point of contact with the hosting group. Implementation of externally hosted LMSs can be quicker. It may, however, take longer to make changes in the system after it is up and running.

(c) With open-source systems, it may be possible for you to contract with a company to host and maintain the LMS for you but the usual scenario for these will be in-house hosting.

(6) **Integration with other systems**, e.g., registration, student information systems, library or data management systems, and/or human resources systems

(7) What kind of **support** will the supplier or community (for open-source solutions) provide during implementation? For example, training, customization, trouble shooting, help desk, etc.

(8) **Training** for instructors and students

(9) **Software updates**

(10) **Conversion of existing or third-party courseware** to run properly on your new LMS.

(11) Are there other **initiatives** happening in your organization which your LMS initiative can support so that mutual success can be achieved?

# Case studies

## TELUS CASE STUDY: AN E-LEARNING SUCCESS STORY: IT'S ABOUT ACCESS

Telus Communications is western Canada's major telecommunications provider and the second largest in the country. It has approximately 25,000 employees across the country. Between 1995 and 1998, BC Tel (prior to the merger with Telus) developed an extensive intranet which became a great information tool for employees. Several internal websites were developed to augment the training courses offered by Learning Services. In 1998, BC Tel contracted with *SkillSoft* for about 20 of its generic, self-directed sales and communications courses to complement its manager training curriculum. The initial licence was for 2,000 participants. The interest was much greater than expected. Many employees at all levels of the organization and in all divisions discovered the courses and used the opportunity because they were "free". Within six months, the licence had to be increased to 3,500. Then additional courses were licensed for other subject areas including information technology (IT) from Smartforce and NETg.

One reason for the success of these courses is that upper management had implemented a policy that all employees would maintain a personal development portfolio, and demonstrate steps towards their goals. Because the e-learning courses were free and available to everyone, they became very popular. It is always good to have an e-learning initiative tied to other organizational objectives and initiatives. People are often hungry to get training to improve their skills and advance their careers, but they don't always get the opportunity. E-learning made it accessible.

Telus management was interested in developing some of their own proprietary courses, so an extensive review of available course authoring tools was made. Click2Learn ToolBook software was selected for this purpose. The plan was to enable more than 100 people throughout the organization to create courses using this tool, so ease of use was an important criterion. A training program was put into place to train those people. The tool was found to be useful particularly for training on new products and services. Telus typically introduces several new products and services each month, and traditional training approaches were simply too slow to address this. One of the first courses developed was on a new feature for telephones called "Talking Call Waiting". The course was made available to sales and customer service people. In this case e-learning made it possible to distribute training to everyone who needed it much more quickly than could have been done by traditional methods.

Another course on **ADSL** (asymmetric digital subscriber line high-speed Internet connection) was made available to everyone and had more than 1,000 hits in the first few days.

Up to this point, only very simple management tools had been used to track the results, and a good deal of work was done manually. Telus then did a study of LMSs and decided that they would build their own system because they had an extensive and skilled IT staff that had developed parts of such a system for individual departments.

In 2004, Telus reported that it had developed 300 custom courses for its employees and there were a total of 100,000 course completions for both custom and generic courses. E-learning is now a way of life for Telus.

## SAN FRANCISCO STATE UNIVERSITY CASE STUDY: AN OPEN SOURCE SOLUTION

*by Kevin Kelly, Online Teaching and Learning Coordinator*

In *Images of Organization*, Gareth Morgan (2006) describes double-loop learning, or a process by which organizations go beyond simple behavioural changes to reach goals. They do this by questioning the way they normally do things in an effort to improve. The decision process to move from one learning management system to another might be considered an example of double-loop learning.

San Francisco State University (SFSU) began this process after experiencing some technical difficulties with a commercial LMS. The campus had experienced a number of issues related to an upgrade, including intermittent performance issues and a thirteen-hour outage during finals week. While the vendor worked hard to alleviate the problems, the campus began to discuss the future. Based on feedback from faculty focus groups, the campus decided to investigate alternative LMS solutions.

To begin, academic technology staff members looked at several commercial and open source solutions. During the focus groups, the faculty members provided a simple requirement: "We can't go backward." In other words, any alternative had to have the same capabilities as the existing LMS. After setting up mock courses in more than ten environments, the academic technology team found that Moodle provided the flexibility to meet faculty and student needs quickly, as well as a nearly parallel set of features for online teaching and learning.

After selecting Moodle, the team created the LMS investigation roadmap. At each stoplight on the roadmap, the campus would evaluate the project status. If Moodle was not meeting teaching and learning needs, then the campus would start over with another tool. If faculty and students gave a "green light", then the investigation would continue.

In Fall 2004, SFSU began an alpha test with five instructors and 300 students. One instructor with more than 100 students in the alpha test liked it so much for her large class that she moved several large sections totaling 850 students to Moodle for the beta test. In Spring 2005, the campus ran a beta test with 25 instructors and 1,500 students. The academic technology team performed extensive outreach to get faculty in all nine colleges to participate in order to evaluate the needs of different disciplines. An Associate Vice President requested scalability tests in Fall 2005 and Spring 2006 with over 100 instructors and 6,000+ students and 9,000+ students respectively. At each stage, the campus used the roadmap test to verify that it was on the right track.

At the same time, the Academic Technology team worked with the Disability Programs and Resource Center to conduct accessibility testing. This involved more than running a web-based verification program. To make sure that the accessibility testing would address real needs, the campus asked students with disabilities to help test the LMS with assistive technology such as JAWS, a screen reader application, and Dragon Naturally Speaking, a voice recognition program. Similarly, the Academic Technology team worked with an SF State faculty member and a UC Berkeley graduate student in a usability related course to facilitate usability testing with Moodle.

The faculty-run Educational Technology Advisory Committee worked with the team throughout the process and, at the end, made a recommendation to move exclusively to Moodle as the online teaching and learning environment. The recommendations included a list of items for the campus academic technology unit to address, such as improving the grade book and creating a list of frequently asked questions for support. Based on this recommendation, the Provost announced that the campus would use Moodle exclusively when the vendor contract expires in Summer 2007.

While the original drivers were technological, the campus also received equivalent pedagogical and administrative benefits. Instructors have been changing the way they teach, and writing articles about the scholarship of teaching and learning. As Moodle is open source software, the campus has created a consortium of regional two-year and four-year colleges and universities to create economies of scale related to software development, training and support, and other forms of collaboration. More is yet to come.

# Summary

When considering the purchase of any learning management system it is essential to assess your needs carefully before buying and to implement them properly to ensure success.

Here are a few key points:

- There are at least 100 LMSs available for business, and at least 50 available for education. Many of the latter are open-source. Although they offer different features, it is best not to ignore the LMSs from the other sector.

- There is no single "best" solution. The ideal solution is the one that fits your needs and environment.
- Obtaining an LMS will change the way you work. Choosing one is not a technology decision. It is about leadership and change.
- Be sure your LMS will work with the tools that instructors are likely to use for course development, and that it will integrate with other systems such as HR and registration systems.
- Be careful about learning content management. Everyone thinks, "What a great idea—save the course materials in a way that they can be reused easily." But too often it doesn't happen. Some organizational cultures do not support the value of sharing. This is a great tool if it is used, but an expensive mistake if not used.
- When assessing your needs be careful of scope creep. When asking people what they would like to see, they will tend to ask for everything. Distinguish between the things that are truly needed and the "nice-to-haves".

## THE FUTURE

> "We contend that the current technical design philosophy of today's learning management systems is substantially retarding progress toward the kind of flexible virtual classrooms that teachers need to provide quality education". (Feldstein & Masson, 2006, para. 4)

There is a need for third generation learning management systems, based on the **constructivism** theory of learning and social networking in order to support online collaborative learning communities. (See Chapter 30, Supporting E-learning through Communities of Practice.) Developing these third generation systems will be a challenge, especially for the corporate models that haven't figured out yet how to manage simple emails. As of this writing, education LMSs are ahead of corporate LMSs in this respect, but the latter will also need to include more social learning tools (wikis, blogs, etc.). In the immediate future, LMSs will continue to be primarily administrative tools and only secondarily learning tools. Instructors and students will be challenged to find ways to use them so that they make learning easy.

The most used electronic learning tools are Google and other search engines. In the near future almost everything will be available online. Ten years ago a colleague of mine said that everything that is current and worthwhile is already online. This is much truer now. Google and the Gutenberg Project are putting libraries of books online. Google is putting maps on the Web. Universities like Massachusetts Institute of Technology (MIT) are making their course materials available online. Communities are creating knowledge repositories with wikis. Blogs are making almost everyone's opinions available, whether we want them or not.

Distributed learning platforms will enable people to access learning modules and services from anywhere. Mobile learning solutions will enable people to access information on their personal digital assistants (PDAs), and cell phones.

The challenge will be for learners (all of us) to manage all of this. Much of it will happen beyond the scope of any locally installed learning management system. Google and other search engines will evolve to provide management features.

Content will be organized as reusable learning objects much like learning content management systems do, but on a much broader scale. Wikis and folksonomies (also called "tagging") may help solve this. Wikipedia defines a folksonomy as "an Internet-based information retrieval methodology consisting of collaboratively generated, open-ended labels [or tags] that categorize content such as Web pages, online photographs, and Web links".

**Personalization** and context-aware devices such as **GPS** (global positioning system) units will also help. Personalization is the ability of a website to adapt to its users, as Amazon does when it suggests other books you may like, or for the user to adapt the website for his or her own purposes, as Google does when it allows you to customize its home page. GPS units can locate the user so that information can be customized for that location. For example, a user who lives in Chicago but is visiting New York would receive weather information for New York.

LMSs will continue to exist for company and institutional record keeping, but much of the learning will happen beyond their scope.

# Glossary

**AICC.** Aviation Industry CBT Committee, one of the technical standards to enable interoperability between LMSs and third-party courseware. The aviation industry was the first to recognize the need and developed the first standards. (http://www.aicc.org/)

**ASTD.** American Society for Training and Development (http://www.astd.org/)

**Asynchronous.** Literally, not at the same time. In e-learning, usually email or discussion groups, or other communications between participants that do not occur in real time. Self-directed courses which learners do on their own without the presence of an instructor are also asyn-

chronous. Asynchronous communication offers communication at the convenience of the learner, the opportunity to consider responses carefully, review them before replying, and the ability to track and revisit discussions.

**Blended learning.** A mix of classroom, self-directed, synchronous and asynchronous approaches. Blended courses may also be called "hybrid" courses.

**Blog.** An abbreviation of weblog, a publicly accessible personal journal that is regularly updated, similar to a personal diary, but shared over the Web.

**Community of practice.** A group of people who share a common interest, need or objective. Online communication tools can facilitate the exchange of information in such a group.

**Constructivism.** A theory of learning that "acknowledges that individuals are active agents, they engage in their own knowledge construction by integrating new information into their schema, and by associating and representing it into a meaningful way". (Hsiao, n.d., para. 6 (II 2))

**Content management systems (CMSs).** Computer programs for managing all forms of electronic content in a way that the content can be easily retrieved and reused.

**Course authoring/development.** Software that facilitates the development of electronically delivered courseware. May include the ability to include audio, video, Flash animations, tests and quizzes, etc.

**Course management system (CMS).** A term often used for an education-oriented LMS. It differs from a business-oriented LMS primarily by including course authoring capability but not including general registration for classroom courses. An alternative term is virtual learning environment (VLE).

**E-commerce.** Tools to facilitate online shopping, with an automatic transfer of funds. In the context of this chapter, funds are transfered from learner to institution or between departments. The tools may include a catalogue, a shopping cart feature and allow secure credit card transactions as well as other forms of payment. Essentially synonymous with e-business.

**E-learning.** Any learning opportunity delivered electronically, usually through the Internet. Synonymous with online learning and web-based training.

**EPSS** (electronic performance support systems). Tools built into an LMS to enable employees to access information as they need it. Also called just-in-time learning.

**GPS** (global positioning system). A satellite based system that determines the receiver's location, speed, and direction.

**Information technology (IT).** The people, computers and computer software systems that support an organization. Often referred to as ICT (information communications and technology) in an educational context.

**ISPI.** International Society for Performance Improvement (http://www.ispi.org/).

**Learning object.** Any digital entity (text, graphics, animations, pages, modules, etc.) that can be used, re-used or referenced during technology-supported learning.

**Learning management system (LMS).** Computer software designed to manage the organization, delivery, and tracking of online courses and people's performance. They are sometimes called virtual learning environments (VLE) or course management systems (CMS). Corporate learning management systems are also designed to manage classroom instruction.

**Learning content management systems (LCMS).** Content management systems specifically designed for managing learning materials. Typically include a searchable learning object repository or database.

**Localization**. In software, this includes translation to other languages, but also requires adaptation of the content and design to reflect local cultures. It is much more extensive than just translation and requires substantial additional work.

**Metadata.** Data that describes other data. Metadata are digital words that uniquely describe other data such as a learning object. Metadata are invisible to the viewer but visible to the system. The most familiar metadata are HTML tags on websites.

**Open-source systems/software.** Computer software whose source code is available free under a copyright licence that permits users to study, change, and improve the software, and to redistribute it in modified or unmodified form.

**Performance management.** The process of managing the workforce of a company to optimize corporate performance by employing strategies for skills, competencies, training and development.

**Personalization.** The ability of a website to adapt to its users and/or for the user to adapt the website for his or her own purposes.

**SCORM.** Shareable Content Object Reference Model. A collection of technical standards including AICC, IMS, etc. to enable interoperability between LMSs and third-party courseware.

**Self-directed**. Any learning done without the direct assistance of an instructor or interaction with other learners.

**Synchronous.** Classroom, virtual classroom or online chat. Synchronicity offers the benefits of immediate instructor presence and support, and the social structure that many people require for effective learning.

**Talent management.** The process of managing the workforce in a company to optimize recruiting, retention, performance in conjunction with training and development.

**Virtual classrooms/Web conferencing.** Computer software that provides for synchronous meetings and training classes over the Internet, and includes audio, whiteboards for presentation and graphics, participant chat, and data sharing.

**Virtual learning environment (VLE).** Synonymous with LMS or course management system (CMS).

**VOIP.** Voice over Internet protocol. Enables direct audio connections over the Internet.

**Weblog.** See blog..

**Wiki**. An online collaboration model and tool that allows users to add and edit content of a website.

# References


Alvarado, P. (2006) *Learning management system selection*. Retrieved September 2006, http://www.elearning-engineering.com/lms/

Ambler, T. (n.d.) *Recommendations to the BCcampus task force: Systemic support for the delivery of online courses in British Columbia. Vancouver, BC: BCcampus*

American Society for Training and Development (ASTD) (n.d.) *E-learning courseware certification*. Retrieved April 2007, http://www.astd.org/astd/Marketplace/ecc/ecc_home.htm

Belyk, D., Schubert, J. & Baggaley, J (2002) *Classification of DE delivery systems.*

Athabasca University. Retrieved February 2007, http://cde.athabascau.ca/softeval/reports/R050201.pdf

Beshears, F. (n.d.) *Web-based learning management systems* Retrieved February 2007, http://socrates.berkeley.edu/~fmb/articles/web_based_lms.html

Brandon-Hall.com (2006). *Everything you need to know about learning management systems.* Retrieved February 2007, http://www.brandon-hall.com/solutions/lms_central.shtml

Brandon-Hall.com (2006). *Creative ways to reduce the cost of your LMS*. Retrieved July 2006, http://www.brandon-hall.com (no longer available).

British Columbia Ministry of Education (2006, June). *Standards for K–12 distributed learning in British Columbia (Version 1.7).* Retrieved February 2007, http://www.bced.gov.bc.ca/dist_learning/documents/dl_standards.pdf

Chambers, J. (2002) *Cisco corporate vision: Education, standard of living, and the Internet.* Retrieved February 2007, http://newsroom.cisco.com/dlls/tln/exec_team/chambers/chambers_vision.html?sid=ETL_200_HP_Vision

Chan, L. (2001) *International standards and trends in e-learning*. Retrieved August 2006, http://www.cyberwisdom.net/download/ihrm_01.pdf

Clark, D. (1995) *Introduction to Instructional Systems Design*. Retrieved February 2006, http://www.nwlink.com/~donclark/hrd/sat1.html

Dick, W. O, Carey, L. & Carey, J. O. (2004) *The Systematic Design of Instruction* (6th ed.). Boston: Allyn & Bacon.

E-learning Centre (2006) *Learning objects and standards.* Retrieved February 2007, http://www.e-learningcentre.co.uk/eclipse/Resources/contentmgt.htm

Ellis, R. K. (2005, July) *E-learning standards update*. Retrieved February 2007, http://www.learningcircuits.org/2005/jul2005/ellis.htm

Ellis, R. (2004) *Interview: The future according to Elliott Masie.* Retrieved February 2007, http://www.learningcircuits.org/2005/jan2005/masie.htm

eQcheck (n.d.) *Quality standards*. Retrieved April 2007, http://www.eqcheck.com/eq/elearning_quality.html

Feldstein, M. & Masson, P. (2006). *Unbolting the chairs: Making learning management systems more flexible.* Retrieved February 2007, http://www.elearnmag.org/subpage.cfm?section=tutorials&article=22-1

Friesen, N. (2002) *E-learning standardization: An overview.* Retrieved February 2007, http://www.cancore.ca/e-learning_standardization_overview.doc

GeoLearning (n.d.) *Building a Business Case for E-Learning.* Retrieved February 2007, http://www.geolearning.com/bizcase

GeoLearning (n.d.) *Courseware Evaluation Checklist.* Retrieved February 2007, http://www.geolearning.com/coursewarechecklist

GeoLearning (n.d.) *E-Learning Needs Assessment.* Retrieved February 2007, http://www.geolearning.com/needs

GeoLearning (n.d.) *E-Learning RFP Template.* Retrieved February 2007, http://www.geolearning.com/rfp.

GeoLearning (n.d.) *E-Learning Strategy Blueprint*. Retrieved February 2007, http://www.geolearning.com/bp

GeoLearning (n.d.) *LCMS Requirements Checklist.* Retrieved February 2007, http://www.geolearning.com/lcmschecklist

GeoLearning (n.d.) *Learning Analytics Requirements Checklist.* Retrieved February 2007, http://www.geolearning.com/analyticschecklist

GeoLearning (n.d.) *LMS Requirements Checklist.* Retrieved February 2007, http://www.geolearning.com/lmschecklist

GeoLearning (n.d.) *Talent Management Suite Requirements Checklist.* Retrieved February 2007, http://www.geolearning.com/talentchecklist

GeoLearning (n.d.) *Webcasting Requirements Checklist.* Retrieved February 2007, http://www.geolearning.com/webcastchecklist

Geometrix Data Systems, Inc. (n.d.) *Key steps for implementing a learning management system.* Retrieved February 2007, http://www.trainingpartner.com/TP2005/tp2000web.dll/Document/DOCUMENTNO=DOCU20041102141438018400 58

Gusdorf, J. (2006). *Software selection processes—Accelerating vendor identification.* Retrieved February 2007, http://www.technologyevaluation.com/Research/ResearchHighlights/TechnologySelections/2006/09/research_notes/MI_TS_XJG_09_11_06_1.asp

Hall, J. (2003). *Assessing learning management systems.* Retrieved February 2007, http://www.clomedia.com/content/templates/clo_article.asp?articleid=91&zoneid=29

Horton, W. & Horton, K. (2003). *E-learning Tools and Technologies: A consumer's guide for trainers, teachers, educators, and instructional designers.* Indianapolis, Indiana: Wiley Publishing Inc.

Hsiao, J. W. D. L. (n.d.) *Constructivism theory*. Retrieved February 2007, http://www.edb.utexas.edu/csclstudent/Dhsiao/theories.html#construct

Kaplan-Leiserson, E. (2006) *Learning Circuits e-learning glossary*. Retrieved April 2007, http://www.learningcircuits.org/ASTD/Templates/LC/LC_OneBox.aspx?NRMODE=Published&NRORIGINALURL=%2fglossary&NRNODEGUID=%7bA1A2C751-7E81-4620-A0A3-52F3A90148EB%7d&NRCACHEHINT=NoModifyGuest#L

Kirkpatrick, D. L. & Kirkpatrick, J.D. (1998). *Evaluating training programs: The four levels.* (3rd ed.). San Francisco, California: Berrett-Koehler Publishers.

Mager, R. F. (1997) *Preparing Instructional Objectives: A Critical Tool in the Development of Effective Instruction* (3rd ed.). Atlanta: The Center for Effective Performance, Inc.

McCall, C. Y. (2001) *WebCT as a tool in educational technology*. Retrieved February 2007, http://gaps.cpb.ouhsc.edu/ebir/meeting/talks01/CM.ppt#13

McIntosh, D. (2006). *E-learning and learning management.* Retrieved February 2007, http://www.technologyevaluation.com/Research/ResearchHighlights/learningManagement/2006/01/research_notes/TU_EL_DM_01_13_06_1.asp

McIntosh, D. (2006). *E-learning and organizational culture.* Retrieved February 2007, http://www.technologyevaluation.com/Research/ResearchHighlights/learningManagement/2006/01/research_notes/TU_EL_DM_01_18_06_1.asp

McIntosh, D. (2006). *E-learning course design.* Retrieved February 2007, http://www.technologyevaluation.com/Research/ResearchHighlights/learningManagement/2006/02/research_notes/MI_EL_DM_02_23_06_1.asp

McIntosh, D. (2006). *Vendors of learning management and e-learning products*. Retrieved February 2007, http://www.trimeritus.com/vendors.pdf

Morgan, G. (2006). *Images of Organization.* (Updated Edition). Thousand Oaks, CA: Sage Publications.

Morgan, G. (2001). *Thirteen "must ask" questions about e-learning products and services.* Retrieved February 2007, http://www.newmindsets.com/resources/13_Questions.pdf

Morgan, G. & Schlais, H. (2005) *How do faculty use course management systems? A modular approach*. Retrieved February 2007, http://www.uwex.edu/disted/conference/Resource_library/proceedings/02_46.pdf

Obregon, M.R. (2007) *Making $ense of talent management*. Atkins, VA: TEDS, Inc. Retrieved April 2007, http://www.teds.com/pdf/competencies-makingsense.pdf.

O'Reilly, S. (2004). *Can e-learning deliver on expectations in the 'knowledge' age*? Dublin, Ireland: Dublin Institute of Technology.

Phillips, J. J. (2003). *Return on investment in training and performance improvement programs.* (2nd ed.). Burlington, Massachusetts: Butterworth-Heinemann.

Sausner, R. (2006) *Course management: Ready for prime time.* Retrieved February 2007, http://www.universitybusiness.com/page.cfm?p=791

Siemens, G. (2004). *Learning management systems: The wrong place to start learning.* Retrieved February 2007, http://www.elearnspace.org/Articles/lms.htm

Web Standards Project (n.d.). *The web standards project.* Retrieved April 2007, http://www.webstandards.org/

Western Cooperative for Educational Telecommunications (2006). *Online educational delivery applications: A web tool for comparative analysis.* Retrieved February 2007, http://www.edutools.info/

# Appendix A: LMS comparison matrix

This LMS comparison matrix offers a quick, generalized look at how the solutions for educational and corporate uses compare to one another. The general descriptors below do not reflect the situation for every solution in either category. Open-source communities and LMS vendors are constantly updating products, so be sure to look at each product individually when you have narrowed down your list of choices.

| Feature | Corporate LMS | Education LMS |
|---|---|---|
| Classroom course management | Included | Not included |
| E-learning management | Included | Included |
| Blended learning mgmt. | Included | Not included |
| Course development | Not included; available as an extra | Included |
| Course content management | Not included; available as an extra | Included but functionality may be limited. |
| Web conferencing/ virtual classroom | Not included; available as an extra | Not included; available as an extra |
| Grade book | Assessment reporting available in a report format | Included |
| Quizzes | May be included. Sometimes available as an extra | Usually included |
| Communication tools—email, discussion groups, etc. | Included but at a lower level of priority than for education LMS | Included |
| Financial analytics | Included | Not included |
| Reporting | Some reporting features are included but may be limited. | Some reporting features are included but may be limited. |
| Performance support | An LCMS feature available as an extra. | Not included |
| Competency and performance tracking (see above) | Often included | Not included |
| Support for e-learning standards | Included | May or may not be included |
| Multiple language support | Often included | May be included |
| Interoperability with third-party courseware | Included but should be tested | Not included but may be possible through standards conformance |
| Personal web page publishing for instructors and students | Not included | Included |
| Self-evaluation | Not included | Included |
| Administration tools | Extensive | Ability to create accounts and monitor activity. |
| e-Commerce | Often included | Available as an extra. |
| e-Portfolio | Not included | Available as an extra |
| File and workflow management | May be included | May be included |
| Streaming audio and video | May be included | May be included |
| Access to electronic libraries | May be included | May be included |

For a comparison of specific education LMSs, visit the edutools website (http://www.edutools.info) generated by the Western Cooperative for Educational Telecommunications (WCET). The site contains an engine that allows you to run a comparison of different versions of about 40 different LMSs, including many listed in this chapter.

# Appendix B: Standards bodies and links

- **Accessibility standards**:
  **Web Accessibility Initiative** (WAI) of the World Wide Web Consortium—http://www.w3.org/WAI/.
  **The Web Standards Project** http://www.webstandards.org/.
  **Section 508 of the Rehabilitation Act** http://www.section508.gov/
- **Aviation Industry Computer-based Training Committee (AICC)** http://www.aicc.org/index.html.
- **Canadian Core Learning Resource Metadata Application Resource (CanCore)** http://www.cancore.ca/elementset.html
- **Centre for Educational Technology Interoperability Standards** http://www.cetis.ac.uk/
- **Dublin Core Metadata Initiative** http://dublincore.org/

- **Eduspecs** http://eduspecs.ic.gc.ca/pub/overviewofspecifications/index.html
- **IMS** http://www.imsproject.org/
- **Instructional Design Standards**:
  **E-Learning Courseware Certification** (ECC) http://www.astd.org/astd/Marketplace/ecc/ecc_home.htm
  **ISPI** (International Society for Performance Improvement) http://www.ispi.org
  **eQcheck** http://www.eqcheck.com
- **International Organization for Standardization (ISO)/International Electrotechnical Commission (IEC) Joint Technical Committee (JTC)1 Subcommittee (SC)36** http://jtc1sc36.org/
- **International Standardization Organization (ISO)/IEC JTC1 SC36** http://jtc1sc36.org/
- **Learning Technology Standards Committee (LTSC)** http://ltsc.ieee.org/
- **Merlot** http://www.merlot.org/
- **National Institute of Standards and Technology** http://www.nist.gov/
- **Open Geospatial Consortium** http://www.opengeospatial.org
- **Schools Interoperability Framework (SIF)** http://www.siia.net/sif
- **Shareable Courseware Object Reference Model (SCORM)** http://www.adlnet.org/
- **The eLearning Guild** http://www.elearningguild.com/
- **www.StandardsLearn.org** http://www.standardslearn.org/home/

# Appendix C: Learning content management system (LCMS) features

**Learning content management system (LCMS) features**

- Different levels of access for users
- Catalog of learning objects and templates
- Import capability for third-party and custom authoring tool course content
- Actions such as import, export, move, delete, relate, contain, status update, and metadata element value updates can be performed on selected single or multiple content objects
- Tracking of knowledge assets
- Workflow design, use, and management
- User definition of levels of learning objects
- HTML presentation
- XML storage and retrieval
- Content, data and user classification
- Content based filtering
- Portal integration (will work with organizational web portals)
- Capture of electronic documents and metadata
- Thesaurus/classification scheme
- Options for records and documents disposal
- Document authoring
- Document searching and retrieval
- Aggregates groups of records
- Cross-references documents
- Saves and converts documents of different types
- Image scanning
- Audits and produces reports on document workflow
- Provides for system backup, rollback and recovery
- Provides tools for easy author/user access
- Provides security and authentication of users
- Provides user profiles
- Provides password and privilege management
- Provides role management
- Provides management of digital assets (photographs, animations, video, music, etc.)
- Provides mass storage capability
- Provides reports and statistical management
- Meets reliability and performance standards

**Version control**

- Check-in/Check-out
- Version labelling
- Rollback and restore
- Reporting

**Metadata**

- Creation and editing of metadata (descriptive tags)
- Non-technical users can configure and manage metadata
- Metadata taxonomy creation and management
- Imports metadata conforming to standards
- Assigns or automatically captures metadata element values as a single content object is captured or imported
- Authors notified of duplicate metadata element values or content during creation

**Third-party integration (list of enterprise systems and courseware)**

**Standards support**

# Appendix D: Course authoring tool features

**Course authoring tool features**

- Fully browser-based web authoring (editing directly in a browser)
- Templates
- Ability to create and manage templates
- Wizards
- WYSIWYG (what you see is what you get) editor
- In-line cascading style sheet rendering (maintains style sheet layout)
- Preview mode
- Import content from Word
- Import content from PowerPoint
- Access to learning objects from a repository
- Content editor provides standard word processing editing features
- The content editor produces valid HTML/XHTML code
- Automatic course menu/map creation
- Choice of navigation buttons and scenarios
- Glossary/dictionary creation
- Bookmarking (provision for students to return to specific points in a course)
- Insert hyperlinks
- FAQ creation
- Manages and updates links
- Multiple languages
- Workflow to manage content development (tracks versions and has check out, check in for different users)
- Can launch third-party applications
- Version control
- Other

**Rich media**

- Rich text (maintains text formatting)
- Graphics formats
- Animation
- Flash
- Audio
- Video
- Editing tools for graphics, audio, video, animation

**Interactivity**

- Pre-tests to build course curriculum
- Tests
- Branching based on learner responses
- Computer screen simulations
- Role-play simulations
- Hot spots (areas of a web page or a graphic which provides feedback or more information with a mouse rollover or click)

# Appendix E: Virtual classroom/ web conferencing features

**Registration**

- Scheduling of sessions
- Registering participants
- Email reminders with links to log-in page

**Interactive features**

- Instant text messaging among learners and with instructor
- Threaded discussions
- Breakout rooms
- Video
- Notepad for learners
- Time remaining clock
- Participants can leave temporarily
- Indicators for status of other participants

**Whiteboard**

- Anyone can use whiteboard
- Text and drawing tools
- Clip art
- Application sharing
- Remote control of applications can be granted
- Participants can save whiteboards
- Synchronized web surfing

**Sound**

- **VOIP** (voice over Internet protocol)
- Telephone conferencing
- Leader can allow anyone to speak
- More than one voice at a time

**Moderator control**

- Able to give participants control
- Moderator can see what participants are getting
- Multiple moderators supported

**Feedback tools**

- During presentation
- Following presentation
- Applause tool
- Speed up or slow down indicators
- Emoticons

**Polling and testing**
- Audience polling or testing during presentation
- Yes/no, multiple choice, etc.
- Reporting results of polling/testing during presentation
- Graphing of polling results

**Recording**
- Screen and sound recording
- Initiated by participants or instructor/administrator only
- Editing of recording

**Technical features**
- Compensation for low speed connections
- Interoperability with third-party LMS /LCMSs
- Support for different platforms—Window, Mac, Unix, etc.

# Appendix F: Needs assessment questions

## QUESTIONS FOR YOUR EXPERT COMMITTEE

### Overall considerations
- What are the primary business drivers that bring you to consider an LMS?
- What is your philosophy of learning, and how do you want the LMS to support it?
- Who will make this decision: the committee or a high level individual?
- What are the organization's cultural and internal political factors in this decision?
- Are you primarily interested in facilitating student learning or in tracking the results?
- Do you want to emphasize self-directed, or instructor-facilitated learning?
- Do you want e-learning to enhance or replace existing courses?
- Is return on investment (ROI) important to you? If so, what are your metrics for determining ROI (including both tangible and intangible elements)?
- Are the systems you are considering widely used and supported?
- Do you want the LMS to be used universally throughout your organization or is this for a particular function or department?
- What is your budget? What is the total cost of ownership including implementation, maintenance and upgrading costs?
- To what scale will your organization ultimately use the LMS? (1,000 users? 10,000 users? 50,000 users? More? How many instructors? How many administrators?). Think five or ten years ahead.
- If you wish to consider open-source solutions, do you have a strong and supportive IT department to implement, manage, and support it, or will you seek a hosted solution to provide that support?
- To what extent will the LMS be accessible to instructors and students with disabilities?

### Audience
- Will online learning be an alternative or a requirement for some people?
- If you are an educational institution, will it be just for continuing education or for all students and/or staff?
- Will it be available to students beyond your jurisdiction? Will it be available for customers, suppliers or the public as well as your employees?
- Will prerequisite learning be required?

### Features
- Does it have the features you need?
- Are you interested in blending e-learning with classroom learning?
- Do you want e-learning to be both synchronous and asynchronous?
- Will you need to manage the physical distribution of materials to students as well as providing them with tools online? Will students need to buy hard-copy textbooks or will they be provided online?
- To what extent do you want to include assessments, including feedback and surveys as well as online tests?

### Look and feel
- Is it easy to use for instructors and students?
- How do you want your courses to look? Do you want them to have similar navigation so it becomes intuitive for students?

### Extras
- Will you be purchasing content from outside sources?
- Will you need additional course development tools?
- Will you need web conferencing/virtual classroom capability?
- Will you want to manage your course content and learning objects so that they are reusable by others?
- Will you need to allow students to register for classroom or distance education courses?

### E-commerce

- Will you want to share or sell what you are doing to other organizations?
- Will you need some kind of online payment system to allow some students to pay for courses?

### Change management

- Will you want to customize the product to give it your brand, to fit the way you do things, and/or to meet current or future instructional needs?
- What change management strategies will be needed?
- How much training will be required for students and instructors?
- Who will support students and instructors as they use the LMS?

### Technical issues

- To what extent do you want a system to integrate with existing systems—registration systems, HR software, email systems, authentication processes, etc?
- Do you want to have the system hosted internally or would you prefer to outsource the hosting?
- How important is the support of standards (SCORM, AICC, IMS, etc.)?
- What kind of technical support can you provide? What will you expect of the vendor, hosting provider, or open-source community?
- To what extent is security (for students and data) a concern?
- Is it platform compatible (PCs versus Macs)?
- Will it work with all the browsers likely to be used without requiring special settings?
- Will it enable the uploading and downloading of files without difficulty?

## QUESTIONS FOR INSTRUCTORS

(1) If you have never been involved with e-learning courses, would you be interested in developing and/or facilitating such courses? What tools do you believe you would need?
(2) Have you ever facilitated an e-learning/online learning course, blended learning course, or a face-to-face course supplemented by online activities?
  (a) If yes, are you interested in continuing to be involved in online courses?
  (b) If no, would you be interested in leading some online courses?
(3) Did you create the course yourself?
(4) Did you use an LMS as the platform for your course?
  (a) If so, which LMS did you use?
  (b) If not, how was your course delivered?
(5) Were you satisfied with the LMS that you used?
(6) If not, in what ways did you find it lacking?
  - hard to learn
  - features that were missing
  - too administrative, did not facilitate student learning
  - lack of support
  - took too much time
  - prefer other systems I have seen
  - other
(7) Would you be interested in trying another LMS?
(8) Did you use any other software to help in the creation of the course itself, course materials, activities, or assessment strategies?
(9) In a corporate environment, are you interested in selling the courses that you have created?
(10) What kind of training should be provided for instructors if we adopt a system?
(11) From the following list of features, choose the list of features that you have used:
  - assignment modules
  - branching lessons
  - calendar
  - chat
  - conferencing
  - course development
  - email
  - discussion forums
  - glossary
  - grade management
  - group projects, presentations, and management
  - student progress tracking and management
  - student self-evaluation
  - student surveys
  - quizzes
  - single-question polling
  - wikis and blogs

  (a) Have you used these and would you use them again?
  (b) What features were most useful and least useful?
  (c) What other features would you like to see?

(12) Can you describe a successful and an unsuccessful online learning initiative?

## QUESTIONS FOR STUDENTS

(1) Have you ever taken an online course, blended learning course, or a face-to-face course supplemented by online activities?
  (a) If so, would you do it again?
    (i) If so, why?

(ii) If not, why not?
(b) If not, would you be interested in trying it?
(i) If so, why?
(ii) If not, why not?

(2) Was the online learning environment easy to use and to find your way around?
(3) Did you receive any training in the use of the systems?
(a) If so, was the training sufficient?
(b) If not, were any support materials available for training yourself?
(c) In either case, what would you recommend for training?
(4) From the following list of features, choose the ones you have used.

- assignment modules
- branching lessons
- calendar
- chat
- conferencing
- course development
- email
- discussion forums
- glossary
- grade management
- group projects, presentations, and management
- student progress tracking and management
- student self-evaluation
- student surveys
- quizzes
- single-question polling
- wikis and blogs

(a) Have you used these and would you use them again?
(b) What features were most useful and least useful?
(c) What other features would you like to see?

(5) Describe your experience
(a) What did you like best about the experience?
(b) What did you like least about the experience?
(c) What suggestions would you make?
(6) Be prepared to ask and record open-ended questions. Prompting may be necessary, especially for students. For example, you might ask whether they were able:
(a) to work by themselves
(b) to work in small groups over distance
(c) to work on their own schedule
(d) to redo portions of the coursework
(e) to keep to deadlines

A needs assessment checklist for educational institutions is available at http://www.caucus.com/inf_needs.shtml
A needs assessment checklist for corporate LMSs is available at http://www.geolearning.com/needs

# Appendix G: Request for proposals questions

## QUESTIONS FOR LMS VENDORS AND HOSTING PROVIDERS

(1) List all of the features you are looking for with priorities indicated. Be sure to include reporting functions and capabilities. How and to what extent does the vendor's product implement the features that you have on your list?
(2) What is the cost? The costs of LMSs vary by a factor of more than 10 to 1, from roughly $10,000 to $200,000 and even more. Be sure to identify clearly what functionality, implementation costs, technical support, upgrades, etc., you are paying for. There are several different costing models: leasing, one-time purchase, annual subscription, fixed cost based on size of organization, variable cost based on number of registered users, based on the number of administrators who need access to the system, etc. Explore all the possibilities, and negotiate.
(3) What are the hosting options: in-house hosting, vendor hosting, third-party hosting?
(4) What are the Implementation issues? How much support does the vendor provide, and what are the costs? Ask specifically about post implementation technical and customer support.
(5) List the third-party systems and courseware that you will be using and ask the vendor about their experience with these products. If you have in-house developed courseware ask if you can test it with their LMS.
(6) Obtain references from other companies that have used the LMS especially from those organizations similar to your own. Different vendors target different industry sectors and size of implementations.
(7) Will they be available to demonstrate the software in-person or online? Will they demonstrate according to scripts you have developed which reflect your own working scenarios?
(8) Is it possible to arrange a free trial or small pilot?

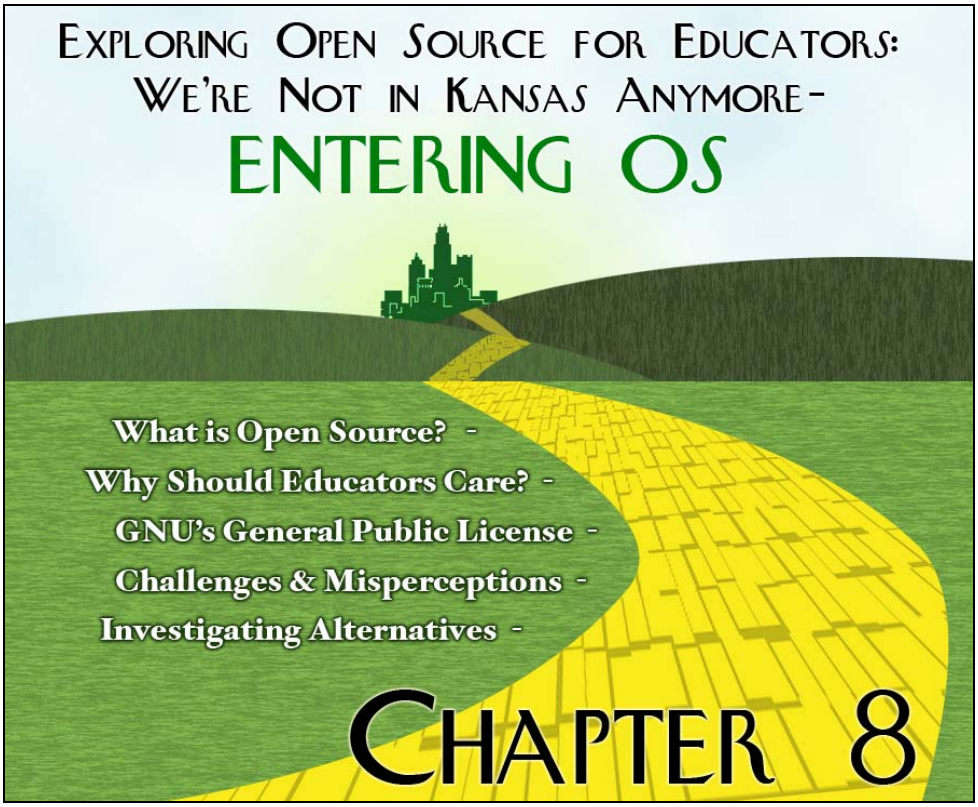
A free template for an RFP for a learning management system is available at. www.geolearning.com/rfp. They also have a number of other very useful resources available.

# 8

# *Exploring Open Source for Educators: We're Not in Kansas Anymore – Entering OS*

Julia Hengstler

It should come as no surprise that the pressures of cost reduction are motivating organizations to incorporate open source technology into their IT architectures … The real problem is widespread unfamiliarity and lack of expertise with open source across all levels of the organization. – Fima Katz, CEO of Exadel (as quoted by Vworld New Media, February 7, 2006)



# Learning outcomes

After completing this chapter, you should be able to:

- Define open source, free software, and freely sourced software.
- Explain the importance of the Open Source and Free Software Movements.
- Locate repositories of open source and free software on the Internet.
- Cite examples of educationally relevant open source and free software.
- Explain the impact of educational software provider mergers and educational patents and the importance of freely sourced alternatives.
- Discuss legal issues around some licensing structures.
- Discuss the barriers and catalysts for widespread adoption of freely sourced software.
- Explain three common misconceptions regarding freely sourced software.
- Propose, plan, and implement an investigation of freely sourced software alternatives.
- Differentiate between copyright and "copyleft".

# Introduction

> "Lions and tigers and bears! Oh, my!" – Dorothy, *The Wizard of Oz* (Langley, 1939)

Though relatively new to our collective consciousness, open source is a phrase tied to some of the more powerful words in our global history—innovation, evolution, movement, revolution—but the forerunner and mate of open source is free software, and by extension, the Free Software Movement. Both movements champion public access to source code. This is so important because software technology is an essential tool for progress on so many fronts, and the Internet has played a significant role in the democratization of information. DiBona, Ockman and Stone (1992) use the following analogy:

> Imagine for a moment if Newton had withheld his laws of motion, and instead gone into business as a defense contractor to artillerists following the Thirty Years' War. "No, I won't tell you how I know about parabolic trajectories, but I'll calibrate your guns for a fee." The very idea, of course, sounds absurd (p. 11).

Richard Stallman, father of the Free Software Movement, GNU[8] and the General Public Licence (GPL), says, "[That] is an understatement. Compared with software in 2000, physics in 1700 had a very small role in affecting people's lives" (personal communication, September 11, 2006 12:58 PM).

# What is open source or free software ?

Open source as a term has only been in existence since 1998. Prior to that, and running parallel with that term, has been "free software".[9] Lately, open source has become the more generic public term. For Stallman and his Free Software Movement, the highest premiums have always been placed on personal/collective intellectual freedom, and he holds fast to the term "free software". He says, "Proprietary software is a social problem and our aim is to solve the problem" (Stallman, personal communication, September 10, 2006). Stallman also says, "In nearly all cases, the software which is called 'free' is also open source, and the software which is called 'open source' is also free (though there are occasional exceptions to the latter). The difference is a mainly matter of the philosophy that the speaker endorses" (personal communication, September 10, 2006). At its most basic, open source and free software mean that the coding for an application or software has been made freely available to the public. It's the *why* of that action where things get tricky. For that reason, I refer to both types of software collectively as "freely sourced".

The spirit of freely sourced software is the spirit of collaboration in much the same way collaboration is meant to drive Web 2.0—code is revealed for people to use it, modify it and share the program/application with others. We see behind the curtains, and anyone can tinker with the Wizard's machine, add to it, make it better, and redistribute it. In this way, freely sourced programs evolve through collective efforts. It is both evolutionary and revolutionary in those respects. Open source and free software applications are constructivist in nature. Due to wide ranging and rapid input from

[8] "GNU is a recursive acronym for "GNU's Not Unix"; it is pronounced guh-noo, approximately like canoe." (Free Software Foundation, Inc. 2007)

[9] This is not to be confused with "freeware" which although free, and redistributable, generally does not make source code available (Stallman, R. M., personal communication, September 11, 2006 7:13 AM).

programmers around the world, software development time can be condensed and programs become far more responsive to users' varied needs. Unlike proprietary commercial software, freely sourced applications are *designed* for user customization.

The Open Source Initiative [OSI] (http://www.oss-institute.org), one of the leading and guiding open source organizations, specified 10 characteristics for open source licensing:

- free redistribution;
- readily available and useable source code;
- permission for modification of the original code and derived works;
- conditions for maintaining integrity of the author's source code;
- equality of access regardless of person or group;
- equality of access regardless of field of endeavour;
- extension of original free distribution rights for subsequent redistributions;
- independence of, or extractable from, particular packages of software or hardware;
- licensing restrictions of the open source program do not automatically extend to additional software distributed along with it;
- non-restriction of the software to any type of technology or user interface so that it may be redistributed via means other than the Internet and may run in environments that do not allow for popup dialogue windows. (Open Source Initiative, 2006a).

As of April 2007, the OSI (2006b) approved 58 variations on open source licensing, among them the General Public Licence (GPL) (Free Software Foundation, Inc., 1991) of Stallman's Free Software Foundation, Inc. (FSF) (http://www.fsf.org/).

This doesn't mean that open source software is completely non-commercial or non-proprietary: open source (as opposed to free software) varies according to the extent of its proprietary-nature and levels of commercialization. Jive Software (http://jivesoftware.com) is a company providing instant messaging software that institutions can leverage to provide real-time contact between instructors, students, and any other users, especially useful for tutorials and collaboration. Jive dual-licences its communication server, Openfire (formerly Wildfire) first as Open Source General Public Licence (GPL)[10] by providing access to source code, modification, and redistribution rights *and* second as a commercially licensed "Enterprise" version (Jive, 2007).

Two major repositories/directories of freely sourced software and applications are the Free Software Directory (http://directory.fsf.org/) and Sourceforge.net (http://sourceforge.net/). SourceForge boasts a repository of over 100,000 projects and claims the "largest repository of open source code and applications available on the Internet" (Open Source Technology Group, 2006). Here you can find Pidgin (http://www.pidgin.im/), an interoperable instant messaging application, and DotNetNuke (http://www.dotnetnuke.com), a framework for "creating and deploying projects such as … websites, … intranets and extranets, online publishing portals, and custom vertical applications" (DotNetNuke, 2006a). If you're of a more technological bent, and speak "programmer", you might use Koders.com (http://www.koders.com), the self-proclaimed "leading search engine for open source code" (Koders, 2006).

# Why should educators care?

Increasingly students are demanding more flexibility in the delivery of courses. As more schools are adopting distributed learning approaches, software and technology have been central. One tool for course delivery is a learning content management system (LCMS) or virtual learning environment (VLE). The current state of the LCMS or VLE field underscores the importance of freely sourced options. Recent commercial mergers, acquisitions, and the rise of educational patents (EduPatents) have created an unstable environment where open source and free software options may in fact be *less* risky from both financial and legal standpoints, not to mention from the standpoint of ensuring intellectual freedom as advocated by Stallman (personal communication, September 10, 2006; Williams, 2002). Jim Farmer (2006), consultant to the US Department of Education and author of an upcoming report on open source communities for Oxford University, warned that "Education patents and the new licensing environment may further commercialize teaching and learning."

Blackboard (http://www.blackboard.com) is a case in point. Over the last four or five years, Blackboard has consolidated its market share to become one of the largest proprietary commercial entities in the field. In January 2002, *The Chronicle* reported on the Blackboard-Prometheus merger, saying it was "the fifth acquisition for Blackboard since its founding in 1997, and three of those were companies originating in academe" (Olsen & Arnone, 2002). Four years later in January 2006, Black-

[10] This is a separate licence not to be confused with GNU's General Public Licence or GPL.

board bought-out competitor WebCT (http://www.webct.com) for an estimated $154,000,000 US (Helfer, 2005), making it one of the major forces in LCMS/VLE provision. (Keep in mind that WebCT also originated in academe, beginning life at the University of British Columbia, Canada.) Helfer (2005) wrote,

> In 2004, many customers of Blackboard and WebCT received rather sizable cost increases to renew their software licenses. Questioners of the merger are concerned that decreased competition may mean increased costs to customers. The merger doesn't necessarily mean the new Blackboard will squash all competition, however.

[Blackboard's proprietary commercial competitors were listed as ANGEL Learning (http://www.angellearning.com), Desire2Learn Inc. (http://www.desire2learn.com) and IntraLearn Software Corporation (http://www.intralearn.com/) (Helfer, 2005).]

Helfer's (2005) optimism may have been misplaced. In January 2006, around the time the WebCT buy-out was finalized, Blackboard filed for a US patent for "Internet-Based Education Support System and Methods" which it received in July 2006 (Mullins, 2006). Blackboard promptly sued Desire2Learn and followed with a flurry of international patent filings in Australia, New Zealand, Singapore, the European Union, China, Japan, Canada, India, Israel, Mexico, South Korea, Hong Kong, and Brazil (Mullins, 2006). This has caused a furor in educational technology communities, and is something about which we should all be concerned. A countermovement has been launched by some. As Feldstein (2006) writes, "patents can be invalidated if one can demonstrate that the claimed invention was in public use or described in a published document prior to the date of the patent filing." Various groups with vested interests—commercial, non-commercial, proprietary and non-proprietary—are seeking to establish *prior art* in bids to undermine Blackboard's patent claims. One such example is the Wikipedia site Michael Feldstein established for virtual learning environments (VLEs) on July 30, 2006 (Wikipedia, 2007). Feldstein (August 1, 2006) reported that while on July 30, 2006, the Wikipedia entry was "[only] a one-sentence stub" by August 1, 2006, was "a pretty good document that was generated by a variety of people". As of May 2, 2007, the same Wikipedia entry was extensive spanning from the pre-1940s to 2006 with terminology, references and further reading sections (Wikipedia, 2007).

Regarding Blackboard, Farmer (2006) wrote:

> The Blackboard patent is not alone, but representative of many that have been issued – and many more that are pending in the U.S. that could apply to any learning system. It is unlikely that all claims of all patents will be found invalid before someone wins an injunction or judgment, and cease and desist letters and license invoices follow. We should be prepared for a new environment of restrictions, licensing, and confrontation of our suppliers … Now any choice of software, any method of instruction, and any choice of content will have to be viewed from a new perspective of risk assessment. This moves the decision from teaching faculty to business officers and attorneys who are least prepared to judge the effect on education and research.

As the educational technology field struggles with Blackboard's attempts to secure a proprietary commercial future, the organization's actions repeat patterns earlier established by AT&T and Microsoft. The actions of these two large proprietary players were key drivers in the rise of both the Free Software and Open Source Movements. If educational software evolution continues to parallel the AT&T and Microsoft model, freely sourced software should play a central role in beating back monopolistic bids—as should GNU's GPL. Based on such a history, freely sourced learning platforms such as ATutor (http://www.atutor.ca), Sakai Project (http://www.sakaiproject.org), and Moodle (http://moodle.org) warrant watching.

## Understanding GNU's General Public Licence—a legal bastion

> "The [GNU's] GPL has become a powerful force in the information age. A hack on the copyright system, it turns the concept of copyright upside down, creates a whole community cooperating around the world and enables the development of *software by the people, of the people and for the people.* Many new licenses were modeled after or influenced by the GPL". – Tai (2001)

Stallman founded the GNU Project in 1984 to create a free software operating system. GNU sought to replace the proprietary Unix platform which AT&T, with the help of Sun, was seeking to establish as the monolithic

operating system for the industry. Hence the recursive name of the project, "GNU is Not Unix" (Free Software Foundation, Inc. 2007). In 1985, Stallman founded the Free Software Foundation, Inc. (FSF), a non-profit organization dedicated to supporting the free software movement in general, and the GNU Project in particular. Between 1984 and 1988, GNU and the FSF developed special licences for specific GNU programs (Tai, 2001). This licensing approach was eventually consolidated in February 1989 as the GNU General Public Licence (GPL) Version 1 (Tai, 2001). The GPL became the gold standard for ensuring the future of freely sourced software for a variety of reasons. First, the GPL protected user rights to free software by delineating responsibilities with regard to distribution, copying and modification of the software. While similar to earlier licences, the GPL was unique in that:

> if you distribute[d] copies of such a program, whether gratis or for a fee, you must give the recipients all the rights that you have. You must make sure that they, too, receive or can get the source code. And you must tell them their rights (Free Software Foundation, Inc., February 1989).

Here, Stallman ensured that any distributions would carry the original rights to distribute, copy and modify. This was further specified in Section 2.b stating that any secondary programming containing the original free work "be licensed at no charge to all third parties under the terms of this General Public License" (Free Software Foundation, Inc., February 1989). Thus, the GPL effectively prevented proprietary commercialization of the free programs. As opposed to "copyright", GPL became commonly known as "copy left."[11]

From the programmers' perspective, another critical aspect of GPL was that the licence ensured any distribution, copying, or modification would always make clear that the *originators* of the software did *not* provide any type of warranty with regard to the software. The GPL was updated as Version 2 in 1991 along with the release of a licence variation called the Library GPL. The second version of GPL included a section to counteract claims that users were unable to fulfill the GPL licence and were therefore not bound by the terms. GPL Version 3 is currently under discussion. Some new aspects have to deal with digital rights management issues, as highlighted in legal cases against peer-to-peer sharing of copyrighted materials.

Two additional licensing documents connected to the GPL are the Library GPL, or as it's now called, the GNU Lesser General Public Licence (LGPL) and the Free Documentation Licence (FDL). The LGPL was originally released in 1991 and updated in 1999 (Free Software Foundation, Inc., 1991/1999). It was developed to allow non-free software to interface with free software. Previously, under the terms of the original GPL, such an interaction would have made the "using" non-free software subject to the GPL (Free Software Foundation, Inc., 1991/1999). The FDL was added to the GPL legal library in November 2000. It was later revised in 2001 and 2002. The original intention was to align manual licensing requirements for GPL software with the GPL, but the licence scope is not limited to free software manuals. The FDL applies to "any manual or other work, in any medium" and ensures the work has "a world-wide, royalty-free licence, unlimited in duration" as long as the FDL terms are met (Free Software Foundation, Inc., November 2002). Similar to the GPL, with regard to the work in question, the FDL grants:

> everyone the effective freedom to copy and redistribute it, with or without modifying it, either commercially or noncommercially … this License preserves for the author and publisher a way to get credit for their work, while not being considered responsible for modifications made by others (Free Software Foundation, Inc., November 2002).

Through the GPL licences, Stallman and the FSF legally and successfully entrenched the ethical obligation to keep free software and any derivative works free. Ultimately, many subsequent agreements, like those among the 58 licences approved by the OSI (Open Source Initiative, 2006b) or The Debian Social Contract Version 1.0 (Software in the Public Interest, 1997) owe a great deal to the GPL. Stallman and Moglen said this of GPL in 2005:

> The GPL is employed by tens of thousands of software projects around the world, of which the Free Software Foundation's GNU system is a tiny fraction. The GNU system, when combined with Linus Torvalds' Linux—which has evolved into a flexible, highly portable, industry-leading operating system kernel—along with Samba, MySQL, and other GPL'd programs, offers superior reliability and adaptability to Microsoft's operating systems, at nominal cost. GPL'd software runs on or is embedded in devices ranging from cell-

[11] While copyright prevents free distribution, copying and modification of intellectual works, or *copyleft,* assured the opposite.

phones, PDAs and home networking appliances to mainframes and supercomputing clusters. Independent software developers around the world, as well as every large corporate IT buyer and seller, and a surprisingly large proportion of individual users, interact with the GPL.

# Enforcing the General Public Licence

Maintaining the legal power and influence of the GPL has become the focus of one recent project, gpl-violations.org (Welte, 2006a). This is a GPL watch-dog group founded by Harald Welte in 2004 (Welte, 2006b) whose actions to date have primarily focused on violations by businesses active in Germany and Holland, as well as the rest of Europe, although many of the parent companies may be elsewhere. Welte became concerned about GPL enforcement around 2003 when he discovered GPL'ed software he had written to work with the Linux kernel (netfilter/iptables) was being used by companies in a manner violating the licence (Welte, 2006b). According to the project site: "After some time … [Welte] discovered that the number of GPL violations was far bigger than expected, as is the number of Free Software projects whose copyrights are mistreated/abused" (Welte, 2006b).

As Welte investigated, he found "more and more cases of infringement … mostly in the embedded networking market" (Welte, 2006b). By mid-2004, Welte's project had secured its first preliminary injunction in favor of the GPL (Welte, 2006b). From there, Welte's work branched out. He began to protect other developers' GPL'ed work that was similarly abused (Welte, 2006b). He gained financial backing from Linux developers like Werner Almesberger and Paul "Rusty" Russell who "transferred their rights in a fiduciary license agreement to enable the successful gpl-violations.org project to enforce the GPL" (Welte, 2006b). The companies that gpl-violations.org claim have violated GPL terms are not necessarily small companies. On March 14, 2005, Welte delivered a warning letter to 13 companies, among which were listed Motorola and Acer (Welte, 2005/2006). In September 2006, the organization won a case against D-Link Germany GmbH, a subsidiary of Taiwan's D-Link Corporation (Welte, 2006c). Other cases, settled out of court, have involved "Siemens, Fujitsu-Siemens, Asus and Belkin" (Welte, 2004/2006). As of June 2006, Welte's project claimed successful completion of 100 infringement cases: "Every GPL infringement that we started to enforce was resolved in a legal success, either in-court or out of court" (Welte, 2006b).

In a 2006 legal case of another sort (amended from earlier actions), David Wallace claimed that the FSF—through the GPL—was acting as a monopoly with regard to operating systems under the US Sherman Anti-Trust Act (Wallace v. Free Software Foundation, Inc., March 20, 2006). In an ironic twist, Wallace charged that the GPL was "foreclosing competition in the market for computer operating systems" (Wallace v. Free Software Foundation, Inc., March 20, 2006, p. 2). In reviewing the complaint, the court found that Wallace's "problem … [appeared] to be that GPL generates too much competition, free of charge" (Wallace v. Free Software Foundation, Inc., March 20, 2006, p. 5). In reviewing the nature of the GPL and the GNU/Linux licensing under this agreement, the court found, "the GPL encourages, rather than discourages, free competition and the distribution of computer operating systems, the benefits of which directly pass to consumers. These benefits include lower prices, better access and more innovation" (Wallace v. Free Software Foundation, Inc., March 20, 2006, p. 5). As Tai (2004) wrote, "The recent attacks on the GPL … demonstrate how far the GPL's influences have come, but we may not have seen the full impact of the GPL yet".

# Challenges for widespread adoption

Those converted to freely sourced software in the last 10 years rank among Roger's (1983) early adopters. If Roger's (1983) model holds true for the open source and free software movements, we should expect a rapid upswing in adoption as we enter the early majority to late majority adoption phases. How quickly this will happen can be more readily explained through the Technology Acceptance Model (TAM) which looks at how perceptions about user friendliness and usefulness of a technology affect adoption over time (Davis, 1989). Another factor that will affect acceptance is simple awareness and knowledge of open source and free software. Potter (2000) cites some concerns people held with regard to freely sourced applications that tie in with Davis's (1989) TAM:

- product concerns: product viability and technical issues such as security, scalability, and technical support;

- contractual concerns: a purchase contract being signed with a company that did not create the product purchased; minimization of copyright for programmers;
- product support concerns: discomfort of software companies with providing warranties for products they did not create; short track records and unknown staying power of small new software companies with regard to the provision of long-term product support;
- product standardization concerns: due to the collaborative nature of source code, functionality, enhancements, and application alterations can be added at will and marketed as a different or newer versions of the program so, "The multiplicity of products and versions can result in incompatible systems and inconsistent products".

While Potter's (2000) concern about application alterations or proliferation of versions can *seem* worrisome, once a freely sourced program is running on your system, under your administration, only the people you (or your system administrators) designate have the permission to access and modify the source code. If you want to switch to a newer version, you are free to do so—but are not compelled to do so. No one else will be able to tinker with the code you've installed on your hardware unless given such permission and no one can force you to upgrade through contractual or licensing obligations. This does not mean that an unscrupulous programmer could not hide something in the source code to allow him or her to go in and modify the program without your knowledge, but that is highly unlikely if you've selected a reputable program with robust user and programmer communities. In these communities, people constantly scrutinize the code. Such issues would be quickly discovered and the program panned in reviews, blogs, or other formats.

Another barrier to adoption can be the perceived portability of data from existing software to a freely sourced option. Often many of the difficulties in migrating an instructor or institution's data to a new platform are attributed to the software, and at one time that was true. In the past, proprietary commercial programs ensured portability of content between *their* versions, with little reference to others. For example, with regard to learning platforms, many institutions developed courses, media, or data without reference to design documents or data tagging, perhaps never envisioning they would contemplate migration to a different software provider. A course designed by one instructor was often significantly different in structure from that designed by another. Materials showed little consistency in design or layout.[12] Since the standards movement, the issues of portability and interoperability have become central considerations when selecting software. Consequently, consistent course design and layout have gained importance in the educational environment. More frequently, instructors or other developers are being trained in ways to build standards compliant courses. It's far easier to build a software program to move content to a new environment when the parts are common, properly identified, and in the similar locations. Even if you don't have the technological expertise within your institution to build the necessary migration software, with standard compliance, good design and foresight at the outset, that process can be outsourced for a reasonable price.

These are not the only obstacles to free and open software—other threats loom. Recently there have been movements afoot to effectively and legally prohibit reverse engineering of software. Potter (2000) discusses recent drafts of the Uniform Computer Information Transactions Act (UCITA) saying:

> Currently, reverse engineering is legal for reasons of "interoperability" between computer systems. Prohibiting reverse engineering inhibits the development of open source [and free software] because for … [freely sourced software] products to be of any value, they must be compatible with other computer applications. The way to establish compatibility is to reverse engineer the other developer's code … advocates are concerned that the UCITA will allow proprietary developers to "establish secret file formats and protocols, which there would be no lawful way for [programmers] to figure out".

Furthermore Potter (2000), identified problems with legal drafts of the UCITA that would entrench implied warranties into software licences. Traditionally, freely sourced software does not provide warranties unless expressly specified by an individual or company. This has been a benefit as it lowers the risk of lawsuits. Consequently, this creates low entry barriers to new software designers and companies. With no prerequisites of insurance or legal representation to limit liability, anyone and everyone can contribute to programming the soft-

[12] This is still true of institutions in the early stages of online course development as their emerging understanding has not yet extended to the need for templates, structures, and data tagging to ensure future portability and interoperability with other platforms.

ware. Potter (2000) states, "Placing the risk of litigation on the open source [or free software] developer may in turn increase the price of … products. Another negative consequence is the possible deterrence of programmers from contributing useful code".

Since the end of Unix market control, another major barrier to freely sourced software has been Microsoft domination. C. DiBona et al. (1992) write, "The question really is not whether venture capital funding will flow to Open Source, but why the flow has only begun to trickle in that direction … Why did it take so long to catch on?" (p. 10). They go on to answer this question:

> Taking a look at the computing landscape, you've got a situation where a very large company with very deep pockets controls the lion's share of the commercial market. In Silicon Valley, hopeful applications vendors looking for backing from the angel and venture capital community learn very quickly that if they position themselves against Microsoft, they will not get funded. Every startup either has to play Microsoft's game or not play at all. (C. DiBona et al., 1992, p. 10)

According to DiBona et al. (1992), programmers forced to play the Microsoft game are locked into the goal of assuring the proprietary nature of their work—"the goal of making the program completely dependent on Microsoft libraries … making any Windows native program very difficult to port to other operating systems" (p. 10). The author's also point out that one of the main reasons Microsoft has not dominated the Internet has been the Net's dedication to "a powerful collection of open standards maintained on the merit of individual participation, not the power of a corporate wallet" (C. DiBona et al., 1992, p. 10). The authors point out, that just like the Internet, free and open source developers "compete based on open standards and shared code" and generally work towards compatibility (C. DiBona et al., 1992, p. 10). Recently, it appears that the freely sourced movements have affected even Microsoft's strategies. In September 2006, Microsoft promised "not to enforce patents for technology in Web services specifications, which are used in connecting applications in service-oriented architectures and other forms of standards-based distributed computing" (Gonsalves, 2006). Gonsalves (2006 ) goes on to say that this was done in an effort by Microsoft "[to] help promote widespread adoption of Web services, which play an important part in how Microsoft ties its software to its own products and other applications" by targeting "developers and customers working with commercial or open-source [/free] software."

While community building and interpersonal relations have been a significant factor in the success of freely sourced software, other aspects help propel its increasing acceptance. Potter (2000) said:

> Economically, open source [/free software] is a more efficient way to allocate the benefits of copyright to society. Because current software protection law benefits relatively few developers, there is a need for change. Open source [/free software] exhibits valid, economical, and marketable alternatives to proprietary software development and distribution.

These reasons listed by Potter (2000) make open source and free software an increasingly popular choice. For example, Apache server, an open source application with over 11 years in the industry, is now used by more than 62 percent of the top developers in the server industry. In comparison, Microsoft holds less than half of the market share at roughly 30 percent (Netcraft, Ltd., 2006). Apache's market share increased from its February 2002 estimate at just over 58 percent (Netcraft, Ltd., 2002). In addition, interest in other open source and free software is growing. A March 2005 article, "Estimating the Number of Linux Users (or: why we think we're 29 million)" did a review of Internet hits in February 2005 as recorded by Teoma and Google (combined). The results are summarized in Table 8.1, Open Source vs. Windows Interest by Internet Hits.

*Table 8.1. (Adapted from "Estimating the Number of Linux Users (or: why we think we're 29 million)" (Linux Online, Inc., 2006)*

| Operating System | Hits |
|---|---|
| Linux + linspire | 269,000,000 |
| Solaris | 27, 000,000 |
| *BSD | 55, 000,000 |
| *Total Freely Sourced* | *351,000,000* |
| Win3.1/95/98/2000/ME | 88, 000,000 |
| Win2003/Server | 19, 000,000 |
| WinXP | 33, 000,000 |
| WinNT | 33, 000,000 |
| WinLonghorn | 33, 000,000 |
| *Total Windows* | *206,000,000* |

Clearly there is evidence of significant interest in open source and free software—if only measured at a shallow level by operating system interest or website hits.

According to Fima Katz, CEO of Exadel, "The real problem is widespread unfamiliarity and lack of expertise with open source [and free software] across all levels of the organization" (V world New Media [Designs4nuke.com], February 7, 2006). A survey by Exadel conducted at the 2005 Gartner Open Source Summit found that "more than half (55%) of survey respondents reported that their organizations currently have limited internal knowledge of open source[/free software]" (as cited in V world New Media [Designs4nuke.com], February 7, 2006). Moreover, the February 23, 2005 Gartner report, "Positions 2005: Open-Source Solutions Will Restructure the Software Industry," found that "40 percent of respondents claimed that their organization's lack of knowledge about open source [/free software] as the top vulnerability to adoption" (as cited in V World New Media [Designs4nuke.com], February 7, 2006).

Despite the various barriers, current trends indicate that freely sourced software will flourish, as witness the proliferation of Apache servers, GNU/Linux operating systems, as well as ATutor, Sakai, and Moodle sites, To ensure this, Potter (2000) offers the following suggestions: formation of a non-profit and/or governmental body to certify interoperability and portability of freely sourced software; using freely sourced software code as a legal remedy for monopoly, anti-trust, and copyright suits; as well as government endorsement of freely sourced software through its own policies, adoption, and use.

The question then is: when, if ever, is it the right time for *you* to migrate to freely sourced software? Only a comprehensive contextual assessment of your situation, as well as increasing your knowledge of free software and open source, can help you make that decision. The next sections offer a possible methodology to increase your knowledge, and move from initial considerations of freely sourced options to implementing pilot projects and widespread organizational adoption.

# Common misperceptions of the "Great" Wizard

> "The wizard? But nobody can see the great Oz. Nobody's *ever* seen the great Oz … Even I've never seen him!" – Guardian of the Emerald City Gates, *The Wizard of Oz* (Langley, 1939)

Just as Dorothy, the Tin Man, the Lion and the Scarecrow held misconceptions of Oz's Wizard, there are many misconceptions about open source and free software. Some of the most common of these are (1) freely sourced programs have no costs; (2) freely sourced programs are of low quality; and (3) freely sourced programs can't compete with proprietary commercial applications.

## MISCONCEPTION 1: NO COST

As a point of clarification, *source code* is free in open source and free software applications. Chances are, though, you will still need someone or several people with technical know-how to install them, run them, tweak them, update them, etc. Sometimes the original developers provide this kind of support for a price. One example of this is ATutor (http://www.atutor.ca), a Canadian open source content management system for course delivery developed at the University of Toronto and licensed under GNU's GPL (Adaptive Technology Resource Centre, 2006). ATutor claims to be, "the first inclusive LCMS complying with … accessibility specifications at the AA+ level, allowing access to all potential learners, instructors, and administrators, including those with disabilities" (Adaptive Technology Resource Centre, 2006). ATutor also complies with "W3C XHTML 1.0 specifications" so it is "presented consistently in any standards compliant technology" (Adaptive Technology Resource Centre, 2006). It allows for content portability by compliance with "IMS/SCORM Content Packaging specifications, allowing content developers to create reusable content that can be swapped between different e-learning systems" (Adaptive Technology Resource Centre, 2006). If you need help with the technical end of things, you can purchase varying levels of ATutor support, from one-time installation to course hosting and individualized consulting.

Recent mergers of commercial proprietary businesses have made it difficult to accurately reflect current fees for similar proprietary commercial service provision. Actual amounts vary based on enrollment volume as well as bargaining power of a purchaser. Available information can give us a rough idea of current price points. A posting by Michael Penney (July 29, 2005), Learning Management System Project Manager for California State University, Humboldt, cited basic Blackboard institution costs as follows for 7,500 course enrollments: a base fee of approximately $7,000 US, $4,000 US for encryption, and $0.75 US per enrollment for MSSQL ($5,625 US/7,500 enrollments). This would total approximately $16,625 for 7,500 course enrollments—*exclusive of any content or course development*. Blackboard can provide some economies of scale compared to other commercial pro-

prietary platforms like eCollege (http://www.ecollege.com). During the same period, eCollege reportedly charged between $70 and $100 US per course enrollment per term for a fully hosted solution (Wright, August 2, 2005). Unfortunately, for smaller institutions or pilot projects—economies of scale don't apply. While exclusive Blackboard or eCollege licences may be too costly, pooling with other small users could make costs manageable. In some instances, this has lead to the creation of licence brokerage/consolidation. One example of this is Open School's (2006) Online Consortium in British Columbia, Canada. This consortium brokers WebCT licences for its members. Even with brokers, licensing can still be expensive for a small pilot. An institution or group's return on investment can be much more promising using a comparable freely sourced product like Moodle, Sakai Project, or ATutor, especially when leveraging in-house technological expertise.

In addition to up-front costs, and unlike proprietary commercial competitors, freely sourced learning platforms have no charges for upgrades other than the resources already committed—no new licences to buy or renew from year to year. While a certain amount of technological knowledge and skill is necessary to deploy a freely sourced option, that is just one component necessary for successful adoption. Appropriate hardware capable of running the programs, as well as appropriate connectivity, or access to it, are also necessary. So, while you may not pay for the program, you may pay for the necessary hardware (computer, server, etc.), and possible Internet service upgrades (depending on what you are planning to do), as well as the technical expertise to leverage it.

Many times, these key elements of technological experience and hardware are already present in your school or institution. Maybe you're a programmer yourself. In that case, you are able to leverage the power of open source and free software right now. If you have the hardware and Internet services necessary to run the programs, you are even farther ahead. Schools and institutions without these advantages will need technical support to deal with program source code. Most organizations like public schools, post-secondary institutions or small to medium-sized private schools have at least one technology employee with programming experience already working for, or contracted to them. Generally, people with programming experience are already converts to open source and free software thinking. The issue then becomes how much of the employee's time can be assigned to a freely sourced project.

If you are thinking about seriously investigating freely sourced options, your best bet is to have a technology expert from your organization, and some potential end-users (known early adopters of technology) review possible alternatives for considerations such as ease of installation, implementation, data conversion, and use. Keep in mind that freely sourced technologies are evolving rapidly. (This is one of the major problems, and worthy of a little more discussion). Be sure to revisit open source and free software as alternatives for your software/application needs periodically, and consider making freely sourced options a standard element of your regular software reviews. As for existing hardware needs, those will be based on the type of programs you want to run, who will access them, and how. If you determine that freely sourced software will work for you, and you will be moving people from proprietary commercial platforms to open source and free software options, you will need a change management plan. This is one of the key strategies for lasting conversion. The topic of change management is beyond the scope of this chapter, however. For this aspect of migration, I strongly recommend John P. Kotter's *Leading Change* (1996). Ultimately, open source and free software programs are low cost, rather than no cost, alternatives to proprietary commercial products.

## MISCONCEPTIONS 2 AND 3: LOW QUALITY AND INABILITY TO COMPETE WITH PROPRIETARY COMMERCIAL PRODUCTS

Quality assurance in open source and free software is primitive and rudimentary: if people like it, they will download it, use it, develop it and redistribute it; if they don't like it, they'll ignore it or pan it in reviews. In this arena only the fittest survive. Freely sourced programs and applications are usually a labour of love. People develop them because they *like* to. In fact, many freely sourced applications are quickly approaching the ease of use and status of proprietary commercial products: evidence the increasing adoption of GNU/Linux ("Linux") as an operating system. Paul Graham (2005), a premier online developer and writer, compared the infiltration of freely sourced software into the market as "the architectural equivalent of a home-made aircraft shooting down an F-18". According to Graham (2005), freely sourced software can teach business three main lessons: "(1) that people work harder on stuff they like, (2) that the standard office environment is very unproductive, and (3) that bottom-up often works better than top-down". A sure harbinger of increasing quality is the notice commercial proprietary developers are paying to open source and free software programs. A review of the rise

of the Free Software and Open Source Movements demonstrates that viable freely sourced software is possible.

Theoretically, freely sourced applications are "disruptive technologies" ala Clayton Christensen's model (2000). Christensen (2000) theorized that established businesses focus their efforts on sustaining and extending the lifespan of existing innovations. These established competitors focus their capital on the most profitable products and target markets while disruptive technologies attract low end or new markets, usually by creating less expensive, more user friendly versions of existing products (Christensen, 2000). Christensen revealed that established organizations "are almost always motivated to go up-market rather than to defend these new or low-end markets, and ultimately the disruptive innovation improves, steals more market share, and replaces the reigning product" ("A Conversation with Clay Christensen", n.d.). By the time the established competitor realizes the strategic error, it is too late: the disruptive technology emerges the winner.

The disruptive innovation model suggests that the strategic timing for disruption is when the target market demands for increased technology performance outstrip the established business's commitment to additional development (Christensen, 2000). Innovative competitors must be more nimble and responsive than established competitors (Christensen, 2000). Freely sourced software is, by definition, highly responsive to user needs, both current and emergent, and extremely nimble in responding to them. If we were examining it from the perspective of purely commercial competition, freely sourced software might be hampered by slow profit return, but freely sourced software is not generally in the business of profit, or at least not from the program code itself. The area in which it is weakest is in the ease of deployment. That said, development of freely sourced educational software continues at a rapid rate, making it easier for non-specialists to deploy. Moodle provides an example of a disruptive educational technology leader. In early 2004, Moodle (2007a) sites numbered less than 1,000. By August 2006, the number of sites approached 15,000 (Moodle, 2007a). In 2005, the Moodle community developed its own ezine, Moodlezine (http://playpen.monte.nsw.edu.au/newsletter/index.php). In 2006, William Rice (2006) published the book, *Moodle E-Learning Course Development*. Moodle (2007b) currently claims a registered user-base of 24,966 sites in 176 countries. For comparison, in 2007 Blackboard claimed a global user base of more than 3,650 clients spread across 60 countries and 2,200 institutions (Blackboard Inc., 2007a, 2007b).

The appeal of freely sourced software reaches beyond the budget constraints of academia. DotNetNuke is used by the New York Stock Exchange's NYSEData.com, the Utah Humane Society, the National Rugby League of Australia, and the British Columbia Soccer Association (Canada) (DotNetNuke, 2006b). The Magnolia Content Management Suite (http://www.magnolia.info) is used by private companies, the Spanish Ministry for Public Administration, the Open Web Application Security Project, as well as the University of Basel, Switzerland (Magnolia International Ltd., 2006). In the future, expect open source and free software applications to give commercial proprietary players a race for your money. For a migration framework, read on.

## Meeting the Wizard and his machines: investigating freely sourced alternatives

Remember when Dorothy, the Tin Man, the Lion and the Scarecrow approached the Wizard of Oz? In each case they already knew what they needed. They had done their own rough needs analysis. To think about migration to freely sourced software, you need to start from a needs analysis perspective as well. This migration framework parallels a planning model used to locate a factory or centre of production. When situating such a business, planners need to weigh access to raw materials/product markets, costs of transportation for raw materials/products, as well as any special requirements such as particular energy sources, or research and development centres. Depending on the identified needs, some industries are materials-oriented (situated closer to raw material sites), some market-oriented (situated closer to markets), some transport-oriented (situated closer to the means of transportation) and others energy or research oriented (situated closer to sites like hydro-electric dams or university research centres) (Dunlop, 1987). Your job is to discover if open source or free software provides a viable alternative to relocate your needs.

When a potential adopter looks at changing software, a form of triangulation has to occur, factoring in the following:

- **Availability and comparability to current proprietary commercial software**—This first consideration has to do with knowing what types of software are currently available. As this information changes al-

most daily, you need to stay current with developments in freely sourced software. The closer the freely sourced and proprietary software programs are in terms of look, user friendliness, features and functions, the smoother the transition and the quicker the adoption. In addition, if the new open source option can approximate or better the old product while delivering desired, voiced needs for upgrades, the more assured the transition.

- **Software viability**—Here you review what version was being considered, how long the program has been around, and how robust a user community and/or commercial community has been built around the product. Certainly, products like Moodle, ATutor, and Sakai are safer bets. Experience has shown that the longer-lived and more robust the communities are, the more successful the freely sourced software will be.
- **Implementation and support costs**—Remember that while the source code is free, you have to have the expertise to deal with it. This includes not only necessary hardware purchases, but the skill to implement and support the software in your group or institution, or the cost of any necessary outsourcing.
- **Level of customization desired**—Unlike proprietary software, freely sourced software is highly customizable. You must know what you want from the software application. If customization is desired, key questions include: is there existing, budgeted expertise in our organization to accomplish customization through modifying programs? or would this work need to be outsourced, and at what cost?
- **Software succession history**—Generally, when organizations undergo a rapid succession of software transitions that involve significant changes/challenges, resistance to adoption of any new software will increase. Your transitions must be managed for the relative comfort of your users.
- **Risk assessment**—This involves an examination of how much risk is acceptable in a transition to freely sourced options. This may be measured by reliance on reputation, availability of warranties, or assumption of liability for the software. If low risk is desirable, then a group or institution can experiment with more established applications, or those with warranties and/or vendor support. If a program plays a critical role, then high software viability, usually at a higher cost, must be sought. The level of risk assumption you are willing to make will affect whether your group or institution will be comfortable with newer, less tried-and-true programs, or a blue-chip program like Moodle or ATutor.

## NEEDS ANALYSIS

First you need a team or individual in your group or institution best positioned to do a software review. This is probably the person(s) responsible for buying, maintaining, and monitoring your technology. You want to look at the applications you are currently running in your organization. Determine which ones are the most expensive, have the most associated costs for upgrades, maintenance, etc. Which ones do your people complain about, or wish were better? For which ones do people request alternatives? When you've established a base list, examine these programs for the functions and features your users need, the ones they don't use, and the ones they wish the programs had. Use this to create your wish-list of functions and features for a freely sourced alternative. This list will form the foundation for a software analysis grid when you review your software options.

- **Outputs**: Needs analysis report—formal or informal; wish lists of software functions and features.
- **Resources**: Technology employee time for analysis.
- **Costs**: Employee wages for needs analysis time.

## RESEARCH AND ANALYSIS

Now it's time to find out if there is anything in the freely sourced world that could meet most of the features and functions on your wish list. Build a research team: invite a technology expert(s) with programming experience from your group or institution to work with your needs analysis group (they could be one and the same) as well as one or more potential end users who are demonstrated early adopters of technology. End users might be clerical staff, instructors, teachers, accountants, etc. Always keep in mind exactly *who* will end up using the software. Ultimately, they will have to be satisfied with the new software. Sometimes your team may only consist of two or three people, and that's fine to start, but you will need to increase your participants in subsequent stages. Feedback from the end users is vital. If the interface—the front end of the application—is too challenging to use or user *un*-friendly, or clearly outweighs other benefits, look for something else, have it developed or wait until it is developed. Keep in mind, many user communities will take requests that build up over time to drive the direction of software development.

Have the team research possible alternatives for use in your organization in light of the needs analysis conducted and your wish list(s). Part of this process should assess viability of freely sourced alternatives including existing hardware and potential costs of new hardware or outsourcing. It should also generate estimates of

technology support time required for migration to the new software for initial testing. Another important aspect of assessment is the development/support community for the specific program. Solid freely sourced applications have vibrant communities that support their use. You might also look at potential partner organizations with similar needs and aims who might contribute resources or otherwise support your migration activities. Using your wish list from the needs analysis stage, build a software comparison grid including any additional considerations you might have so that you can evaluate your options side by side. Depending on the item in the grid, you might have an X or check mark (to indicate an item is present) and/or a 1 to 5 scoring framework (e.g., for easy of use where 1 is most difficult and 5 is easiest).

If your team determines that there are viable freely sourced options, the next step in the assessment process is to create and submit a project outline with a draft budget to determine if your group or institution is prepared to commit more resources. Be sure to include meeting time for the project team to discuss the project, review reports, generate communications, etc. When drafting your budget, you should also prepare a rationale for a migration. Be sure to compare existing and projected costs of current proprietary commercial software/applications in use with implementation of the freely sourced options. Look at projected licensing costs for versioning, etc. Review the product versioning cycles of existing software to determine how often you are required to upgrade, and the associated costs. This is often a big selling point for conversion to freely sourced programs.

- **Outputs**: Comparison grid; research and formal or informal analysis report with organizationally specific recommendations; draft budget/cost including estimates from technology expert for migration of limited organizational data to freely sourced applications/programs.
- **Resources**: Employee project time for research and drafting proposal.
- **Costs**: Employee wages for research and analysis.

## TRIAL IMPLEMENTATION

If you reach this stage, you have already determined that there are viable alternatives, and possible potential partners for converting to freely sourced software. You have drafted a proposal with a potential budget for conversion that has been accepted. Resources have now been committed to determine if freely sourced options will work for your organization. If you haven't already done so, designate a project manager or lead who will help draft schedules, track tasks, monitor budgets, etc. This is a critical position and will help keep the project on track. In a perfect world, this individual would have project management training or experience. During the first wave of implementation, you will probably test a set of select applications with your early adopters in limited deployments.

Initial testing might look at three to five applications for a week or month then narrow the field to just one or two options for a longer trial. The early adopters run the programs, comment on the benefits, pitfalls, etc., while working with the technology experts. Those periodic team meetings you budgeted for should guide the program pruning process. Be sure to get feedback from everyone: the people installing, maintaining and tweaking the source code, as well as the end users. Should the applications work well, these early adopters can become your professional development mentors who will then train other people to use the new software.

One of the results of this work may be a decision to abandon the trial software, but if you've found something that works well, you will need to communicate that news through your organization. Show people what you've done, how well it works, chat up the benefits of a wider conversion. Plant the seeds of interest in the new software and draft a project plan for wider organizational adoption. The project plan for the second phase of implementation should include a rationale, a budget, a change management plan, professional training/development, etc. For the fuller roll-out, you should definitely involve a project manager with experience who is skilled with managing organizational change. However, if the freely sourced options do not work for you at this time, provide a project close-down report indicating the issues with the software, but remember, freely sourced software will continue to develop, and new options will present themselves. Be open to further alternatives and research in the future.

- **Outputs**: Installation of programs/applications; limited conversion of organizational data to new programs/applications; training of select organizational personnel on new software/applications; meetings and periodic reports on challenges and successes with the new programs/applications; assessments of whether the project should continue/expand; project plan for wider organizational adoption, or report on the close-down of the project.
- **Resources**: Employee wages, including meeting time for project team; additional resources as designated in draft budget.
- **Costs**: Dependent on budget.

# Conclusion

> "I've got a way to get us in there, and you're gonna lead us". – Scarecrow, *The Wizard of Oz* (Langley, 1939)

Ultimately, no one can tell you that open source or free software is better for you than your current proprietary and/or commercial products. Just like the journey to Oz, your journey to Os should be one of self-discovery. If you do hire a consultant, don't imagine you can hand-off the work and expect someone else to make a decision. People in your group or institution need to participate actively in that process. Open source and free software are constructivist theory in action, with the spirit of collaboration, and trickle-up thinking. If you want to adopt freely sourced software, if you want it embedded in your organizational culture, that culture may need to shift to embrace these values. You've already taken the first step: you've begun to educate yourself about your options. If you have a colleague or two with a similar interest, share this information with them. Like Dorothy, only you can find your way to Os and back, but remember that Dorothy had the Lion, the Tin Man, and the Scarecrow to help. There are lots of people out there ready and willing to help *you*—many of them for free! Imagine that.

# Acknowledgments

I would like to thank two gentlemen for their support of this chapter—Phil Rees for his contributions to "Meeting the Wizard & His Machines: Investigating Freely-sourced Alternatives", and as always, I would like to thank my husband, Arnie Hengstler, without whose support I would be unable to do the many things I do.

Julia E.W. Hengstler
Saltspring Island, British Columbia, Canada
May 2007

# References

*A Conversation with Clay Christensen and Michael Raynor, authors of The Innovator's Solution.* (n.d.). [The Innovator's Solution [http://www.theinnovatorssolution.com/]]. (n.d.). Retrieved September 27, 2006, from http://www.theinnovatorssolution.com/conversation.html

Adaptive Technology Resource Centre, University of Toronto. (2006). *ATutor.* [Why ATutor?]. Retrieved September 27, 2006, from http://www.atutor.ca/

Blackboard Inc. (2007a). *Blackboard and WebCT Complete Merger [Just the Facts].* Retrieved June 6, 2007 from http://www.blackboard.com/webct

Blackboard Inc. (2007b). *In Practice [Global].* Retrieved June 6, 2007 from http://www.blackboard.com/inpractice/global/

Christensen, C. (2000). *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail.* New York: Harper Collins.

Davis, F. D. (September 1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly, 13*(3), 319–340. Retrieved September 29, 2006, from http://links.jstor.org/sici?sici=0276-7783(198909)13%3A3%3C319%3APUPEOU%3E2.0.CO%3B2-E#abstract

DiBona, C., Ockman, S. & Stone, M. (1992). Introduction. In C. DiBona, S. Ockman & M. Stone (Eds.), In *Open Sources: Voices from the Open Source Revolution.* Retrieved September 28, 2006, from http://www.oreilly.com/catalog/opensources/book/intro.html

DotNetNuke. (2006a). *What Is DotNetNuke?* Retrieved May 23, 2006, from http://www.dotnetnuke.com/About/WhatIsDotNetNuke/tabid/777/Default.aspx

DotNetNuke. (2006b). *Showcase Links.* Retrieved September 27, 2006, from http://www.dotnetnuke.com/Community/Showcase/tabid/541/Default.aspx

Dunlop, Stewart. 1987. Towards tomorrow: Canada in a changing world—geography. Harcourt Brace Jovanovich Canada Inc.

Farmer, J. (2006). The new "post-patent" environment for e-learning: A perspective. *Fortnightly Mailing [*http://www.schmoller.net*].* Retrieved September 26, 2006, from http://fm.schmoller.net/2006/09/the_new_environ.html

Feldstein, M. (August 1, 2006). Wikipedia Page on History of the VLE Gathers Prior Art Info. *e-Literate.* Retrieved September 26, 2006, from http://mfeldstein.com

Free Software Foundation, Inc. (November 2002). *GNU Free Documentation License, Version 1.2.* Retrieved July 2006 from http://www.gnu.org/licenses/fdl.html

Free Software Foundation, Inc. (June 1991). *GNU General Public License Version 2.* Retrieved from http://www.gnu.org/licenses/gpl.html

Free Software Foundation, Inc. (February 1989). *GNU General Public License Version 1.0.* Retrieved September 2006 from http://www.gnu.org/copyleft/copying-1.0.html

Free Software Foundation, Inc. (1991/1999). *GNU Lesser General Public License.* Retrieved September 2006 from http://www.gnu.org/licenses/lgpl.html

Free Software Foundation, Inc. (2007). *The GNU Operating System—Free as in Freedom [What is the GNU Project?].* Retrieved June 6, 2007 from http://www.gnu.org/

Gonsalves, A. (September 13, 2006). Microsoft Won't Enforce Patents On Web Services Spec. *TechWeb Technology News.* Retrieved October 1, 2006, from http://www.techweb.com/wire/software/193000323

Graham, P. (August 2005). *What Business Can Learn from Open Source.* Retrieved June 1, 2006, from http://www.paulgraham.com/opensource.html

Helfer, D. S. (2005). E-Learning Service Leaders Blackboard and WebCT Merge. *Information Today Inc. [*http://www.informationtoday.com*].* Retrieved September 26, 2006, from http://www.infotoday.com/newsbreaks/nb051017-2.shtml

Jive Software. (2007). *Frequently Asked Questions [Licensing Questions].* Retrieved May 2, 2007, from http://www.jivesoftware.com/products/openfire/resources/faq.jsp#licensing

Koders. (2006). *About Koders.* Retrieved May 23, 2006, from http://www.koders.com/info.aspx?f=About

Kotter, J. P. (1996). *Leading Change.* Boston: Harvard Business School Press.

Langley, N. (Screenwriter). (1939). *The Wizard of Oz.* California, USA: Metro-Goldwyn-Mayer (MGM).

Magnolia International Ltd. (2006). *Reference Sites.* Retrieved September 27, 2006, from http://www.magnolia.info/en/magnolia/about-magnolia/reference-sites.html

Moodle. (2007b). Moodle Sites. Retrieved May 2, 2007, from http://moodle.org/sites/

Moodle. (2007a). Moodle Statistics. Retrieved May 2, 2007, from http://moodle.org/stats/

Mullins, C. (August 7, 2006). Blackboard Awarded Patent for Internet-based Education Support Systems and Methods; Sues Desire2Learn for Infringement. Message posted to Instructional Technology Council [ITC] Network

Netcraft, Ltd. (February 2002). *February 2002 Web Server Survey.* [Top Developers]. Retrieved September 29, 2006, from http://lwn.net/2002/0307/pr/pr5529.php3

Netcraft, Ltd. (September 2006). *September 2006 Web Server Survey.* [Top Developers]. Retrieved September 29, 2006, from http://news.netcraft.com/archives/2006/09/05/september_2006_web_server_survey.html

Olsen, F. & Arnone, M. (January 25, 2002). Blackboard will acquire competitor Prometheus from George Washington U. *The Chronicle of Higher Education Information Technology*. Retrieved May 2, 2007 from http://chronicle.com/weekly/v48/i20/20a03101.htm

Open School BC. (2006). *Open School Online Consortium.* Retrieved September 27, 2006, from http://online.openschool.bc.ca/oc_announcements.html

Open Source Initiative. (2006b). *The Approved Licenses.* Retrieved April 1, 2007, from http://www.opensource.org/licenses/

Open Source Initiative. (2006a). *The Open Source Definition Version 1.9.* Retrieved June 6, 2007, from http://www.opensource.org/docs/definition.php

Open Source Technology Group [OSTG]. (2006). *Document A01: SourceForge.net.* [What is SourceForge.net]. Retrieved June 3, 2006, from http://sourceforge.net/docs/about

Penney, M. (July 29, 2005). Using Moodle Forum: Comparisons and Advocacy [Re: Anyone know costs for WebCT and Blackboard?]. Message posted to http://moodle.org/mod/forum/discuss.php?d=28182 http://moodle.org/mod/forum/discuss.php?d=28182

Potter, S. W. (2000). Opening Up to Opensource. *Richmond Journal of Law and Technology, VI*(5 [Spring 2000]). Retrieved September 28, 2006, from http://law.richmond.edu/jolt/v6i5/article3.html

Rice, W. (2006). *Moodle E-Learning Course Development*. Birmingham, United Kingdom: Pakt Publishing, Ltd.

Rogers, E. M. (1983). *Diffusion of Innovations* (Third). New York: Free Press.

Software in the Public Interest. (1997/2006). *Debian Social Contract Version 1.0.* Retrieved May 21, 2007 from http://www.debian.org/social_contract.1.0

Stallman, R. & Moglen, E. (June 2005). *GPL Version 3: Background to Adoption.* Retrieved May 21, 2007 from http://www.attivazione.org/wp/index.php/2005/06/09/gnufsf-press-gpl-version-3-background-to-adoption/

Tai, L.C. (2001). *The History of the GNU General Public License.* Retrieved May 21, 2007, from http://www.free-soft.org/gpl_history/

Vworld New Media [Designs4nuke.com]. (February 7, 2006). *Information Technology: Survey Confirms:*

*Open Source Demand Growing, But Lack of Knowledge and Commercial Support Hinder Rapid ROI.* Retrieved September 29, 2006, from http://www.designs4nuke.com/76/index.php?name=News&file=article&sid=239

Wallace v. Free Software Foundation, Inc. (March 20, 2006). *United States District Court, Southern District of Indiana, Indianapolis Division [Document 41, Case 1:05-cv-00618-JDT-TAB].* Retrieved September 28, 2006, from http://www.groklaw.net/pdf/WallaceFSFGrantingDismiss.pdf

Welte, H. (2005/2006). *13 Companies at CeBIT receive warning letter regarding their alleged GPL incompliance.* In News & Announcements. Retrieved October 20, 2006 from http://gpl-violations.org/news/20050314-cebit-letter-action.html

Welte, H. (2004/2006). *The netfilter/iptables project concludes a series of GPL encorcements [sic].* In News & Announcements. Retrieved October 20, 2006 from http://gpl-iolations.org/news/20041004-majorupdate.html

Welte, H. (2006b). *About the gpl-violations.org project.* [Project History]. Retrieved October 20, 2006 from http://gpl-violations.org/about.html#history

Welte, H. (2006a). gpl-violations.org project. Retrieved October 20, 2006 from http://gpl-violations.org

Welte, H. (2006c). *gpl-violations.org project prevails in court case on GPL violation by D-Link.* In News & Announcements. Retrieved October 20, 2006 from http://gpl-violations.org/news/20050314-cebit-letter-action.html

Wikipedia. (2007). *History of virtual learning environments.* Retrieved May 7, 2007, from http://en.wikipedia.org/wiki/History_of_virtual_learning_environments

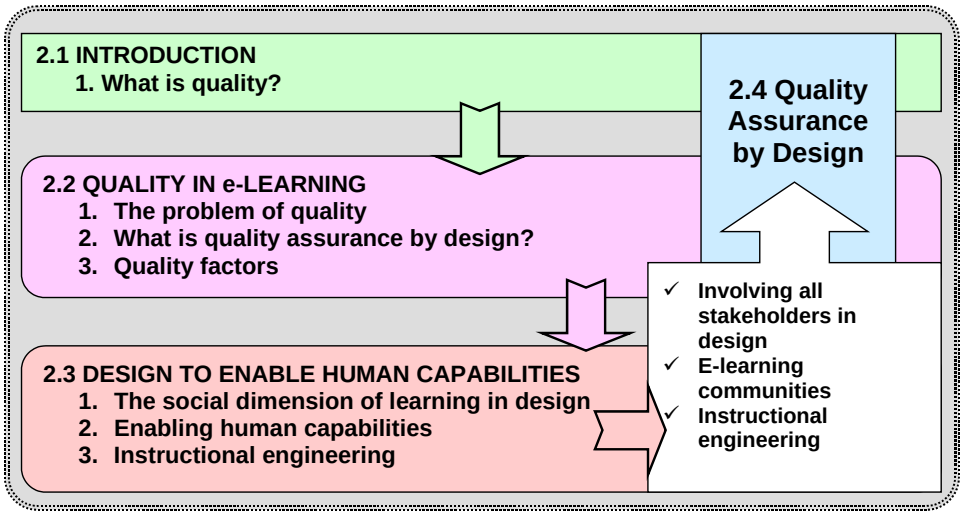
Williams, S. (March 2002). *Free as in Freedom: Richard Stallman's Crusade for Free Software.* Retrieved September 27, 2006, from http://www.oreilly.com/openbook/freedom/

Wright, D. (August 2, 2005). Using Moodle Forum: Comparisons and Advocacy [Re: Anyone know costs for WebCT and Blackboard?]. Message posted to http://moodle.org/mod/forum/discuss.php?d=28182

# 9
# *Quality Assurance by Design*

Niki Lambropoulos
*Centre for Interactive Systems Engineering*
*London South Bank University*

If we are to have viability and credibility in whatever quality assurance measures we adopt in the 21st century, we must open ourselves and the process to other stakeholders: the community, employers, professional organizations, peer institutions, and especially the students themselves. – Pond (2002)



# Learning outcomes

After completing this chapter, you should be able to:

- Apply contemporary approaches to quality assurance and quality standards.
- Tailor quality assurance standards to the organization's needs.
- Identify quality by design, and apply best practices in an online setting.

# Introduction

E-learning is characterized by the evolution of educational tools in a transitional period, that is, the use of computers for learning. The turn of the 21st century also suggests a turn from the Industrial Age to the Information and Collaboration Age, evident in the changes of people's life and work. E-learning has yet to be proved as an important form of learning, but this is a problem of e-learning quality.

To deal with this problem, organizations produce checklists and guidelines to ensure quality from the early stages of design. By applying predefined quality factors to educational systems engineering, quality can be ensured. This is what we mean by quality assurance by design: ensuring that mechanisms allow human capabilities to further expand. The mechanisms of e-learning engineering are:

- focus on pedagogical values such as individualistic or collaborative learning;
- identification, control, and elimination of inherent problems; and
- dynamic real-time evaluation.

Thus, the organization can protect the learner as a customer able to acquire the maximum benefit of e-learning. This chapter is intended to raise awareness of the importance of ensuring quality in the early stages of design and planning by:

- identifying the stakeholders' common goals;
- providing best practices and frameworks to every e-learner;
- identifying the effectiveness of quality improvement activities; and
- proposing frameworks to ensure quality by design.

Organizations in many countries now support open and distance education, starting with higher educational institutions and descending to secondary and primary education. E-learning has become increasingly importance because the Internet has facilitated the gradual elimination of time, space, and cultural boundaries. However, despite investments in technology and e-infrastructure, the high levels of interest among educators, and administrators, and policy makers worldwide, e-learning remains an unproven experiment (Cuban, 2003; Zaharias, 2004; Oliver, 2005).

In a survey on quality in e-learning, Cedefop, the European agency for vocational training, found that 61 percent of the 433 respondents rated the overall e-learning quality negatively as fair or poor. One percent rated it excellent, and five percent rated it very good (Massy, 2002). They gave several reasons for questioning e-learning quality. One of the common problems identified was the absence of performance signposts and measurements. Thus, learners are unmotivated and frustrated (O'Regan, 2003, Piccoli et al., 2003). Another problem was increasing plagiarism and a corresponding lack of original ideas (Culwin & Naylor, 1995; Lancaster & Culwin, 2004; Culwin, 2006). These results may be related to the absence of collaboration among stakeholders on a pedagogical level, and the operational level of systems engineering, both resulting in technocentric design.

In addition, the e-learning interface frustrates learners because of poor usability (Diaz, 2002; Notess, 2001). Since the focus so far has been more on the technological than on the pedagogical aspects of e-learning, there is need for useful and usable educational design in the e-learning environment (CHI SIG, 2001). One reason for this technocentric bias is that technology evolves much faster than its associated pedagogical approaches. In 2003, Laurillard identified a need for pedagogical perspectives, such as the focus on user interface, learning activities design, performance assessment, and an evaluation of whether the learning objectives have been met (Neal, 2003). Measurements for pre-, post-, and trans comparison of best practices are therefore essential.

Researchers are working on a design that can solve such quality problems (Muir et al., 2002; Zaharias, 2005). Nancy Parker (2003), acting executive director for external relations at Athabasca University,[13] refers to a lack of broad acceptance of online education in higher education as the new paradigm shift, as well as the lack

[13] Athabasca University has become the first Canadian university to be awarded accreditation by Middle States Commission on Higher Education (MSCHE), one of the six higher education regional boards in the US (http://www.athabascau.ca/media/releases.php?id=82).

of understanding of its particularities relative to the real classroom. E-learning, she claims, continues to foster the long-standing conflict in values between business and public services resulting from the absence of **quality assurance** (QA) policies.

Nowadays, quality control creates challenges to contemporary research, owing to its intangible dimensions. There are discrepancies between the traditional quality measures associated with accreditation or state-administered quality assurance frameworks and the new, emerging educational paradigm.

# Quality in e-learning

## THE PROBLEM OF QUALITY

Certain e-learning and pedagogical innovations have not succeeded in meeting a number of promises (Salmon, 2005), and have created confusion between the mere supply of information and actual knowledge-building and training (Barbera, 2004). Projects aiming at supporting e-learning environments such as UK eUniversity, NYU Online, Scottish Knowledge, Universitas 21, Global University Alliance (Garret, 2004), as well as a number of European corporate learning projects (e.g., StarScience, Dunes, Adapt-IT, Teachers-in-Europe, POLE STAR) have failed to realize many of their goals. However, the collapse of such initiatives does not indicate the failure of the e-learning concept per se, but rather the lack of quality. For example, lack of planning and marketing were the major reasons for the UKeU failure (Garrett, 2004.) The questions that arise include: What constitutes quality in e-learning? Why is it important? Are there ways we can ensure e-learning quality?

In general, quality refers to fitness of purpose. In e-learning, quality refers to learning (Stephenson, 2005), something excellent in performance (EFQUEL, 2005). In particular, quality in e-learning means providing the right content at the right time, enabling learners to acquire knowledge and skills and apply their learning to improve their performance, whether as an individual or within an organizational framework (ASTD & NGA, 2001). Stephenson (2005) proposed that quality depends on its interdisciplinary nature, and the identification of quality factors for a given environment depends on the chosen perspective. As there are two essential levels—the pedagogical and the operational—the target for return of investment must therefore be viewed as long term.

National bodies and international organizations have now developed principles, guidelines, and benchmarks to describe quality based on the international developments in the field (QAA, 1998; CHEA, 2001; USNEI, 2001; ISO-9000, the Benjamin Franklin Institute, 2001; EFQUEL, 2006). Furthermore, importance is also attached to national standards resulting from the globalization and universal access of learners as customers and taxpayers. For example, in Europe, there were efforts for regionally harmonized systems (see Bologna Declaration, European Ministers of Education, 1999) and Quality Assurance (QA) and accreditation systems developments. Brajnik (2001) proposed that a quality model seeks 'quality' by:

- understanding, controlling, and improving a product or a process;
- identifying problems or performance bottlenecks, base-lines, and timescales, and,
- comparing these for progress assessment, as well as for distinguishing certain attributes from others.

This method for developing and documenting a quality model suggests the production of a complete and consistent set of quality requirements (Firesmith, 2003). Attempts to provide such quality frameworks were conducted by European organizations but they have yet to be fully tested.

The European Foundation for Quality in E-learning (EFQUEL) was established in June 2005 in order to provide a coherent framework of quality factors for all European organizations. Its mission is "to enhance the Quality of eLearning in Europe by providing services and support for all stakeholders" (Nascimbeni, 2005, EFQUEL). This means that the quality factors are explicitly connected to the provision of services and support for all stakeholders from different fields. EFQUEL has attempted to map a quality model by incorporating stakeholders' perspective for policy makers, researchers, e-learning quality related organizations, decision-makers, e-learning users, and learners. EFQUEL conducted a European survey between 15 August 2004 and 15 November 2004 (Panorama Report, Ehlers, Hildebrandt, Görtz & Pawlowski, 2005). Of the 5,023 responses, 28 percent completed it, and only seven percent finished the two basic sections on quality of e-learning. (The low response rate may have been due to inherent difficulties of understanding and defining what e-learning quality is. It is perhaps easier to described what quality is than to define it (Stephenson, 2005).) According to the results, quality relates to obtaining the best learning achievements (50 percent) and "something that is excellent in performance" (19 percent). In detail, the Panorama Report revealed the following:

(1) **the importance of e-learning quality**: Quality is, and will be of great importance for e-learning.
(2) **the need for specific frameworks:** Although numerous quality strategies and concepts were used, the understanding of quality is lacking—this being conceived as an abstract rather than a concrete form. The respondents *believed* that they knew about quality but they showed a general lack of information on quality measures, and that deceived them.
(3) **quality requirements in design:** Learners are both users and customers, and are seldom involved in design in public and business sectors, but design for quality needs to consider the following issues:

- their recommendations for successful quality development. This will prevent the low level of acceptance of designs that lack user quality.
- the inclusion of organizations' own checklists for quality found in web resources, discussion forums and fairs;

The above shows that designers of quality must have experience of quality and ability to meet challenges; to change and adapt, to incorporate quality strategies, and being open to creativity for entirely new forms of quality development.
(4) **critical awareness:** Analysis and criticism of quality demands:

- a high degree of critical awareness;
- quality systems that reconcile the objectives of all the individuals involved;
- quality must be seen as a dynamic process of adaptation to users' needs, primarily those of learners.

The researchers produced a framework of processes for describing quality approaches. This framework refers to general conditions of e-learning that comprise analysis of the external context; design and production involving testing, adaptation, and release of learning resources; implementation, evaluation, and optimization; and lastly, establishment of requirements such as initiation, identification of stakeholders, definition of objectives, and analysis of needs. They stressed that "learners must play a key part in determining the quality of e-learning services", and insisted on the integration of all stakeholders in the process. The outcome of the European efforts was the white paper ISO/IEC 19796-1 entitled *How to Use the New Quality Framework for Learning, Education, and Training* (Pawlowski, 2006)—yet to be fully tested.

In the UK the Government's University for Industry has embraced a learner-centred approach, learning to be determined by the learner, for its ICT programmes. This is to be done by transforming traditional methods of learning (University for Industry, 2003). The Quality Assurance Agency for Higher Education (QAA, 2004) described quality assurance as a code of practice with conditions in place for students to achieve, as set by the institution (QAA, 1998). QAA evaluation is based on teams of academics conducting audits and processing learner reviews. (For detailed QA efforts and comparison see Parker, 2003.) The quality assurance seems to be a description of quality factors for a planned and systematic review of an institution or a program. This description determines the acceptable standards of learner-centred education, scholarship, pedagogic culture and expertise, infrastructure, and organizational strategy and vision, and ensures that these are being maintained and enhanced (Pond, 2002). In the business sector, quality of e-learning in organizations is associated with guidelines for finding and choosing quality in e-learning courses, services, and providers in the e-learning marketplace (WR Hambrecht + Co, 2000).

Because of its intangible dimensions, e-learning quality control creates challenges to contemporary research. Overall, e-learning quality appears to derive from interdisciplinary approaches on learner-centred frameworks and depends on the organization's' infrastructure, organizational strategy, and vision. However, working on a meta-study on e-learning, Pinelle and Cutwin (2000) reported that in real world settings only one-quarter of the articles included evaluations. Thus researchers missed the current transition from the Industrial to the Information and Collaboration Age as the Tavistock Institute had predicted in 1949 (Mumford, 1983; Dolence & Norris, 1995, cited in Parker, 2003). In fact, these changes are apparent in the ways people work, learn, and entertain themselves, which shows the need of multiple skills within an organization. Therefore, although QA processes are necessary, it is difficult to set specific QA standards in a transitional period. In this connection, a European survey on e-learning quality revealed the problem of reflecting reality, and directly associated it with e-learning instructional design (Massy, 2002).

In order to ensure quality education without empirical and systematic assessment, Pond (2002) provided a set of universal attributes (criteria). He referred to the most widely used definitions of quality, quality assurance, and accreditation, with the learner at the centre of the evaluation process. According to Pond, accreditation is the process used in education to ensure that schools,

post-secondary institutions, and other education providers meet and maintain the minimum standards of quality and integrity. This would include academics, administration, and related services (USNEI, 2001). He called on the Council for Higher Education Accreditation to define quality. In its glossary for International Quality Review, quality is defined as "fitness of purpose—meeting or conforming to generally accepted standards … [Quality assurance is] … planned and systematic review … of an institution or program to determine that acceptable standards of education, scholarship, and infrastructure are being maintained and enhanced" (CHEA, 2001). That is to say, learners' expectations have to be met or exceeded. In other words, they must acquire knowledge and skills that they did not possess before the learning experience took place. Wallace (1999) and Smulders (2002) saw the learner in e-learning as both a learner and a user, and then quality standards need to be defined in practical terms on both pedagogical and operational levels.

## QUALITY ASSURANCE (QA)

**Quality assurance** (QA) is a planned and systematic review process of an institution or program to determine that acceptable standards for learner-centred education, scholarship, pedagogic culture and expertise, infrastructure, and organizational strategy and vision, are being maintained and enhanced. This would include expectations that mechanisms of quality control for benchmarking are in place and effective. QA provides the means through which an institution ensures that conditions are such that students can achieve the standards set by that institution or other awarding body. Benchmarking provides signposts against which outcomes can be measured. Subject benchmark statements allow the academic community to describe the nature and characteristics of programs in a specific subject. They also represent general expectations about the standards for qualifications at a given level; they articulate the attributes and capabilities that those possessing such qualifications should be able to demonstrate. Benchmarking is therefore a prerequisite for quality assessment.

**Quality assessment** is a diagnostic review and evaluation of teaching, learning, and outcomes based on detailed examination of curricula, structure, and effectiveness. It is designed to determine whether or not the institution or program meets generally accepted standards of excellence, and to suggest further quality improvements.

**Quality improvement** refers to expectations that an institution will have to plan, monitor and improve the quality of its programs. In most cases, the quality assurance of an accrediting agency requires established procedures to ensure an ongoing process (CHEA, 2001). According to Pond (2002), the new educational online paradigms are learner-centred, tailored, open, collaborative, qualitative, and flexible. They may also be locally differentiated. These criteria meet a universal set of quality e-learning criteria. Online education should therefore provide:

- continuity between advertising and reality
- continuity between purpose and practice
- preparation for external credentialing/further study
- personal/professional/academic growth for the learner
- relevant
- rich, multidirectional interaction
- functional, user-friendly interface
- adequate resources for: instructors, learners, curriculum
- appropriate assessment methods/opportunities

Pond's criteria seem to be eminently constructive for a learner's development.

In conclusion, quality assurance, assessment, and improvement require sets of performance, benchmarks, and indicators based on evaluation tools and techniques. The latter need specific criteria anchored in quality factors. E-learning quality factors describe these systematic reviews and evaluation of principles, guidelines, and benchmarks. However, there is a problem related to labour-management issues during collective bargaining vis-à-vis quality education. It is important that to be in alignment with the international, national and organizational targets need to be in alignment. This is the major challenge.

## QUALITY FACTORS

It is evident that '*quality is easier to describe and illustrate than to define*' (Stephenson, 2005:1). Ensuring e-learning design for cognitive engagement in practice associated with outcomes is exactly what constitutes e-learning (Kalantzis & Cope, 2004; Oliver, 2005). Systems design has to ensure factors for quality at different levels and fields, micro or macro (Hedberg et al., 2002). Recent studies aim to identify quality factors. These studies are guides to good practice (Grahan et al, 2002); indicators for online teaching (Corich et al., 2004); pedagogical dimensions for computer-based education evaluation (Reeves, 1997); quality management (López et al., 2003); learners' perspective (Ehlers, 2004); pillars for quality assurance and accreditation (Pond, 2002); and evaluation frameworks and tools (Muir et al., 2003). These studies referred to specific institutions' QA standards, defining all stakeholders' goals based on international, national, and organizational frameworks.

According to the International Standard Organization ISO/IEC 19796-1, QA can be ensured by:

- identifying the main quality objective for a process;
- identifying the responsible actors;
- identifying methods or instruments that can be used to assure quality; and
- designing to measure the success of the quality objective.

For example, if an organization provides short-term programming courses for groups of 20 students learning C++ in two weeks, the online teaching and learning style is quite different than it would be if the objective were to learn Greek. The system needs to meet the learner's objectives. Another example is proposed by Parker, as four QA principles (2003):

- guaranteeing consistency in the product's results based on long-term values;
- guaranteeing consistency in governmental and corporate education;
- guaranteeing learner-centred education;
- guaranteeing collaboration between internal and external stakeholders).

Parker believes that in order to maintain continuity and consistency it is important to define values. As mentioned earlier, collaboration between the stakeholders for a learner-centred education is the key to success. Institutions need to have a proper understanding of their monitoring operations if they are to improve decision-making and performance. This being done, they will satisfy both themselves and external agencies that they are effective in achieving aims and objectives, as well as being cost-effective and cost-efficient (Rumble, 1986).

To sum up, specific frameworks are necessary to specify quality factors and requirements fit for purpose. Collaboration between all stakeholders is critical: involvement of all stakeholders in the process of design is important: good evaluation tools and techniques ensure quality. E-learning is valuable as an added learning environment to enhance human capabilities further.

# Design to enable human capabilities

For the past 50 years, two main trends have been observed in general education: (a) the socio-cultural focus; and (b) the integration of technology in educational practice. However, still in its infancy, e-learning has yet to construct models of design to reach socio-cultural learning targets. There is as yet to employ consideration of the learner and user (Wallace, 1999; Smulders, 2002). Poor interfaces do not support e-learners efficiently and effectively, even though the existing commercial and open source **learning management systems** (LMS) provide several applications and tools. Most learning management systems are based on a constructivist model, and not on an e-learning community and reflective model of supporting distance education (Rumble, 2001). There are, therefore, no multiple perspectives of e-learning's theoretical framework. Evaluators are still not supported by coherent, interdisciplinary evaluation frameworks and tools. This results in inadequate understanding and lack of descriptions of quality factors. To Silius and Tervakari (2003), one evaluator, whether s/he is a teacher or a systems' designer or a quality planner, can hardly be an expert in all aspects. Collaboration between the stakeholders is the first step towards the adoption of a more social model for e-learning.

## THE SOCIAL DIMENSION OF LEARNING IN DESIGN

**Computer-supported collaborative learning (CSCL):** The social aspects of learning with the aid of computer networks first appeared in CSCL. This followed the computer-supported collaborative work (CSCW) that utilised **ethnography** (Garfinkel, 1967) in systems design. Ethnography provides descriptions of qualitative and quantitative data about human social phenomena based on fieldwork, and was used to search for descriptions that could provide abstract specifications for systems design, i.e., finding ways to communicate to the designers what users want. Thus, the research of Hughes and colleagues was based on **socio-technical design** (STD) (Mumford, 1983; Fan, 2006) to inform the designers of system requirements. The STD mission was to assist system designers to maximize human gains while achieving business and technical excellence (Mumford, 1983). It recognises the interaction of technology and people, and produces work systems that are both technically efficient and have social characteristics. CSCL is linked to STD via CSCW (Hughes et al., 1997) and is anchored in the notion that, the system cannot be accurately understood as each property depends on the other.

Computer-supported collaborative learning (CSCL) was based on theories that emphasized the social dimension of learning, such as distributed cognition (Hutchins, 1995; Salomon, 1993); activity theory (Engestrom, 1987; Kuutti, 1996); situated learning (Resnick, Levine & Teasley, 1991); Greeno, Smith & Moore, 1993); collaborative learning (Crook, 1994); and legitimate peripheral participation in communities of practice (Lave & Wen-

ger, 1991; Wenger, 1998; Wenger et al., 2002). Collaborative computer-supported collaborative learning has contributed significantly to the socio-cultural field.

**Network-supported collaborative learning (NSCL):** NSCL has emerged as a similar educational paradigm. It includes cognitive sciences, sociology, and computer engineering. See Banks, Goodyear, Hodgson & McConnell, 2004; Steeples and Jones, 2002. This interdisciplinary approach has also introduced the role of learning technologist (Conole & Oliver, 2002; Conole, 2004). However, owing to inherent difficulties in performing evaluation in general, as well as evaluation in its own field, very few systematic and complete studies have been reported in NSCL literature (Retalis et al., 2006).

Research in computer-supported collaborative learning and network-supported collaborative learning have found common ground between disciplines, and is now focused on learners working collaboratively. There is still the need, however, for the teacher and the technologist to acknowledge the individual e-learner's requirements. In fact, the learner behaves as a learner, a user, and a customer. Even though learning technologists have aimed to fill this gap, the result is still technocentric design and poor usability (Diaz, 2002; Notess, 2001). The problem remains. There is need for learning management systems to provide an integrated platform for collaborative learning in communities of practice (CoP, Lave & Wenger, 1991). Delivery of the learning product, supporting management, engagement, and tracking of information and activities should facilitate e-learning communities. The Web 2.0 philosophy and tools are currently in favour of such initiatives, but the systems are still in the first stage of development supporting information provision that community knowledge building.

Socio-technical design requires social software qualities of sympathy, trust, and integrity (Mumford, 1983). In e-learning this has been referred to as **affective learning** (AL). Affective learning properties link the individual with the community. Such properties include the emotions, intentions, attitudes, interests, attention, awareness, trust, motivation. or empathy enable communication, consultation, and participation (Zaharias, 2004). For example, Grosz and Sidner (1986) suggest that the discourse structure is intimately connected to intention; for instance intentional information in discourse structure creates adaptation of a conversational channel (Woodruff & Aoki, 2004). Empathy is another example, which is considered essential for participation in online communities (Preece, 1999; Preece & Ghozati, 2000; Lambropoulos, 2005).

**Affective learning in design:** A learner-centred approach to e-learning quality relies not only on cognitive but also on emotional and affective learners' engagement (Zaharias, 2004). Such a learner-centred approach acknowledges the importance of context, and views learning as a social and collaborative process. In the learner-centred paradigm, learners are the focal point—the centre of the learning process. They should take responsibility for their own learning, reflect, and make sense of their experiences. Interconnections between the dual persona of the learner as a user, as well as the inclusion of affective learning factors are the links between the individual and the learning community in the e-learning world. The development of brain research (LeDoux, 1998) and cognitive neuroscience allowed Rizzolati and Arbib (1998) to discover the areas where the mirror neurons are located, interacting in both hemispheres (Broca are 44 and PE/PC). Such neurons are responsible for representing the existence of other people in the brain. This discovery resulted in the scientific identification of empathy, widespread in online communities (Preece & Ghozati, 2000).

According to Zaharias (2004), such affective networks justify the *why* in learning as humans pursue goals, develop preferences, build confidence, persist in the face of difficulty, establish priorities, and care about learning. And yet, affective networks are not considered important in educational technology. It is generally difficult to engineer empathy, but with the advantage the affective learning factors provide, learning theories for the individual can co-exist with socio-cultural learning. The learning activity is the outcome, as Zaharias stressed. Learner-centred frameworks and principles should require learners to be active participants in every quality assessment process. In order to achieve this, Zaharias provided a set of quality principles and their implications for e-learning instructional design quality. His seven quality principles associated with specific implications for e-learning design quality are:

- individual differences relevant to learning styles and preferences
- information overload
- contextual learning
- social learning
- active learning
- reflective learning
- emotional engagement focusing on motivation.

Zaharias' quality principles echo the need for a systems' design model that can support the formation of e-learning communities for the benefit of the individual

and the community. Currently, there is still need of support of collaborative activities and active participation integrated applications. The first generation of learning management systems (LMS) was focused on information provision and management rather than learning. The new generation of LMSs following Web 2.0 philosophy needs to support the learners in their collaborative activities.

## ENABLING HUMAN CAPABILITIES: DESIGN FOR LEARNERS AS USERS AND USERS AS LEARNERS

Design for learners-users-customers refers to Shackel's definition of user-centred design (1991). He suggested that designers need to enable human capabilities. To achieve this, the individual needs to meet the purpose of systems design without any additional cognitive and physical struggle to use it. The International Organization for Standardization (ISO) defined **usability** as a measure of quality of user experience when interacting with a system, in terms of effectiveness, efficiency, and satisfaction (ISO FDIS 9241-11, 1997). Faulkner (2000) suggested that users who do not have to learn to use the system, as the system is already easily used, are freed from the restrictions of their own ability to learn. Initial adaptation of the right attitude is of primary importance (Faulkner, 2000, p. 78). This implies that ensuring usability enables the ability to learn.

**Instructional design** (ID) is a process of resolving instructional problems through systematic analysis of learning conditions. ID starts with the initialization and project planning phase (how the instructional design is carried out); the design and development phase (appropriate strategies and approaches in targeted contexts); a QA phase is focused on evaluation and deployment. The general observation of Bichelmeyer and colleagues (2004) is that the process for most instructional designers is the same: **a**nalyze, **d**esign, **d**evelop, **i**mplement, and **e**valuate (ADDIE). However, Schwier and colleagues (2006) complain that systematic models of ID do not reflect actual practice, are cumbersome, ineffective, inefficient, and costly to implement. This is due to several reasons including unfamiliarity of stakeholders with ID, division between 'academic' and 'corporate' approaches, and unawareness for the need of quality standards. He has reason. Whereas **learner-centred design** (LCD) is focused on making users more effective e-learners, **user-centred design** (UCD) is focused on making e-learners effective users in order to free them from cognitive and physical constraints, making the system easy to use. These two activities as Wallace (1999) claimed should be networked on shared social interfaces for users-as-learners and learners-as-users. This is e-learner-centred design.

To date, the focus has been on the technological (techno-centric interfaces) and not on the social aspects of learning. Thus, there are still issues for useful and usable design in support of e-learning (CHI SIG, 2001). Researchers are still seeking a design to solve such quality problems (Muir et al., 2003; Silius et al., 2003b; Zaharias, 2005). A socio-technical approach for a learner-centred design (LCD) was adopted in turn by Soloway et al., 1994; by Norman & Spohrer, 1996 and Wallace et al., 1998. Their work aimed to bridge the gap between learners as users. At the time, Norman and Spohrer suggested that LCD has three dimensions:

- engagement
- effectiveness by measuring the quality
- viability of interventions.

In support of the third dimension, they observed that projects "won't scale to real curriculum needs or large numbers of students, or diverse content areas, or to everyday teachers and students rather than handpicked ones". They also emphasized the importance of active participation, evaluation, and implementation of design interventions in real-life settings.

Their example of a combined LCD framework has been developed by later researchers along different lines. Whereas Muir and colleagues (2003) worked on pedagogical usability for online courses for learning language, Daniel and colleagues (2005) worked on a variety of user-centred evaluation approaches to consider methods for determining whether a learning community exists, attempting to isolate and understand interactions among its constituent elements. Zaharias (2004) on the other hand developed a questionnaire-based usability evaluation technique that relies upon web usability and instructional design parameters, associating them with a motivation to learn. The latter is proposed as a new affective-oriented measure for e-learning usability.

It appears that combined frameworks are necessary to go out of the control room and controlled experimentation and adjust the interventions to stakeholders' needs. In addition, measurement and evaluation is not towards control but to support successful designs and eliminate existing problems.

Every learning context is unique. Parker (2003) believes that there is an ideological congruence with the reduction of "citizens" to "taxpayers", and as the focus moves to "value-added" activities, the terrain of the debate is being narrowed to shorter and shorter transactional terms. Their focus on institutional policy and

teaching with learning styles based on all stakeholders' targets is not a disadvantage and, in this chapter, it is worth considering a focus depending on active participation in collaborative learning. Understanding the controlling processes and improving them by evaluation and assessment will eliminate existing problems.

# Quality assurance by design

## INVOLVING ALL STAKEHOLDERS IN THE PROCESS OF DESIGN

**Pedagogical heuristics:** When designing systems for e-learning, we must first determine the goal, the intention, and specifications by collecting the relevant information. As a result, learners will be free to justify why they use the applications and their reasons will need to match the organization's intentions. On an operational level, we can use several evaluation frameworks, known as pedagogical heuristics. Heuristics provide a map to work with, without extensive users' evaluations. Norman (1998), Shneiderman (2002, 2005, 2006), and Nielsen (cited on his website, not dated) tried to help designers and evaluators design systems for the users by providing general guidelines. Norman proposed "seven principles for transforming difficult tasks into simple ones":

(1) Use both knowledge in the world and knowledge in the head.
(2) Simplify the structure of tasks.
(3) Make things visible: bridge the gulfs of execution and evaluation.
(4) Get mappings right.
(5) Exploit the power of constraints, both natural and artificial.
(6) Design for error.
(7) When all else fails, standardize.

A second set of heuristics comes from Shneiderman's Eight Golden Rules:

(1) Strive for consistency.
(2) Enable frequent users to use shortcuts.
(3) Offer informative feedback.
(4) Design dialogues to yield closure.
(5) Offer simple error handling.
(6) Permit easy reversal of actions.
(7) Support internal locus of control.
(8) Reduce short-term memory load.

Both sets of rules can be used as evaluation tools and as **usability heuristics**.

Nielsen (n.d.) proposed other usability heuristics for user interface design. His are more widely used:

- visibility of system status
- match between system and the real world
- user control and freedom
- consistency and standards
- error prevention
- recognition rather than recall
- flexibility and efficiency of use
- aesthetic and minimalist design
- help users recognize, diagnose, and recover from errors
- help and documentation.

His heuristics mostly refer to information provision interfaces and do not explicitly support learning in communities using social software platforms. New heuristics to support the social nature of the systems are needed after the migration of the socio-technical environments on the Internet. For example, whereas Suleiman (1998) suggested a check of user control, user communication, and technological boundary for computer-mediated communication, Preece (2000) proposed usability for online communities supports navigation, access, information design, and dialogue support.

**Pedagogical usability (PU):** When e-learning started to be widely used in mid 1990s, new heuristics with a social and pedagogical orientation were needed. With a social perspective in mind, Squires and Preece (1999) provided the first set of heuristics for learning with software Similarly, Hale and French (1999) recommended a set of e-learning design principles for reducing conflict, frustration, and repetition of concepts. They referred to the e-learning technique, positive reinforcement, student participation, organization of knowledge, learning with understanding, cognitive feedback, individual differences, and motivation. To date, learning design is concentrated on information provision and activities management aimed at the individual instead of e-learning communities. Thus there exists an absence of common ground between collaborative learning theories and instructional design. Lambropoulos (2006) therefore proposes seven principles for designing, developing, evaluating, and maintaining e-learning communities. These are: intention, information, interactivity, real-time evaluation, visibility, control, and support. In this way, she stresses the need to bring e-learning and human-computer interaction (HCI) together.

From an HCI viewpoint, new heuristics are needed, and there is room for research. Silius and colleagues (2003) proposed that pedagogical usability (PU) should question whether the tools, contents, interfaces, and tasks provided within the e-learning environments supported e-learners. They constructed evaluation tools using questionnaires. They involved all stakeholders in the process and provided easy ways for e-learning evaluation. Muir and colleagues (2003) also worked on the PU pyramid for e-learning, concentrating on the educational effectiveness and practical efficiency of a course-related website. They stressed that the involvement of all stakeholders in design and evaluation for decision-making was necessary.

One of the great challenges of the 21st century is quality assurance. What quality factors can be measured for effective, efficient, and enjoyable e-learning? It is suggested that this kind of evaluation be part of pedagogical usability. There have been studies investigating issues of e-learning quality: management and design (Pond, 2002); quality that improves design (Johnson et al., 2000); and quality measurement and evaluation, the last recommended by McGorry (2003) in seven constructs to measure and evaluate e-learning programs. These are:

- flexibility
- responsiveness
- student support
- student learning
- student participation in learning
- ease of technology use and technology support
- student satisfaction.

McGorry's evaluation is learner-centred, both system and e-tutors need to support learners with the ultimate goal of learner satisfaction. Absence of empirical research in the field of the everyday e-learner indicates that methods and tools for interdisciplinary measurements have yet to be considered for the individual. Because existing e-learning evaluation in general is based on past events there remain inherent problems related to understanding e-learning with the use of evaluation for feedback, and decision-making. These problems can be addressed with the integration of instructional design phases under real-time evaluation.

## INTEGRATION OF INSTRUCTIONAL DESIGN PHASES: E-LEARNING ENGINEERING

The evolution of the socio-cultural shift in education created a turn in the design of instructional systems and learning management systems. Fenrich (2005) identified practical guidelines for an instructional design process targeted at multimedia solutions. He provided an overall approach involving all the stakeholders in the process of design by covering all their needs. He also employed a project-based approach by dividing the analysis phase into sub-stages, which were: the description of the initial idea, analysis, and planning. By the systematic iteration of activities and evaluation of the first stages in design, Fenrich ensured quality.

But however well-designed e-learning environments are, they cannot facilitate independent learning without interaction with others (Oliver, 2005). Current learning management systems do not facilitate social and collaborative interactions; they only provide the space for it. Collaborative e-learning can be better supported if there is more information on these interactions. These design problems are related to the collaborative nature of the task, the methods used to inform practice, design competencies, and the actual design process itself. Bannon (1994) suggested that, when designing computer-supported cooperative work, design and use of the system as well as evaluation need to be integrated. It is true that analysis, design, evaluation, and use of systems in e-learning are sustained by the interaction of pedagogy and technology. If this instructional design process is underpinned by real-time evaluation, all design phases can be informed fully and accurately. So, there is still room for feedback of instructional design phases. If this is done and instructional design accepts the integration of all the phases supported by real-time evaluation then this is called **instructional engineering** (Figure 9.2):

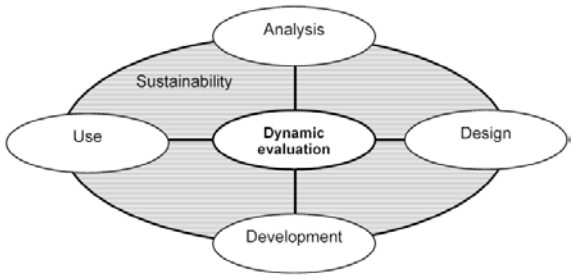



*Figure 9.2 The instructional engineering cycle*

Instructional engineering (IE) is the process for planning, analysis, design, and delivery of e-learning systems. Paquette (2002, 2003) adopted the interdisciplinary pillars of human-computer interaction This considers the benefits of different stakeholders (actors) by integrating the instructional design concepts and processes, as well as principles, from software engineering and cognitive engineering. Looking at the propositions of Fenrich and Paquette, we suggest there could be two ways to ensure

all stakeholders' benefits. There are identification of **key variances** and **dynamic evaluation**.

**Identification of key variances:** All organizations need to function well without problems. The weakest links should be identified, eliminated, or at least controlled. Working on socio-technical design, Mumford (1983) believed that design needs to identify problems that are endemic to the objectives and tasks of organizations. Intentional variances stem from the organizational purposes and targets. Operational variances predate design, and are the areas the organization has to target. They stem from the operational inadequacies of the old system, and the technical and procedural problems have been built into it inadvertently. "Key variances refer to the same variance in both intentional and operational levels".

Design and engineering are connected to both intentional (pedagogical) and operational (engineering) approaches. Sometimes there are problems, called variances in socio-technical design. From an educational perspective, Schwier and his colleagues (2006) emphasized the need of intentional (principles or values) and operational approaches (practical implications), and provided an analytical framework of the gaps and discrepancies that instructional designers need to deal with. The identification of a key variance helps the organization to provide added-value outcomes. This is achieved by the use of dynamic evaluation.

**Dynamic evaluation:** According to Lambropoulos (2006), e-learning evaluation aims to control and provide feedback for decision-making and improvement. It has four characteristics: real-time measurements, formative and summative evaluation, and interdisciplinary research. Dynamic evaluation links and informs design. It also provides immediate evaluation to user interface designers. In addition, it identifies signposts for benchmarking, which makes comparisons between past and present quality indicators feasible (Oliver, 2005). Such dynamic evaluations will enable the evolution of design methods and conceptual developments. The use of several combined methodologies are necessary in online environments. Andrews and colleagues (2003), De Souza and Preece (2004), and Laghos and Zaphiris (2005) are advocates of multilevel research in online, and e-learning environments. Widrick, cited by Parker, claimed that: "[it] … has long been understood in organizations that when you want to improve something, you first must measure it" (2002 p. 130). Parker (2003 p. 388), does not see that engineering for unified learning environments is feasible:

> "The engineering (or re-engineering) of systems designed to guarantee that manufacturing processes would meet technical specification might seem to imply a uniformity that may not be possible, or even desirable, in the dynamic and heterogeneous environment of higher education."

According to Parker, a unified systems design is not possible, or even desirable. The interdisciplinary nature of e-learning, the large number of stakeholders involved, and the uniqueness of the context make e-learning engineering extremely difficult. Nichol and Watson (2003, p. 2) have made a similar observation: "Rarely in the history of education has so much been spent by so many for so long, with so little to show for the blood, sweat and tears expended".[14] It is contended that e-learning engineering, including dynamic evaluation, may well minimize the cost. User interface designers should recognise the need to limit this process to a period of days or even hours, and still obtain the relevant data needed to influence a re-design (Shneiderman & Plaisant, 2005).

At present, the design process is still vulnerable to the **Hawthorn effect** (Faulkner, 2000). Laboratory research ignores the distractions of e-learner behaviour in the real world. On the other hand, dynamic evaluation enables the evolution of design methods and conceptual developments (Silius & Tervakari, 2003; Rogers, 2004). Ethnography captures events as they occur in real life, and then uses them for design. It can be a time-based methodology aiming for a description of a process in order to understand the situation and its context, and to provide descriptions of individuals and their tasks (Anderson, 1996). This type of research could be said to be part of dynamic evaluation in e-learning engineering (Figure 9.3):

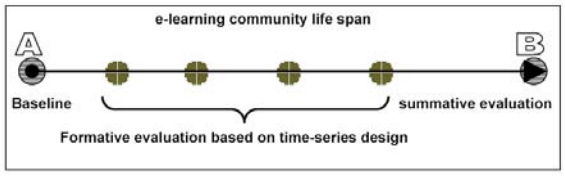



*Figure 9.3 Formative and summative evaluation in e-learning communities*

The line from A to B in Figure 9.3 represents the lifespan of an e-learning community. A short or long term e-learning community may have a beginning (A) that is the baseline, and an end (B). Usually, the comparison of

[14] Editorial "Rhetoric and Reality—The Present and Future of ICT in Education" for the *British Journal of Educational Technology*, by Nichol and Watson (2003:2).

data collected in A and B provides the summative evaluation. The success or failure of the e-learning community is apparent where the initial organization's targets are met. Most times there are differences between what the different stakeholders want or seem to need. (See Cohen's PhD thesis, Appendix I, 2000.) Formative evaluation can shed light on the individual stages of e-learning and in understanding key variances as they occur. This provides feedback and control for all stakeholders.

To date, most evaluation and research is designed to support summative evaluation. The existing tools and evaluation methods are not designed to aid dynamic evaluation. If new tools can be designed for e-learning engineering, then, quality assurance, assessment, and improvement will control arising problems, and enhance best practices. Current efforts to meet these targets for quality are connected to the dissolution of traditional educational hierarchies and other systems (Pond, 2002).

# Summary

The intention of this chapter on quality assurance by design is to raise awareness of the importance of quality, and attempts to propose frameworks in order to ensure quality by design. E-learning quality derives from interdisciplinary approaches on learner-centred and social frameworks, and depends on organizations' infrastructure, strategy, and vision. Web 2.0 signifies the current transition from the Industrial to the Information and Collaboration Age. Changes in the new ways that people work, learn, and entertain themselves are being established. It is therefore necessary to agree on specific quality standards in this transitional period. In general, quality refers to a fitness of purpose and excellence in performance defined on pedagogical and operational levels. In e-learning quality assurance is a planned and systematic review process to determine that equally acceptable standards are being maintained and enhanced. A summary of this chapter would include the following:

- awareness of the importance of quality in e-learning
- inclusion of all stakeholders in e-learning engineering
- support for e-learning communities
- dynamic evaluation

In this time of change, participation of all stakeholders in quality assurance processes will help the e-learning evolution in the 21st century.

# Acknowledgments

Part of this chapter comes from Niki Lambropoulos' PhD research, currently conducted at the Centre for Interactive Systems Engineering, London South Bank University. Thanks to my supervisors, Dr. Xristine Faulkner, Professor Fintan Culwin, and David Harper, editor, for their valuable time, support, and expert advice. Special thanks are acknowledged to Betty Shane for her advice and dedicated editing of the final draft.

# Glossary

**Affective learning.** The "why" in learning. Plays a part in the development of persistence and deep interest in a subject by incorporating affective elements in the learning goals.

**Computer-supported collaborative learning (CSCL).** CSCL focuses on how collaborative learning supported by technology can enhance peer interaction and work in groups, and how collaboration and technology facilitate sharing and distributing of knowledge and expertise among community members.

**Dynamic evaluation.** Real-time evaluation in e-learning environments that covers interdisciplinary assessment for decision-making, control, and improvement.

**Ethnography.** From the Greek *ἔθνος ethnos* = people and *γράφειν graphein* = writing. Refers to the sociological approach that aims to describe varying degrees of qualitative and quantitative descriptions of human social phenomena, based on fieldwork. Ethnography presents the results of a holistic research method founded on the idea that a system's properties cannot necessarily be accurately understood independently of each other.

**Hawthorn effect.** Asserts as fact the idea that the mere act of observing/studying something can alter it, and also asserts that this effect explains some of research results.

**Human-computer interaction** (HCI). Concerned with the design, evaluation and implementation of interactive computing systems for human use, and with the study of major phenomena surrounding them.

**Instructional design** (ID). A process of resolving instructional problems through systematic analysis of learning conditions. This process is often referred as ADDIE to describe the ID phases of analysis, design, development, implementation and evaluation.

**Instructional engineering** (IE). An instructional design process with integrated phases via dynamic, real-time evaluation and focus on one pedagogical approach as the added value.

**Learner-centred design** (LCD). An instructional design process where learning is determined by the learner.

**Learning management systems (LMS).** Synchronous and asynchronous learning environments that incorporate tools for teaching and learning management.

**Network-supported collaborative learning.** Emphasizes the role of social interactions in the construction of knowledge.

**Pedagogical heuristics.** Guidelines used as checklists to ensure that usability serves the purposes of learning.

**Pedagogical usability** (PU). Denotes whether the tools, content, interface, and tasks support learning without any physical and cognitive effort to use the system, which is easy-to-use.

**Quality assurance** (QA). A planned and systematic review process of an institution or program to determine that acceptable standards for learner-centred education, scholarship, pedagogic culture, and expertise, infrastructure, organizational strategy, and vision are being maintained and enhanced. Usually includes expectations that mechanisms of quality control for benchmarking are in place and effective.

**Quality assessment.** A diagnostic review and evaluation of teaching, learning, and outcomes based on a detailed examination of curricula, structure, and effectiveness of the institution or program. It is designed to determine if the institution or program meets generally accepted standards of excellence and suggestions for further quality improvements.

**Quality improvement.** The expectation that an institution will have a plan to monitor and improve the quality of its programs.

**Socio-technical design** (STD). A process for systems design that supports the social system which is built for, and assists, designers to maximize human gains while achieving business and technical excellence.

**Usability.** A measure of quality of user's experience when interacting with a system, in terms of effectiveness, efficiency, and satisfaction.

**Usability heuristics.** Checklists used as rules of thumb to ensure that systems are easy to use by the users.

**User-centred design** (UCD). An iterative process whose goal is the development of a usable system achieved through involvement of potential users of a system in system design.

**Value-added.** The additional value created at a particular stage of production, referring to the contribution of selected factors in order to raise the value of a product.

# Appendix

*Comparison of the roles of ICT in education (Cohen, 2000; adapted and cited in Nichol & Watson, 2003, p. 4)*

| Theme | Policy Makers | Teachers | Pupils |
|---|---|---|---|
| (1) Idealism | Leap of faith required—policy must be based on 'a common-sense act of faith' (Stevenson Report) | Idealism is treated with suspicion and skepticism, both as to motives and practical effects | Enthusiastic with some practical reservations |
| (2) Economic competitiveness | Vital role, but undefined<br>'Technology has revolutionised the way that we work' (DIEE Connecting *the Learning Society*) | Economic role seen as peripheral, some low-level skills for low-level jobs | Strong sense of usefulness for future employment prospects, undefined as to how ICT can help, i.e., no link between use of ICT in schools and the world of work |
| (3) Individualised learning | Will produce autonomous learners, linked to their needs and abilities | Concern over too much non-directed learning, with opportunity for pupils to be off task. However, increase in attention and motivation from ICT identified | Mixed response, benefits of autonomy recognized, while recognizing that teacher help and support is essential |
| (4) Enjoyment | ICT makes learning more attractive | Recognition of pupil enjoyment of using computers, but concern over computers as a distraction from normal school work, i.e., computers as games playing machines | Mixed—it is the use that is made of the computer that matters. In some instances it enhances enjoyment; in others it has a negative impact. |

| Theme | Policy Makers | Teachers | Pupils |
|---|---|---|---|
| (5) ICT for the production of work | Only marginal importance, one of a cluster of skills. Emphasis on versatility (DIEE, *Superhighways*) | Central role, particularly in producing good quality work | Accepted as a tool for research and editing of work. High value attached to improvements in neatness, spelling and presentation |
| (6) Social relations | Important cross-cultural and egalitarian role. Facilitates communication and interaction between people | Doubtful as to social effects, as computers may encourage both laziness and anti-social behaviour. But recognise the growing communication role of ICT | Mixed. Accept communication role of ICT but also concerned over anti-social effects, i.e., addiction and laziness |
| (7) New educational methods | Major change in classroom culture vis-à-vis the role of both teacher and pupil. Teachers as classroom managers, with pupils as independent e-learners | Add to existing teaching methods. Other, radical aims concerned unrealistic in currect school context | No perceptions of any changes. Assumed to be an aid to existing methods, and complementing what is already being taught |
| (8) Scepticism | No room for scepticism | Highly sceptical as to reasons behind ICT policy. Innoveation without any clear indication fo change that brings about improvement. Suspicious of the reasons behind having computers in schools, as the National Curriculum defines what is to be taught | Mixed reaction. Positive as to benefits of ICT in terms of point 5—the production of work. Recognise that ICT can have benefits. Overall regard it as one of many phenomena that they encounter on a day-to-day basis |

# References


Alem, L. and Kravis, S. (2005). Design and evaluation of an online learning community: a case study at CSIRO. *ACM Siggraph Bulletin. 25* (1: Sp. issue on Online Learning Communities), 20–24.

Anderson, R. (1991). Representation and Requirements: The Value of Ethnography in System Design. *Human-Computer Interaction*, *9*, 151–182.

Andrews, D., Nonnecke, B., Preece, J. (2003) Electronic survey methodology: A case study in reaching hard to involve Internet Users. *International Journal of Human-Computer Interaction*, *16*(2), 185–210. Retrieved May 24, 2006, http://www.ifsm.umbc.edu/percent7Epreece/Papers/Online_survey_design_IJHCI04.pdf

ASTD and NGA (2001). *A Vision of E-Learning for America's Workforce*. Retrieved March 16, 2006, http://www.astd.org/NR/rdonlyres/8C76F61D-15FD-4C57-8554-D7E940A59009/0/pp_jh_ver.pdf

Banks, S., Goodyear, P., Hodgson, V., Jones, C., Lally, V., McConnell, D and Steeples, C. (Eds) (2004) Networked Learning 2004: Proceedings of the *Fourth International Conference on Networked Learning 2004*. Lancaster: Lancaster University and University of Sheffield.

Bannon, L. (1994) Use, design and evaluation: steps towards an integration. In the Proceedings of the International Workshop on the Design of CSCW and Groupware systems, in D. Shapiro et al. (Eds.), *The Design of Computer Supported Cooperative Work and Groupware Systems*, Elsevier Science, Amsterdam, 1994. Retrieved May 11, 2006, http://www.ul.ie/~idc/library/papersreports/LiamBannon/18/COMIC.html

Barbera, E. (2004). Quality in virtual education environments. *British Journal of Educational Technology. 35*(1), 13–20.

Bichelmeyer, B., Boling, E. & Gibbons, A. (2005). Instructional Design and Technology Models: their impact on research and teaching in IDT. *Educational media and technology yearbook 2005*, *30*. Westport, Connecticut: Libraries Unlimited.

Bologna Declaration, European Ministers of Education, 1999. Retrieved May 24, 2006, http://www.bologna-berlin2003.de/pdf/bologna_declaration.pdf

Brajnik, G. (2001). Towards valid quality models for websites. Paper presented at the *7th Conference on Human Factors and the Web*, Madison, Wisconsin.

Brown, J. S., Collins, A. & Duguid, P. (1989). *Situated Cognition and the Culture of Learning*. Educational Research, *18*, 32–42.

CHEA, Council for Higher Education Accreditation, *2001 Annual Conference The Many Dimensions of*

*Quality Assurance*. 22 January 2001,New Orleans, LA, USA. Retrieved March 16, 2006, http://www.chea.org/Events/01_01_folder/jan01_preliminary.html

CHI SIG (2001) Notes From E-learning Special Interest Group (SIG) Discussion at CHI 2001. Seattle, Washington, April 3, 2001. *eLearn Magazine*, Notes by Lisa Neal, Ken Korman and Marisa Campbell. Retrieved May 24, 2006, http://www.elearnmag.org/subpage.cfm?section=reviews&article=1-1

CHI SIG (2001) Anyone. Anywhere. *CHI 2001 Conference on Human Factors in Computing Systems*. Seattle, Washington, April 5, 2001. Retrieved May 24, 2006, http://www.sigchi.org/chi2001/ap/technical-program/papers-category.html

Conole, G. (2004). The Role Of Learning Technology Practitioners And Researchers In Understanding Networked Learning. In the Proceedings of the Networked Learning Conference 2004, Lancaster University, England, UK (5–7 April, 2004). Retrieved May 24, 2006, http://www.shef.ac.uk/nlc2004/Proceedings/Symposia/Symposium1/Conole.htm

Conole, G. & Oliver, M. (2002). Embedding Theory into Learning Technology Practice with Toolkits, *Journal of Interactive Media in Education*, Special issue on learning technology theory. The Open University.

Corich, S., Kinshuk & Hunt, L. M. (2004) Assessing Discussion Forum Participation. In Search of Quality, *International Journal of Instructional Technology and Distance Learning, 1*(12).

Cohen M (2000) *What is the educational value of IT?* University of Exeter, PhD.

Crook, C. (1994). *Computers and the Collaborative Experience of Learning*. London: Routledge.

Cuban, L. (2003). *Oversold and underused: Computers in the classroom*. Cambridge, MA: Harvard University Press.

Culwin, F. (2006). Either my students are getting naughtier, or the tools are getting better! In the Proceedings of the 2nd International Plagiarism Conference, Newcastle, UK, 19–21 June 2006. Retrieved July 15, 2006, http://www.jiscpas.ac.uk/conference2006/documents/abstracts/FintanCulwin.pdf

Culwin F. & Naylor J., Pragmatic Anti-Plagiarism. In the Proceedings Third Conference on the Teaching of Computing, DCU Dublin IE (1995).

Daniel, B.K., McCalla, G.I. & Schwier, R.A. (2005). Data mining and modeling social capital in virtual learning communities. Proceedings of the 12th International Conference on Artificial Intelligence in Education, Amsterdam, 18–22 July, 200-208.

De Souza, C., S., Preece, J. (2004) A framework for analyzing and understanding online communities. *Interacting with Computers, The Interdisciplinary Journal of Human-Computer Interaction*. Retrieved July 30, 2005, http://www.ifsm.umbc.edu/percent7Epreece/Papers/Framework_desouza_preece2003.pdf

Diaz, D. P. (2002). Online Drop Rates Revisited. *The Technology Source*. Retrieved April 3, 2005, http://ts.mivu.org/default.asp?show=article&id=981

Dolence, M. G. & Norris, D. M. (1995). Transforming higher education: A vision for learning in the 21st century. Ann Arbor, MI: Society for College and University Planning.

EFQUEL, 2006. *European Foundation for Quality in eLearning*. Retrieved March 16, 2006, http://www.qualityfoundation.org/

Ehlers, U., Hildebrandt, B., Görtz,L. & Pawlowski, J. (2006). *PANORAMA Report: Use and dissemination of quality approaches in European e-learning*. EFQUEL, 2006. Retrieved May 11, 2006, http://www2.trainingvillage.gr/etv/publication/download/panorama/5162_en.pdf

Ehlers, U. (2004). Quality in ELearning From a Learner's Perspective. *The European Journal for Distance and Open Learning, eZine*. http://www.eurodl.org. Retrieved March 23, 2006, http://cms.eun.org/shared/data/pdf/quality_from_learners_perspektive.pdf

Ellis, C.A., Gibbs, S.J. & Rein, J.L. (1991). Groupware, Some Issues and Experiences, *Communications of the ACM*, *34*(1), 38–58.

Engestrom, Y. (1987). *Learning by Expanding*. Helsinki: Orienta-konsultit.

EPSRC, The Engineering and Physical Sciences Research Council (EPSRC). *Research on Technology Enhanced Learning Call* announced on 13/03/2006. Retrieved March 16, 2006, http://www.epsrc.ac.uk/CallsForProposals/ResearchOnTechnologyEnhancedLearning.htm

Fan, I.S. (2006). Light at the End of the Tunnel: Socio-technical integration can help companies deliver successful IT projects. *Computing Business Newspaper*, 19 Jan 2006. Retrieved May 23, 2006, http://www.vnunet.com/articles/print/2148698

Faulkner, X. (2000). *Usability Engineering*. New York, NY: Palgrave, MacMillan.

Faulkner X & Culwin F. (2000). Enter the Usability Engineer: Integration of HCI and Software Engineering. In the Proceedings of *ITiCSE 2000*, Helsinki, pp. 61–64.

Fenrich, P. (2005). *Creating Instructional Multimedia Solutions: Practical Guidelines for the Real World*. Santa Rosa, Ca, USA: Informing Science.

Firesmith, D.G. (2005). Quality Requirements Checklist. In the *Journal of Object Technology*, *4*(9), 31–38.

November-December 2005. Retrieved August 8, 2006, http://www.jot.fm/issues/issue_2005_11/column4

Forsblom, N. & Silius, K. 2002. Value Added on Web-based Learning Environments. In Pantzar, E. (Ed.). *Perspectives on the Age of the Information Society*. Reports of the Information Research Programme of the Academy of Finland. Tampere University Press, pp. 103–113.

Forsblom, N. and K. Silius (2001). *What is the Added Value of Web-based Learning and Teaching? The Case of Tampere University of Technology*. Retrieved May 24, 2006, https://ep.eur.nl/bitstream/1765/1225/1/3+What+is+the+added+value+of+web-based.pdf

Garfinkel, H. (1967) *Studies in Ethnomethodology*. Englewood Cliffs, NJ: Prentice- Hall.

Garrett, R. (2004). The real story behind the failure of the UK eUniversity. Educause Quarterly, 27(4). p. 3–6. Retrieved March 16, 2006, http://www.educause.edu/ir/library/pdf/eqm0440.pdf

Gentry, C. (1994). *Introduction to instructional development*. Belmont, Ca, USA: Wadsworth Publishing Co.

Grahan, C., Cagiltay, J. Lim, B., Craner, J. & Duffy, T.M. (2002). *Seven Principles of Effective Teaching: A Practical Lens for Evaluating Online Courses*. Michigan Virtual University. Retrieved, http://ts.mivu.org/default.asp?show=article&id=839

Greeno, J; Smith, D & Moore, J (1993). Transfer of Situated Learning. In D. Detterman & R. Sternberg (Eds.). *Transfer on Trial*. Norwood, New Jersey: Ablex Publishing Corporation. Pp. 99–167.

Grosz, B & Sidner, C. (1986). Attention, Intentions, and the Structure of Discourse. Computational Linguistics, *12*(3), 175–204.

GSN, Greek Schools Network. Retrieved May 31, 2006, http://www.sch.gr/en/

Hale, C. & French, D. (1999) Web-related Assessment and Evaluation. In: French, D., Internet Based Learning: An Introduction and A Framework for Higher Education and Industry. Stylus Publications, USA.

Harasim, L. (1989). Online Education: A New Domain. In R. Mason and A. Kaye (Eds.), *Mindweave: Communications, computers, and distance education*. Oxford: Pergamon Press. Pp. 74–85.

Harvey, V.S. (2004). *Evaluation Methods for On-Line Programs*. Retrieved May 31, 2006, http://www.massachusetts.edu/administration/itc/pdgrants/04reports/harvey.html

Hedberg, J., Wills, S., Oliver, R., Harper, B. & Agostinho, S. (2002). Developing Evaluation Frameworks for Assessing Quality ICT-based Learning in Higher Education. In P. Barker & S. Rebelsky (Eds.), Proceedings of ED-MEDIA 2002, World Conference on Educational Multimedia, Hypermedia & Telecommunications (pp. 729–735). Denver, Colorado, USA: Association for the Advancement of Computing in Education.

Hughes, J. A. (1999). The General Acceptance of Ethnography in System Design. In the Proceedings of the Conference *Ethnography in systems design: an Industrial Approach to Work Analysis and Software Design*. Thursday April 29th 1999. The Conference Centre, Lancaster University, Lancaster, UK. Retrieved May 23, 2006, http://www.comp.lancs.ac.uk/computing/research/cseg/projects/coherence/workshop/Hughes.html

Hughes, J. A., O'Brien, J., Rodden, T., Rouncefield, M. & Blythin, S. (1997). Designing with Ethnography: a presentation framework for design. Paper presented at the Symposium on Designing Interactive Systems, Proceedings of the Conference on *Designing Interactive Systems: processes, practices, methods, and techniques*. Amsterdam, The Netherlands.

Hutchins, E. (1995). *Cognition in the Wild*. Cambridge Mass: MIT Press.

International Standard Organization ISO/IEC 19796-1, Retrieved March 16, 2006, http://www.iso.org/iso/en/commcentre/pressreleases/2006/Ref992.html

ISO 9000, The Benjamin Franklin Institute of Global Education. (2001). Distance education: Quality assurance initiative. Retrieved April 5, 2004, http://www.academyWeb.com/DEQA

ISO FDIS 9241-11. Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs), Part 11: Guidance on Usability Specification and Measures. Technical report, 1997.

Jonassen, David H. (1991). Evaluating constructivistic learning. Educational Technology, 31, 28–33.

Johnson, S. D., Aragon, S. R., Shaik, N. & Palma-Rivas, N. (2000) Comparative Analysis of Learner Satisfaction and Learning Outcomes in Online and Face to Face Learning Environments. Journal of Interactive Learning Research, 11(1). Retrieved August 8, 2006, http://www.aace.org/dl/files/JILR/JILR11129.pdf

Kalantzis, M. & Cope, B. (2004). Designs for learning. E-learning, 1(1), 38–92.

Kukulska-Hulme, A. & Shield, L. (2004). The Keys to Usability in E-learning Websites. In the Proceedings of the *Networked Learning Conference 2004*, 5–7 April, 2004, Lancaster University, UK. Retrieved August 8, 2006, http://www.networkedlearningconference.org.uk/past/nlc2004/proceedings/individual_papers/kukulska_shield.htm

Kuutti, K. (1996). Activity theory as a potential framework for human computer interaction research. In Nardi, B. A. (Ed.), *Context and consciousness: Activity*

*theory and human-computer interaction*. Pp. 17–44. Cambridge, MA: The MIT Press. Retrieved May 23, 2006, http://www.dwr.bth.se/Kari_Kuuttipercent20Nardi_book.PDF

Lambropoulos, N. (2006). User-Centered Design of Online Learning Communities. In Niki Lambropoulos & Panayiotis Zaphiris (Eds) (2006), *User-Centered Design of Online Learning Communities*. Hershey, PA, USA: Idea Publishing.

Lambropoulos, N. (2005). Paradise lost? Primary Empathy in Online Communities of Interest and Ways of Use. In the Proceedings of the 1st Conference on Online Communities and Social Computing, in the 11th International Conference on Human-Computer Interaction 2005, 22–27 July, Las Vegas, Nevada, USA.

Laghos, A., Zaphiris, P. (2005). Frameworks for Analyzing Computer-Mediated Communication in E-learning. *11th International Conference on Human-Computer Interaction (HCI-International)*, Las Vegas, USA.

Lancaster, T. & Culwin, F. (2004). A visual argument for plagiarism detection using word pairs. At Plagiarism: Prevention, Practice and Policy Conference, Newcastle, UK.

Landauer, T. (1991) Let's get real: A position paper on the role of cognitive psychology in the design of humanly useful and usable systems. In J.M. Carroll (Ed.) (1991) *Designing Interaction: Psychology at the Human-Computer Interface*, pp. 60–73. New York, NY: Cambridge University Press.

Lave, J. and Wenger, E. (1991). *Situated Learning. Legitimate peripheral participation*. Cambridge: Cambridge University Press.

LeDoux, J. (1998). The emotional brain: The mysterious underpinnings of emotional life. London: Weidenfeld & Nicholson.

López, A.J., Pérez, R., Fernández, M.M., Vicente, M.R. (2003) Approaching The Quality Of The Spanish Universities Through ICT Indicators, Paper to the European *Society for Organizational Excellence (ESOE) conference on TQM for Higher Education Institutions*.

Lorenzo, G., Moore J.C. (2002). *Report to the Nation: Five Pillars of Quality Online Education*, The Sloan Consortium, Needham, MA. Retrieved March 16, 2006, http://www.sloan-c.org/

Massy, J. (2002). Quality and eLearning in Europe: Summary report 2002. *BizMedia 2002*. Online archive. Retrieved March 26, 2006, http://www.elearningage.co.uk

McConnell, D. (1994). Implementing Computer Supported Cooperative Learning. London: Kogan Page.

Muir, A., Shield, L. & Kukulska-Hulme, A. (2003). The Pyramid of Usability: A Framework for Quality Course Websites. In the Proceedings of *EDEN 12th Annual Conference of the European Distance Education Network, The Quality Dialogue: Integrating Quality Cultures in Flexible, Distance and eLearning*. Rhodes, Greece, pp. 188–194.

Mumford, E. (1983). *Designing Human Systems—The ETHICS Method*. Retrieved March 16, 2006, http://www.enid.u-net.com/C1book1.htm

Nascimbeni, F. (2005). *Facing the Issue of eLearning Quality through Dialogue and Inclusiveness*. Retrieved March 23, 2006, http://cms.eun.org/shared/data/pdf/efquel_article_pt_magazin_1005.pdf

Neal, L. (2003). Q&A With Diana Laurillard. *eLearn Magazine* (1/17/03). Retrieved April 12, 2006, http://www.elearnmag.org/subpage.cfm?section=articles&article=14-1

Nichol, J. & Watson, K. (2003). Editorial: Rhetoric and Reality—The Present and Future of ICT in Education' for the British Journal of Educational Technology. *The British Journal of Educational Technology*, *34*(2), pp. 1–6.

Nielsen, J. (1994). Heuristic evaluation. In Nielsen, J., and Mack, R.L. (Eds.), Usability Inspection Methods. New York, NY: John Wiley & Sons. Retrieved May 24, 2006, http://www.useit.com/papers/heuristic/heuristic_list.html

Nonnecke, B. (2000). *Lurking in Email-based Discussion Lists*. Unpublished Ph.D. Thesis, London South Bank University. London, UK.

Norman, D. & Spohrer, J. (1996). Learner Centered Education. *Communication of the ACM*. *39*(4), 24–27.

Norman, D. A. (1988). The Psychology of Everyday Things. New York, NY, USA: Basic Books.

Notess, M. (2001). *Usability, User Experience, and Learner Experience*. Retrieved January 12, 2006, http://www.elearnmag.org/

NSCL, Networked Learning Conference 2004. *Learning Technologists: Split Personality or Community of Practice?* Retrieved September 14, 2005, http://www.shef.ac.uk/nlc2004/Proceedings/Symposia/Symposium1/index.htm

O'Hagan CM (1998), Staff Development for Teaching and Learning Technology: Ten Keys to Success, Briefing Paper 53, Sheffield: Universities and Colleges Staff Development Agency (UCoSDA).

Oliver, R. (2005). Quality Assurance and Elearning: Blue Skies and Pragmatism. *ALT-J, Research in Learning Technology, 13*(3), 173–187.

O'Regan, K. (2003). Emotion and E-Learning. *Journal of Asynchronous Learning Networks 7*(3): 78–92. Retrieved August 8, 2006, http://www.sloan-c.org/publications/jaln/v7n3/pdf/v7n3_oregan.pdf

Oshima, J., Bereiter, C. & Scardamalia, M. (1995). Information-access characteristics for high conceptual progress in a computer-networked learning environment. *Computer Support for Collaborative Learning '95*, Bloomington, IN, USA. Mahwah, NJ: Lawrence Erlbaum.

Paquette, G. (2003). Instructional Engineering for Network-Based Learning. Pfeiffer/Wiley Publishing Co.

Paquette, G. (2002). Instructional Engineering for Online Environments. Retrieved June 10, 2006, http://vcampus.uom.ac.mu/upload/public/2002102116552.ppt

Parker, N. K. (2003). The Quality Dilemma in Online Education. In Terry D. Anderson, Fathi Elloumi (Eds.). *Theory and Practice of Online Learning*, pp. 385–421. Retrieved March 16, 2006, http://cde.athabascau.ca/online_book/ch16.html

Pawlowski, J. (2006). How to Use the New Quality Framework for Learning, Education, and Training. Retrieved May 22, 2006, http://cms.eun.org/shared/data/pdf/iso19796-1_summary.pdf

Piccoli, G., R. Ahmad, and B. Ives. (2001). Web-based Virtual Learning Environments: A research Framework and a Preliminary Assessment of Effectiveness in Basic IT Skills Training. *MIS Quarterly 25*(4): 401–426. Retrieved August 8, 2006, http://home.business.utah.edu/actme/7410/Piccoli.pdf

Pinelle, D., and Gutwin, C. (2000). *A Survey of Groupware Evaluations,* Technical Report HCI-00-01, Computer Science Department, University of Saskatchewan.

Pond, W. K. (2002). Twenty-First Century Education and Training: Implications for Quality Assurance. *The Internet and Higher Education*. 4, 185–192

Preece, J. (1999). Empathic communities: Balancing emotion al and factual communication. *Interacting with Computers*, 12, 63–77.

Preece, J. & Ghozati, K. (2000). Experiencing empathy online. In R. Rice & J. Katz (Eds.), *The Internet and Health Communication: Experience and Expectations* (pp. 237–260). Thousand Oaks: Sage.

Preece, J. (2000). *Online Communities: Designing Usability, Supporting Sociability*. Chichester, UK, John Wiley & Sons.

Rumble, G. (2001) Re-inventing distance education, 1971–2001. International Journal of Lifelong Education. *20*(1/2): 31–43.

Rumble, G. (1986) *The planning and management of distance education*. London: Croom Helm.

QAA, The Quality Assurance Agency for the Higher Education. Retrieved May 23, 2006, http://www.qaa.ac.uk/

QAA, Quality Assurance Agency for Higher Education (UK). Press Release 1998. Retrieved May 23, 2006, http://www.qaa.ac.uk/news/media/pressreleases/15_pr_1998.asp

Reeves, T.C. (1997), Evaluating What Really Matters in Computer-Based Education. University of Georgia. Retrieved May 22, 2006, http://www.oltc.edu.au/cp/refs/reeves.htm

Retalis, S., Papasalouros, A., Psaromiligkos, Y., Siscos, S., Kargidis, T. (2006). Towards Networked Learning Analytics—A Concept and a Tool. In Banks, S., Hodgson, V., Jones, C., Kemp, B., McConnell, D. & Smith, C. (Eds). The Proceedings of the *Networked Learning Conference*, Lancaster, Lancaster University. Retrieved May 23, 2006, http://www.networkedlearningconference.org.uk/abstracts/pdfs/P41percent20Retalis.PDF

Resnick, M. (1996). Distributed Constructionism. Proceedings of the *International Conference of the Learning Sciences*, Northwestern University. Retrieved May 23, 2006, http://web.media.mit.edu/percent7Emres/papers/Distrib-Construc/Distrib-Construc.html

Resnick, L.B., Levine, J.M. & Teasley, S.D. (Eds) 1991. *Perspectives on Socially Shared Cognition*. Washington, DC: American Psychological Association.

Rizzolatti, G. & Arbib, M. A. (1998) Language within our grasp. Trends in Neurosciences. 21:188–94.

Rogers, Y. (2004). New theoretical approaches for HCI. *Annual Review of Information Science and Technology*, 38. Retrieved May 22, 2006, http://courses.washington.edu/is540/papers/rogers1.pdf

Rudenstein, N. (1997, February 21). The Internet and education: A close fit. The Chronicle of Higher Education, p. A48.

Salmon, G. (2005). Flying not flapping: a strategic framework for e-learning and pedagogical innovation in higher education institutions, *ALT-J Research in Learning Technology*, *13*(3), Oct 2005, 201–218.

Salomon, G. (1995). What does the design of effective CSCL require and how do we study its effects? In the Proceedings *CSCL '95 Conference*. Bloomington, Indiana, 17–20 October. Retrieved June 22, 2002, http://www-cscl95.indiana.edu/cscl95/outlook/62_Salomon.html

Schwier, R. A., Campbell, K. & Kenny, R. (2006). Instructional Designers' Perceptions of Their Agency:

Tales of Change and Community. Instructional design. In M. J. Keppell (Ed) (2006). *Case studies in communities of practice*. Hershey, PA: Idea Group.

Shackel, B. (1991). Usability-Context, framework, definition, design and evaluation. In Shackel, B., and Richardson, S. J. (Eds.), Human factors for informatics usability. Cambridge: Cambridge University, 21–37.

Shneiderman, B. (2006). User-Centered Design for Quality in Online Learning Communities (Foreword). In Lambropoulos, N. & Zaphiris, P. (2006). *User-Centered Design of Online Learning Communities*. Hershey, PA, USA: Idea Publishing. Pp. vii-viii.

Shneiderman, B. & Plaisant, C. (2005). Designing the User Interface: Strategies for Effective Human-Computer Interaction: Fourth Edition, Addison-Wesley Publ. Co., Reading, MA.

Shneiderman, B. (2002). Leonardo's Laptop: Human Needs and the New Computing Technologies. Cambridge, MA, MIT Press.

Silius, K. & Tervakari, A-M. (2003). An Evaluation of the Usefulness of Web-based Learning Environments. The Evaluation Tool into the Portal of Finnish Virtual University. In: Peñarrocha, V. and alt. (ed.), *mENU 2003—International Conference on University Networks and E-learning* 8–9 May, Valencia, Spain.

Silius, K., Tervakari, A-M. & Pohjolainen, S. (2003). A Multidisciplinary Tool for the Evaluation of Usability, Pedagogical Usability, Accessibility and Informational Quality of Web-based Courses. *The Eleventh International PEG Conference: Powerful ICT for Teaching and Learning*, 28 June – 1 July 2003, St. Petersburg, Russia. Retrieved May 24, 2006, http://matriisi.ee.tut.fi/arvo/liitteet/PEG2003.pdf

Smulders, D. (2002). Designing for Learners, Designing for Users. *ACM eLearn Magazine.* Retrieved May 24, 2006, http://www.elearnmag.org/

Sulaiman, S. (1998). *Heuristics for Evaluating the Usability of CMC Systems.* MPhil Thesis, London South Bank University.

Soloway, E., Guzdial, M., Hay, K. (1994) Learner-Centered Design: The Next Challenge for HCI, *ACM Interactions,* April 1994.

Steeples, C., and Jones, C. (Eds) (2002). *Networked Learning: Perspectives and Issues*. London, UK: Springer-Verlag.

Stephenson, J. (2005) *Definitions of Indicators of Quality on the Application of ICT to University Teaching*. Paper for workshop at Tarragona, Spain. September 20th 2005. Retrieved May 22, 2006, http://cms.eun.org/shared/data/pdf/qual_onlinehe.pdf

Squires, D. and Preece, J. (1999). Predicting Quality in Educational Software: Evaluating for Learning, Usability, and the Synergy Between Them. *Interacting with Computers, 11*(5), 467–483. Retrieved May 24, 2006, http://www.ifsm.umbc.edu/communities/Heur2.html

UfI, University for Industry (2003). The ELLIS Pilot: Researching the appropriateness of the ELLIS packages in Ufi/learndirect centres to support the learning of English for speakers of other languages. Retrieved May 22, 2006, http://www.ufi.com/home/section4/1_summaries/ellispilot.pdf

USNEI—United States Network for Education Information. (2001). *Accreditation Described*. Retrieved May 22, 2006, http://www.ed.gov/NLE/USNEI/us/accred-whatis.html

Wallace, R. (1999). *Learners as Users, Users as Learners: What's the Difference?* Retrieved March 14, 2006, http://www.msu.edu/~mccrory/pubs/HCIC_LCDboaster.htm

Wallace, R., Soloway, E., Krajcik, J., Bos, N., Hoffman, J., Hunter, H. E.., Kiskis, D., Klann, E. & Peters, G. (1998): ARTEMIS: Learner-Centered Design of an Information Seeking Environment for K–12 Education. In: Karat, Clare-Marie, Lund, Arnold, Coutaz, Joëlle, Karat, John (ed.): Proceedings of the ACM CHI 98 Human Factors in Computing Systems Conference. April 18–23, 1998, Los Angeles, California. pp. 195–202.

Wenger, E., McDermott, R. A. & Snyder, W. (2002). *Cultivating Communities of Practice: a guide to managing knowledge*. Boston: Harvard Business School Press.

Wenger, E. (1998). *Communities of Practice: Learning, Meaning and Identity*. Cambridge, UK: Cambridge University Press.

Widrick, S. M., Mergen, E. & Grant, D. (2002). Measuring the dimensions of quality in higher education. *Total Quality Management*, *13*(1), 123–131.

Woodruff, A. & Aoki, P. M. Conversation analysis and the user experience. Digital Creativity. 2004; 15 (4): 232–238.

WR Hambrecht + Co (2000*). Corporate E-learning: exploring a new frontier*. Retrieved March 14, 2006, http://www.astd.org/NR/rdonlyres/E2CF5659-B67B-4D96-9D85-BFAC308D0E28/0/hambrecht.pdf

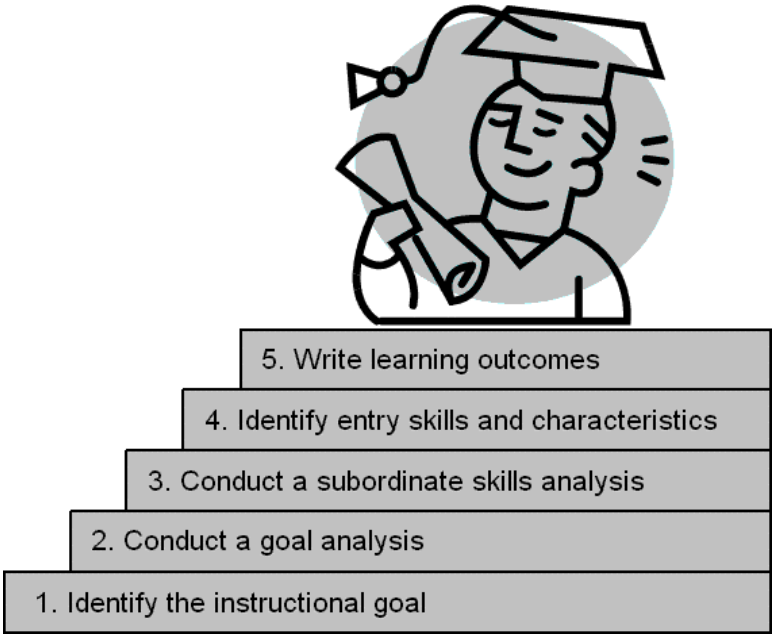
Zaharias, P. (2005). E-Learning Design Quality: A Holistic conceptual framework. In Caroline Howard, Judith Boettcher, Lorraine Justice, Karen Schenk, Patricia L. Rogers & Gary A. Berg (Eds). *Encyclopedia of Distance Learning*. New York, NY, USA: Idea Group. Retrieved March 14, 2006, http://www.eltrun.gr/news/Encyclopedia_ElearnQuality.pdf

Zaharias, P. (2004). *A Usability Evaluation Method for E-Learning Courses*. PhD Thesis. Athens University of Economics and Business.

# 10
# General Principles of Instructional Design

Peter Fenrich
*British Columbia Institute of Technology*

If you're not sure where you're going, you're liable to end up some place else.
– Robert Mager



# Learning outcomes

After completing this chapter, you should be able to:

- Describe each step of the instructional design process.
- Assess needs.
- Analyze goals.
- Identify subordinate skills.
- Conduct a learner analysis.
- Write complete learning outcomes at the highest appropriate level.
- Create courseware using the instructional design process.

# Introduction

**Instructional design** is a systematic, repetitive process of activities aimed at creating a solution for an instructional problem.

In this chapter we describe the instructional design process, and provide details and practical guidelines for completing the process. You will also learn how to conduct a needs assessment and a learner analysis. This chapter also introduces a revised **Bloom's taxonomy** (Anderson & Krathwohl, 2001).

The steps in the instructional design process are shown in Figure 10.1. These steps, which are similar to other models, are adapted from Dick and Carey's (1990) model. Note that this chapter only covers the steps through to "Write learning outcomes". The subsequent steps, shown in Figure 10.1, are covered in other chapters of this book.

One danger in the instructional design process is that it can go on forever. Each step is a checkpoint, and must be signed off with the general knowledge that the results are acceptable enough to continue in the project. However, subsequent evaluation **feedback** may indicate a need to make changes in previously signed-off steps. These changes are sometimes the result of not putting the necessary time and resources into each step the first time.

This model represents an ideal situation. However, cost and time constraints will sometimes force you to make modifications. How safe such modifications as omitting or minimizing steps are will depend on the actual problem being solved, the information that is available, and your intuition or experience.

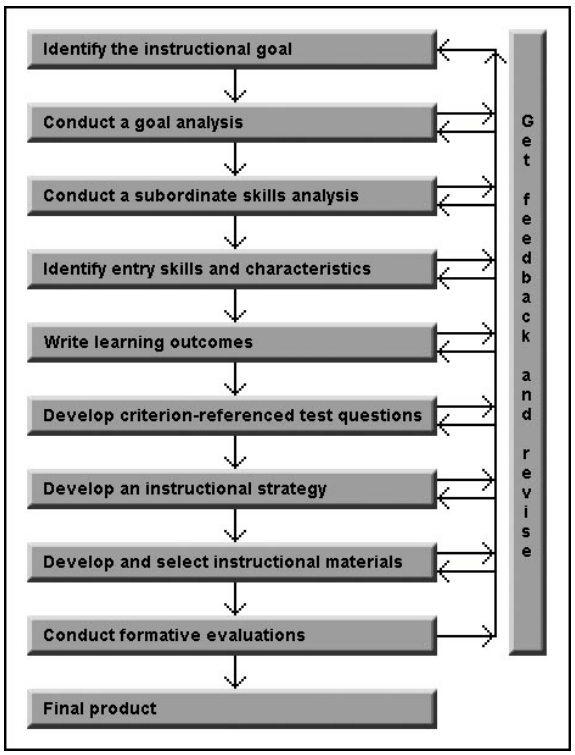



*Figure 10.1 Steps in the instructional design process*

For some courses, the systematic instructional design process can take hundreds of hours of development time. Factors such as the course's complexity, the course management system used, the availability of resources such as instructor notes, the team members' experience, team dynamics, and whether suitable design specifications exist, can all affect how much time is required.

# Identify the instructional goal(s)

**Instructional goals** are general **learning outcomes** that break down into specific measurable skills, for instance, learning to speak conversational French. Before identifying the instructional goal, you must first define the actual problem. You can gather the information for defining the problem and identifying the instructional goal through a **needs assessment**.

A needs assessment is a method for determining the actual problem, rather than the symptoms of a problem. For example, an individual may refuse to use the computer system because the "program doesn't work". In this case, the symptom (refusing to use the computer)

may be hiding the real problem, which might be a fear of the technology, or of change.

A needs assessment is a valuable tool for:

- gathering information;
- understanding potential users;
- consulting users; and
- ensuring involvement, ownership, and fewer surprises for all affected individuals.

**Tip**
Be sure that you define the real problem rather than a symptom of the problem.

## NEEDS ASSESSMENT TOOLS AND TECHNIQUES

Needs assessment tools and techniques include interviews, observations, surveys, group meetings, and a review of any existing documentation. You will need to decide on the best way to get accurate information, given limitations such as time and money. While conducting the needs assessment, avoid letting preconceived ideas, one particular idea, or too many ideas overly influence the problem definition or any step in the instructional design process.

### Interviews

During interviews, consider asking people to:

- share problems they have experienced;
- rank a list of skills that can make them more effective;
- describe feelings or impressions pertaining to certain skills; and
- identify the best solution to a problem.

Phone interviews can be convenient, though person-to-person interviews are often preferred because body language can provide critical information. It takes skill to determine the truth, as Robert Orben noted: "Smart is when you believe half of what you hear. Brilliant is when you know which half."

### Observations

When making observations, ask people to demonstrate particular tasks. A task analysis, or complete step-by-step breakdown of the duties needed to perform a task, can provide important information about what actually happens. Watch for problems caused by inefficiencies. Determine the difference between actual and optimal performances. Be careful of the **halo effect** in which people behave differently because they are being observed. Determine what you can do when people do not want to be observed. Another observation technique is to analyze work products. Defects can show where problems occur in the process.

Note that existing reports, records, and statistics often contain relevant information.

### Surveys

Surveys can be more effective if the survey is based on earlier observations, which might provide useful information about what questions to ask. In the survey, try to determine feelings. Attitudes can play a major role in job performance. Consider whether the provided information will be accurate. Will everyone fill out the survey honestly? Provide incentives to encourage participants to complete the surveys.

### Group meetings

Group meetings can be an economical way to gather information. Before the meeting begins, carefully plan how you expect the meeting to proceed, but be flexible enough to allow the meeting to flow in other useful directions. Note that it is important to prevent discord between group members, and to prevent one or two individuals from influencing the group unduly.

### Reviewing existing documentation

Existing documentation could provide a list of existing goals or even reveal that the problem is already documented. It may state that there is a requirement for new instruction (e.g., learning how to use or repair new equipment or technology) or that there is a new mandate that requires an instructional solution. Documentation can be problematic if the goals and learning outcomes are non-existent or vague, there are contradictions between what is asked for and what is needed, or goals and learning outcomes shift.

## NEEDS ASSESSMENT RESULTS

Most importantly, your needs assessment should result in a precise definition of the problem. There should be a clear distinction between "what is" and "what should be". Be sure that the real problem has been identified, rather than a symptom of the problem.

Sometimes the problem can be linked to:

- environmental issues, or technical problems such as worn or outdated equipment;
- lack of motivation, including low morale;
- poor incentives that can range from lack of recognition to undesired consequences such as extra work, or responsibilities, or an unwanted transfer;

- communication weaknesses;
- illiteracy or lack of knowledge; or
- a combination of these problems.

Remember that a simple approach such as a job aid, perhaps a checklist, a print-based package, or a trainer hired for a short time, may be the most reasonable solution.

**Tip**
Remember that many problems can be solved with simple solutions.

A needs assessment can also result in a statement of:

- the difference between wants and needs;
- the range of skills and knowledge that are available, and the range needed;
- how to bridge the gap between optimal workers and the less-accomplished workers;
- individual opinions and feelings;
- any factors that can interfere with learning;
- potential solutions for problems; and
- ideas for meaningful examples, cases, problems, and questions for use in the instructional solution.

Any resulting clearly defined instructional goal(s) should be:

- cost-effective;
- reached by consensus; and
- achievable with respect to time and resources.

# Conduct a goal analysis

A **goal analysis** results in a visual statement of what the learner will be able to do. Consider the goal of a learner who wants to learn how to film with a camcorder. Figure 10.2 illustrates how this general goal can be broken down into specific learner requirements.

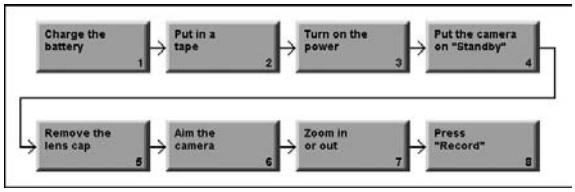



*Figure 10.2 Goal analysis for operating a camcorder*

To analyze a goal, describe in detail the consecutive steps the learner will complete to achieve the goal. As a rule of thumb the task should involve five to 15 steps. If there are more than 15 steps, the goal is either too big or the steps are too detailed. Some of these steps may be intangible, such as making an estimate of materials needed. Some steps may require a decision that results in two or more alternate paths. Focus on what learners need to do or perform, rather than what learners need to know.

Goal analysis includes classifying the goal into the **domain**, or kind of learning that will occur. The domains can be **verbal information** where learners state, list, describe, name, etc., **intellectual skills** such as learning how to discriminate, identify, classify, demonstrate, generate, originate, create, etc., **psychomotor skills** where learners make, draw, adjust, assemble, etc., and **attitudes** such as making choices or decisions [see Fenrich (2005) for details on these domain classifications]. Establishing the domain is important in determining what instructional strategies to use in subsequent steps.

# Conduct a subordinate skills analysis

The sequential steps derived in the goal analysis are often too large to be taught in one step. The learner might need more information prior to learning a step. This can be seen in step 7 in Figure 10.2, where the learner needs some information about zooming in or out. Consequently, you need to break the steps into smaller components, using a **subordinate skills analysis**. When identifying subordinate skills, ensure the components are not too numerous, which can bore learners and interfere with learning, or too few, which can make the instruction ineffective. For each learning domain classification, you need to conduct a different type of subordinate skills analysis:

## VERBAL INFORMATION

With verbal information, you should derive the subordinate skills through a **cluster analysis**. In conducting a cluster analysis, identify all of the information that is needed to achieve the goal. After you gather the information, organize the information into logical groupings. Logical groupings should have up to five pieces of information for weaker or younger learners, or up to seven pieces of information for brighter or older learners. A few people can handle nine pieces of information but it is risky to assume that all learners in the target audience can do this. Humans can only process a limited amount

of information at a time. These limitations must be factored into the design. To be safe, whenever there is doubt, choose smaller groupings.

Although some people think that verbal information is trivial, it provides the knowledge base for higher-level skills.

**Tip**
Organize the information into small enough chunks for the learners to successfully learn.

Given the learning outcome "learners will be able to name body parts," the verbal knowledge can be organized as illustrated in Table 10.1.

*Table 10.1. Organization of verbal knowledge for teaching body parts*

| Body area | Major parts | Smaller parts |
|---|---|---|
| Head | Eyes | |
| | Ears | |
| | Nose | |
| | Mouth | Lips, teeth, tongue |
| Torso | Shoulder | |
| | Chest | |
| | Abdomen | Belly button |
| Arm | Upper arm | |
| | Elbow | |
| | Forearm | |
| | Wrist | |
| | Hand | Palm, thumb, fingers |
| Leg | Thigh | |
| | Knee | |
| | Shin | |
| | Ankle | |
| | Foot | Heel, toes |

## INTELLECTUAL SKILLS

With respect to intellectual skills, you need to conduct a **hierarchical analysis** to determine the subordinate skills. An example of the skills needed to multiply three digit numbers is shown in Figure 10.3.

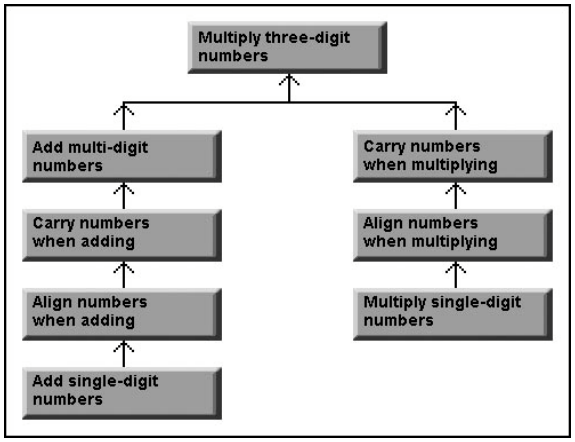



*Figure 10.3 Hierarchical analysis for three-digit multiplication*

For a hierarchical analysis, follow these steps:

(1) For each goal analysis ask, "What must the learner know before learning this skill?" This creates the first hierarchical level.
(2) For each first level component, ask the same question. This creates a second hierarchical level.
(3) Continue this process as needed.

Assuming a problem-solving goal, the first level might be composed of rules, the second level might be rules or concepts, the third level might be concepts or verbal information, etc. Each level can have a simpler or equally difficult skill underneath it. (See Fenrich (2005) for more information on rules and concepts.)

## PSYCHOMOTOR SKILLS

You can derive subordinate psychomotor skills through a **procedural analysis**. An example of the subordinate skills needed for charging a battery for a camcorder is shown in Figure 10.4.

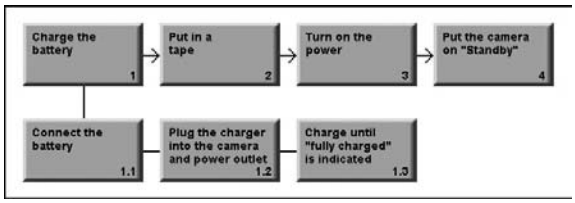



*Figure 10.4 Procedural analysis for charging a camcorder battery*

When conducting a procedural analysis:

(1) Specify each activity that must be done for each goal analysis step.

(2) Ask, "What must the student do or know before this step can be done?"
(3) Continue this process as needed.

The resulting chart can include several layers.

### ATTITUDES

To determine the subordinate attitude skills, you usually need to conduct at least one of the preceding instructional analysis techniques:

- For each goal analysis step, ask "What must the student do when showing this attitude?" The answer is usually a cognitive, intellectual, or psychomotor skill. With this information, you can do the appropriate analysis.
- Ask, "Why should learners show this attitude?" The answer is usually verbal information. You should then do a **cluster analysis**.

## Identify entry skills and characteristics

For learning to be effective and to avoid frustrating learners, you must create a match or balance between the instruction and the learners' capabilities. The instruction must be designed for the target population, defined as the widest practical range of learners. Determine, as discussed below, the learners' abilities, language level, motivation, interests, and other relevant factors. You can obtain this information by interviewing teachers and learners, testing learners, and reviewing existing documentation such as test scores. The result should determine the entry or basic skills that the target population learners have mastered before the instruction begins. In other words, these preliminary skills will not be taught. In this step, you may also discover other factors that may influence the instructional design.

**Tip**
Create a balance between learner capabilities and the instruction.

Based on the completed instructional skills analysis, draw a dashed line just below the skills that most, if not all, of the target population possess (Figure 10.5). You will teach the skills above the dashed line, and *not* those below the dashed line. In the example here, learners will not be taught how to add multi-digit numbers, any skill below that, or how to multiply single-digit numbers. It is assumed that target audience learners will have these skills.

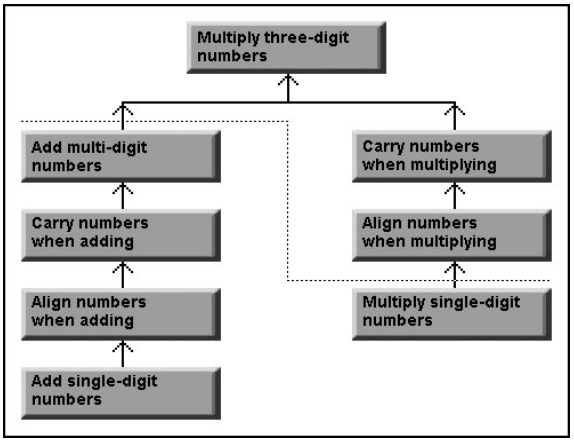



*Figure 10.5 Entry skills*

You should confirm this decision by asking the subject-matter experts whether the entry skills should be tested within your lesson. If there is any doubt about whether the target audience learners possess the skills, pre-test for those skills. You can do this on paper, by computer, or in any format that provides accurate data. The instructional design process later includes testing the instruction with learners who are truly representative of the target audience population to ensure that the entry-level behaviours are set appropriately.

### LEARNER ANALYSIS

To adapt your instructional design to the needs of your target population, you should ask questions that elicit information about the learners' abilities, language skills, motivation, and interests. Conducting a **learner analysis** will also let you define your population precisely.

If possible, you should observe typical learners., This can help in selecting relevant and meaningful examples, choosing appropriate role models, and avoiding inappropriate stereotyping.

**Tip**
To ensure your materials are aimed at the correct student population, consider the learners' abilities, language capabilities, motivation, interests, and human factors.

#### Abilities

You should ask the following questions about the learner's abilities:

- What are the current skill levels?
  - Sometimes, a learner's prior knowledge and experience can interfere with the new learning. For example, the menu items in an old software package may be different from those used in the new version of the software. These differences can be addressed in the instructional materials.
  - Are all of the learners computer literate? To what degree? What guidance will they need?
- What are the learners' mental capabilities?
  - Are they fast or slow learners?
  - How well can they memorize information?
  - Will learners be able to choose appropriate learning paths? How will they be guided?
- What are their confidence levels?
  - This information can be used to determine the size of the incremental learning steps.
- What are the learners' maturity levels?
  - Are they independent or do you need to closely monitor their work and progress?
- Are there any learner misconceptions?
  - Ensure that you address all misconceptions.
- Will learners prefer to work alone, in pairs, or in groups?
  - Provide activities for each preference. for variety, and to ensure that learners can work in the way they prefer some of the time.

### Language capabilities

You should ask the following questions about the learner's language capabilities:

- What are the learners' language levels?
- What specialized vocabulary do the learners already know?
- Is their preferred language style conversational, scholarly, or technical?
- Should the material be taught in one, two, or more languages?
- Will an audio narration be needed for learners who have weak reading skills but good oral comprehension?

### Motivation and interests

You should ask the following questions about the learner's motivation and interests:

- Why should the learners learn the material?
  - What would make the material particularly relevant and meaningful?
  - Are there any attitudinal or motivational problems? If so, how can these problems be overcome?
- What are the learners' background experiences?
  - Learners can bring a vast amount of knowledge and life experiences to a learning situation.
- What will the learners find interesting?
- Are learners learning the material because they are required to learn it, or because they want to learn it?
- Are there any learner preferences for specific media?
  - Remember that learning effectiveness is a primary concern.
  - Will learners be easily de-motivated with certain media? For example, do learners presume that materials with a large text component are boring?
  - Are there past failures associated with a particular medium?
- How should testing be done?
  - Are certain test formats preferred over others? For example, would short-answer questions deter learners who have poor keyboarding skills?
  - Should testing be formal or informal?

## Write learning outcomes

Learning outcomes or objectives are specific measurable skills and are more specific than instructional goals. For example, if a goal is to be able to speak conversational English, a learning outcome could be to conjugate the verb "to be".

Learning outcomes communicate to learners, instructors, and other interested people, what the learners should be able to do, compared to their current skill level. Success occurs when learners achieve the planned outcomes. Learning outcomes help learners organize their studying, avoid becoming lost, make appropriate decisions such as whether to study a section or not, and maintain their motivation. If you inform your learners of the learning outcomes, they will, on average, attain slightly but significantly higher results. Even though some learners do not read learning outcomes, include them for those who do want and need them.

It is critical for you to define specific learning outcomes since they form the basis of the subsequent instructional development process. Accurate, well-written learning outcomes can save development time and money by helping to keep the process on track. Without specific learning outcomes, it is easy to start branching off on interesting tangents, which could make it impossible to finish a project within the constraints given. Whenever you have doubt about whether some material should be included, you can refer to the stated learning outcomes.

Many projects have failed because of poorly written or non-existent learning outcomes. Check all learning

outcomes for flaws. If a learning outcome is not specific and measurable, do *not* proceed with further design and development. Even when you define the learning outcomes, there is no guarantee that you will successfully teach them. In order to ensure that learning takes place, you still need to follow the subsequent instructional design steps.

**Tip**
Well-written learning outcomes help keep the subsequent instructional development process on track.

## STEPS TO WRITING LEARNING OUTCOMES

There are five steps to writing learning outcomes. For each step, think about why each example is good or poor.

(1) Once you have decided on a content area, use action verbs to identify specific behaviours. The verb should be an observable behaviour that produces measurable results. The verb should also be at the highest skill level that the learner would be required to perform. We'll discuss the revised Bloom's Taxonomy, which will give you details about the different skill levels, in the next section. Note that learners often need a knowledge base of lower-level skills in order to succeed at higher-level skills. Based on your previous entry skills decisions, you might have to teach the lower-level skills.
   Good: calculate, compute
   Poor: understand, know.

(2) Specify the content area after the verb.
   Good: Calculate averages and compute variances.
   Poor: Calculate statistical information and compute values needed in economics.

(3) Specify applicable conditions. Identify any tools to be used, information to be supplied, or other constraints …
   Good: Given a calculator, calculate the average of a list of numbers.
   Given a spreadsheet package, compute variances from a list of numbers.
   Poor: Given an available tool, calculate the average of a list of numbers.

(4) Specify applicable criteria. Identify any desired levels of speed, accuracy, quality, quantity …
   Good: Given a calculator, calculate averages from a list of numbers correctly 100 percent of the time.
   Given a spreadsheet package, compute variances from a list of numbers rounded to the second decimal point.
   Poor: Given a calculator, calculate averages from a list of numbers correctly most of the time.

(5) Review each learning outcome to be sure it is complete, clear, and concise. Get content experts and learners to review them, and get approval before continuing.

Perhaps the worst example of a learning outcome ever written is:

*The learner will understand and appreciate the learning outcomes of the course.*

## REVISED BLOOM'S TAXONOMY

Bloom et al. (1956) classified learning outcomes into six taxonomies:

(1) Knowledge
(2) Comprehension
(3) Application
(4) Analysis
(5) Synthesis
(6) Evaluation

This has been an invaluable resource that has helped numerous educators design instructional materials to the appropriate skill and thinking levels needed. Relatively recently, Anderson & Krathwohl (2001) revised Bloom's taxonomy into these hierarchical categories:

(1) Remember
(2) Understand
(3) Apply
(4) Analyze
(5) Evaluate
(6) Create

Your subsequent instructional strategies, questions, other interactions, and tests should relate to the appropriate skill and thinking levels, which directly correspond to the stated learning outcomes. Remember that each of these six categories can contain verbal information, intellectual skills, and attitudes.

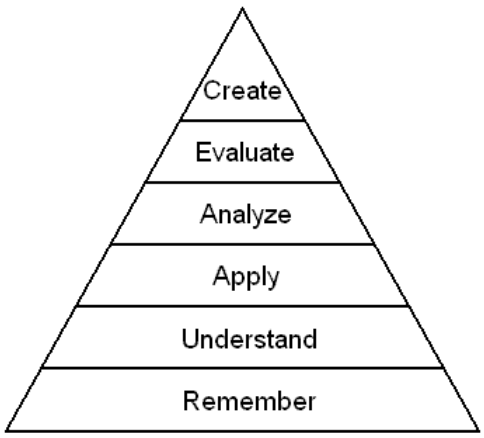



*Figure 10.6 Revised Bloom's Taxonomy*

### Remember

Remembering skills entails recalling information as it was presented.

Sample verbs: State, describe, label, list, name
Example: List the different types of media that online courses can include.

### Understand

Understanding skills can include restating knowledge learned earlier in one's own terms, translating ideas and concepts, and recognizing inferences and assumptions. Understanding skills can be tested by repeating questions and problems in a different form.

Sample verbs: Convert, estimate, explain, summarize, locate
Example: Explain why online courses should not necessarily include all types of media.

### Apply

When applying skills, learners apply knowledge to new situations. Learners must decide how to solve the problem. For application skills, you can use fictional situations, material learners have not seen, or modify old problems.

Sample verbs: Relate, compute, change, apply, use
Example: Using Bloom's taxonomy, write complete learning outcomes at the appropriate level.

### Analysis

Analysis breaks down existing knowledge into meaningful parts. Analysis can require learners to detect relationships and draw conclusions. You can use experiments or supply data to test analysis skills.

Sample verbs: Break down, differentiate, determine, relate, analyze
Example: Given a properly written learning outcome, identify the learning outcome's conditions, skill, and criteria.

### Evaluate

Evaluation entails using personal values to judge knowledge. Evaluations are hard to grade objectively.

Sample verbs: Appraise, compare, conclude, criticize, assess, evaluate
Example: Evaluate the effectiveness of an online course.

### Create

To create is to produce something new, or to modify a thing that already exists. Creating can also take the form of a speech, proposal, project, or theory.

Sample verbs: Summarize, revise, compose, construct, create, synthesize
Example: Create an online course that includes all of the instructional events.

## Summary

Instructional design is the systematic process of activities that solve an instructional problem by identifying the instructional goal, conducting a goal analysis, conducting a subordinate skills analysis, identifying entry skills and characteristics, and writing learning outcomes.

An instructional goal is broad learning outcome that can be broken down into specific measurable skills. To identify the instructional goal, you must first define the actual problem through conducting a needs assessment.

Once you have determined the instructional goal, the goal is refined through a goal analysis. This will lead to a statement of what the learner will be able to do. The emphasis is on what learners need to be able to do, rather than on what learners need to know.

The goal analysis is refined into smaller components through a subordinate skills analysis. The subordinate skills analysis ensures that each component is small enough to teach, and shows what information a learner needs prior to learning each component. Verbal information, intellectual skills, psychomotor skills, and attitudes each need a different type of subordinate skills analysis.

With verbal information, conduct a cluster analysis in which you have identified all of the information needed

to achieve the goal, to determine the subordinate skills. After identifying the information, organize the information into logical groupings of up to five pieces of information for weaker or younger learners or seven pieces of information for brighter or older learners. Verbal information is important in that it can form the needed knowledge base for higher-level skills.

For intellectual skills, conduct a hierarchical analysis to determine the subordinate skills:

- For each goal analysis step, ask "What must the student know before this skill can be learned?" This creates the first hierarchical level.
- For each first level component, ask the same question. This creates a second hierarchical level.
- Continue this as far as needed.

Subordinate psychomotor skills can be derived through a procedural analysis:

- Specify each activity that must be done for each goal analysis step.
- Ask, "What must the student do or know before this step can be done?"
- Continue this as far as needed.

To determine the subordinate attitude skills, conduct at least one of the following instructional analysis techniques:

- For each goal analysis step, ask "What must the student do when showing this attitude?" The answer is usually a cognitive, intellectual, or psychomotor skill. With this information, you can do the appropriate analysis.
- Ask, "Why should learners show this attitude?" The answer is usually verbal information. You should then do a cluster analysis.

For learning to be effective, and to avoid frustration, the instruction and the learners' capabilities must match. Design the instruction for the target population, defined as the widest practical range of learners. Determine the learners' abilities, language level, motivation, interests, and human factors. The end result should determine the entry or basic skills that they must have before the instruction begins.

Learning outcomes, or objectives, are specific, measurable skills that communicate to learners, instructors, and other interested people, what the learners should be able to do after completing the learning. Success occurs when learners achieve the planned outcomes. Learning outcomes form the basis of the subsequent instructional development process.

To write learning outcomes:

(1) Identify specific behaviours through action verbs. The verb needs to be stated at the highest skill and thinking level that the student will need to do. Use the revised Bloom's taxonomy as a foundation for selecting verbs.
(2) Specify the content area after the verb.
(3) Specify applicable conditions. Identify any tools to be used, information to be supplied, constraints, etc.
(4) Specify applicable criteria. Identify any desired levels of speed, accuracy, quality, quantity, etc.
(5) Review each learning outcome to be sure it is complete, clear, and concise.

# Glossary

**Attitude.** Tendency to make particular decisions or choices under specific circumstances.

**Bloom's taxonomy.** A classification system containing six hierarchical taxonomies for learning outcomes.

**Cluster analysis.** Analysis used to organize verbal information into logical groupings that are small enough to be learned successfully.

**Feedback.** Any response related to input.

**Goal analysis.** The process for providing a visual statement of what the learner will be able to do.

**Halo effect.** A result in which people behave differently because they are being observed.

**Hierarchical analysis.** Used to determine the subordinate skills required to learn an intellectual skill.

**Instructional design.** The process of activities aimed at creating a solution for an instructional problem.

**Instructional goals.** General skills that will be further defined into specific learning outcomes.

**Intellectual skills.** Skills that require learners to think rather than simply memorize information.

**Learner analysis.** Determines information about the student's abilities, language capabilities, motivation, interests, human factors, and learning styles.

**Learning outcomes** or **objectives**. Specific, measurable skills.

**Needs assessment.** A method of gathering information for determining the actual problem.

**Procedural analysis.** Used to derive subordinate psychomotor skills.

**Psychomotor skills.** Skills that require learners to carry out muscular actions.

**Subordinate skills analysis.** A process for determining the skills that must be learned before performing a step.

**Verbal information.** Material, such as names of objects, that learners have to memorize and recall.

# References


Anderson, L. W. & Krathwohl, D. R. (Eds.). (2001). A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives. New York, NY: Longman.

Armstrong, D., Denton, J. & Savage, T. (1978). *Instructional skills handbook*. Englewood Cliffs, NJ: Educational Technology Publications.

Bastiaens, T. & Martens, R. (2000). Conditions for web-based learning with real events. In Abbey, B. (Ed.), *Instructional and cognitive impacts of web-based education* (pp. 1–31). Hershey, PA: Idea Group Publishing.

Beach, B. K. (1993, October). Learning with Roger Schank. *Training & Development, 47*(10), 39–42.

Bloom, B., Engelhart, M., Hill, W., Furst, E. & Krathwohl, D. (1956). *Taxonomy of educational objectives, Handbook 1: The cognitive domain*. New York, NY: David McKay Inc.

Churach, D. & Fisher, D. (2001). Science students surf the web: Effects on constructivist classroom environments. *Journal of Computers in Mathematics and Science Teaching, 20*(2), 221–247.

Danielson, J., Lockee, B. & Burton, J. (2000). ID and HCI: A marriage of necessity. In Abbey, B. (Ed.), *Instructional and cognitive impacts of web-based education*. (pp. 118–128). Hershey, PA: Idea Group Publishing.

Dick, W. & Carey, L. (1990). *The systematic design of instruction* (3rd ed.). Glenville, IL: Harper Collins Publishers.

Ference, P. & Vockell, E. (1994, July-August). Adult learning characteristics and effective software instruction. *Educational Technology, 34*(6), 25–31.

Fenrich, P. (2005). *Creating Instructional Multimedia Solutions: Practical Guidelines for the Real World*. Santa Rosa, CA: Informing Science Press.

Gagne, R., Briggs, L. & Wager, W. (1988). *Principles of instructional design* (3rd ed.). New York, NY: Holt, Rinehart and Winston.

Jonassen, D. & Hannum, W. (1991). Analysis of task analysis procedures. In G. J. Anglin (Ed.), *Instructional technology: Past, present, and future* (pp. 170–187). Englewood, CO: Libraries Unlimited.

Mager, R. (1962). *Preparing instructional objectives*. Belmont, CA: Fearon Publishers.

Miller, S. & Miller, K. (2000). Theoretical and practical considerations in the design of web-based instruction. In Abbey, B. (Ed.), *Instructional and cognitive impacts of web-based education*. (pp. 156–177). Hershey, PA: Idea Group Publishing.

Rossett, A. (1987). *Training needs assessment*. Englewood Cliffs, NJ: Educational Technology Publications.

Schwier, R. & Misanchuk, E. (1993). *Interactive multimedia instruction*. Englewood Cliffs, NJ: Educational Technology Publications.

# 11
# *Accessibility and Universal Design*

Natasha Boskic, Kirsten Starcher, Kevin Kelly, and Nathan Hapke

# Learning outcomes

After completing this chapter, you should be able to:

- Understand what accessibility means in an online environment, why it is important, and what standards and policies are in place to support it.
- Apply principles of universal design while creating your materials in order to provide online content to ALL students, to assess equally all students' skills, knowledge and attitudes, and to engage and motivate all students.
- Have deeper insight in various types of disabilities, their effect on how people use the Internet, and into assistive technologies that exist to accommodate these disabilities.Analyze how websites are designed, what tools are available for their creation, and how to write for users with disabilities.
- Explore different types of multimedia: their potentials and challenges when using them for online learning with students with disabilities.Apply a checklist to test your site for accessibility and use automated validators;
- Look ahead at some additional resources for learning about accessibility.

# Introduction

Most of the content in this chapter is based on the work performed at the University of British Columbia (UBC) as a part of the "Web Content Accessibility" project in the period September 2005 – August 2006.

Great efforts have been made to give every student equal access to high-quality learning, and to remove barriers for people with disabilities. However, most of these efforts are focused on the traditional, face-to-face classroom experience. Less attention is devoted to those taking courses fully online, and their ability or inability to cope with web-based interactive content. While standards and guidelines have been developed to support and assist with accessible web design, their primary focus has been on technical specifications, assistive technologies, or legal issues. Fewer studies have been conducted to investigate how that "accessible" content is perceived from a learner's perspective, and how helpful it really is.

As distance learning adapts to new technology, instructors should be innovative in their relationship with students and in the methods for developing educational content, accommodating the diverse needs and learning styles which will be beneficial for all, regardless of their (dis)abilities.

At the beginning of this chapter you will find a brief description of the situation at post-secondary institutions, regarding adjustments of their online materials to students with disabilities, as well as legal and ethical framework for making modifications. You will find information about, and examples of, applying Universal Design for Learning principles to the online environment for the benefit of everyone. A description of various disabilities will follow, where we will focus on specific student needs. Next, you will learn about legal requirements and existing standards for creating web content. We will describe practical steps and procedures and explain them with respect to different elements of online material design, together with several ways for testing and assessing accessibility. At the end of the chapter you will find a list of additional resources for further exploration.

> "If the basics of usable design are ignored all users can be disabled by the inappropriate use of technology". (P. Jeffels, 2005*)*.

# Framework

## ACCESSIBILITY AT HIGHER EDUCATION INSTITUTIONS

Universities are increasingly becoming involved in technology-based education programs. The level of sophistication of such offerings (cohort organizations, electronic learning) is accelerating rapidly. However, persons with disabilities, taking courses off campus, are not always provided with the same rights of access and program accommodation as those on-campus. In some cases, slow Internet access is a problem, and in other cases, electronic course offerings coming from the university have not been coded to support adaptive technologies (like screen readers, Braille display, enhanced print size, voice-over, sip and puff control, etc.). The end result is an unfair imbalance in academic access.

Conformance with the **World Wide Web Consortium**'s (W3C, an international organization for developing Web standards) and its **Web Content Accessibility Guidelines** 1.0 will enhance the market share and audience reach of programs by increasing their general **usability**. Adoption of WCAG 1.0 recommendations also demonstrates a commitment to social responsibility and equity of access to education, information and services.

These changes do not have to be substantial to be successful. Web accessibility is usually achieved by careful planning and attention to details. This all trans-

lates into **Universal Design for Learning** (UDL), a practice of designing web pages so that they can be navigated and read by everyone, regardless of location, experience, or the type of computer and technology used, In addition, it means providing educational material with flexible goals, instructional and assessments strategies that apply to different learning styles and practices. We will talk more about Universal Design later in this chapter.

Having an increased number of life-long learners, as well as those who are returning to school for their professional development or upgrade, removing barriers to web access becomes even more pressing.

## LEGISLATION

In the United States, a law called Section 508 requires federal agencies to ensure that people with disabilities have the same access to information in electronic systems as people without disabilities.

> "Section 508 requires that when Federal agencies develop, procure, maintain, or use electronic and information technology, Federal employees with disabilities have access to and use of information and data that is comparable to the access and use by Federal employees who are not individuals with disabilities, unless an undue burden would be imposed on the agency. Section 508 also requires that individuals with disabilities, who are members of the public seeking information or services from a Federal agency, have access to and use of information and data that is comparable to that provided to the public who are not individuals with disabilities, unless an undue burden would be imposed on the agency" (Section 508, 2006, Subpart A—General, para. 1).

In the United Kingdom, there is a similar law known as SENDA (Special Educational Needs and Disabilities Act) that applies specifically to students.

Canada has no such law at the moment, but the Canadian Human Rights Act and the Charter of Rights and Freedoms both deal with discrimination on the basis of many factors, including disability. A failure to provide information in an accessible manner could be considered discrimination if no reasonable attempt is made to accommodate the disabled person.

The Human Rights and Equal Opportunity Commission (HREOC) in Australia published World Wide Web Access: Disability Discrimination Act Advisory Notes, All government websites are required to follow these policies and guidelines.

Around the world, accessibility and information access issues are being addressed at different levels. The Report on Developments World-Wide on National Information Policy (2001) gives a nice overview of what a number of countries are doing to support all online users, including those with special needs.

## BACKGROUND

The term "disability" is very broad, and can include persons with sensory impairments (blind or visually impaired, deaf or hard of hearing), learning disabilities, motor functioning problems, or neurological impairments. The number and severity of challenges increases with the age of the population served—especially in the area of sensory impairment. For example, while the Canadian Federal government reports that the overall disability rate in the total population is about 12.4 percent—for persons between the age of 65 and 74 it increases to 31.2 percent (Statistics Canada, 2001, para. 2).

The main goal is to improve usability and to provide online learners with disabilities, who were academically qualified, with full, fair and equal access to all university services, and programs. It means either redesigning the existing electronic content or developing a new one with accessibility in mind. Usually, you need to do both.

The first step is to carefully look at the courses or modules and determine their level of accessibility. Consultation and collaboration with users, advocacy groups, other university and government agencies, and various experts is very helpful. In the case of the project described here, all the procedures were tested by making adaptations and necessary changes inside WebCT. During this process, it is important that the work does not entail any modification of the academic standards of the university or elimination of the academic evaluation of students.

Making online courses accessible to students with disabilities, i.e., providing easy and consistent navigation structure, and presenting the material in a clear and organized way brings benefit to all students, regardless of their physical and mental condition. Every student is different; everyone has different levels of comfort with new technology, from computer-shy technophobe to web-savvy expert. We are all in the process of adaptation to new tools: in a survey conducted at Renton Technical College in Renton, Washington, in 2002, the highest number of participants (31 percent) reported difficulties in studying and troubles with computers (Microsoft, 2005). It will take a lot of time for computers or similar devices to become as invisible and user-friendly as books, for example. Universal design for learning attempts to reach that "easiness" by improving usability for non-disabled and

disabled users alike. It supports persons with low literacy levels, improves search engine listings and resource discovery, repurposes content for multiple formats or devices, increases support for internationalization of courses and assists access for low-bandwidth users.

An inaccessible site in a corporate world may mean a loss of clientele. In an educational setting, the quality of a learning experience is much more difficult to measure, since it is not only a matter of numbers and physical access. With this awareness, content should be presented in a variety of ways in order to meet the online learners' needs. Material that is inaccessible to a student with one type of disability can be offered in an alternative format. It is important to realize, however, that not everything can be made accessible without compromising the value of the learning experience. Teaching visual concepts and explaining different colour schemes, for example, is not fully adaptable for students who are blind. The materials should be made as accessible as possible for most groups of disabled students, but some people ultimately may still be excluded. In those cases, you will need to offer alternative exercises for the affected student, although the production of such materials can be time consuming. The choice of different delivery methods can exist, but only "in ideal world" (Draffan & Rainger, 2006).

Every effort made to increase accessibility will help to disseminate information on accessibility issues and provide a basis for raising awareness not only in British Columbia, where this project was conducted, but in wider academic communities as well.

### ACCESSIBILITY AT UNIVERSITIES IN BRITISH COLUMBIA

It is the policy of UBC (and it is similarly stated in virtually every other university policy in North America and Western Europe) that "the University is committed to providing access for students with disabilities while maintaining academic standards" (UBC Student Services, 2006, para. 1). This is in keeping with UBC policy that recognizes its moral and legal duties to provide academic accommodation. The University must remove barriers and provide opportunities to students with a disability, enabling them to access University services, programs and facilities and to be welcome as participating members of the University community. The Policy goes on to note that such accommodation is in accordance with the B.C. Human Rights Code, the Canadian Charter of Rights and Freedoms and US federal law. Universities have worked hard to write and implement policy that improves access to campus buildings, ensures the health and safety of those with disabilities, and which provides appropriate supplementary support in the facilitation of learning.

The External Programs and Learning Technologies office (EPLT) (http://www.eplt.educ.ubc.ca/) acts as the facilitator for all off-campus Faculty of Education programs, both domestic and international at the University of British Columbia, Vancouver, Canada. EPLT seeks to use innovative, efficient and effective delivery vehicles that are first and foremost designed to meet the diverse needs of learners. Furthermore, it provides them with access to the highest quality programs possible by making Web content accessible to a variety of Web-enabled devices, such as phones, handheld devices, kiosks and network appliances.

The second largest university in British Columbia, Simon Fraser University has a Centre for Students with Disabilities (CSD), which primarily offers services to students on campus, similar to UBC's Access and Diversity—Disability Resource Centre (http://www.students.ubc.ca/access.drc.cmf).

## Universal design

The first six sections of this chapter discuss how to address accessibility issues for an online environment, along with resources, activities, and assessments, used with face-to-face coursework or a fully online course. If you are just starting out, then you can address these issues and numerous others from the beginning by using **Universal Design for Learning** (UDL) principles. UDL builds upon universal design concepts from other fields, such as architecture and urban planning, and applies them to learning situations.

The "curb cut" is a common urban planning example used to demonstrate the fundamental idea of UDL. Since the Americans with Disabilities Act of 1990, curb cuts—ramps extending from the street up to the sidewalk—must be present on sidewalks. Curb cuts allow people who use wheelchairs or who have low mobility to go from sidewalk to street and back again more easily. However, to add a curb cut to an existing sidewalk requires a jackhammer and a lot of extra work. Making a sidewalk that was designed with a curb cut from the beginning is much easier. Coming back to UDL, it is often easier to accommodate different learning needs by designing the course with those needs in mind.

As we will see with accessibility solutions for online learning, the curb cut accommodates everyone, not just the original intended audience. Parents with strollers, children walking their bicycles, skateboarders, and more

benefit from curb cuts just as much as people in wheelchairs. Along the same lines, the Center for Applied Special Technology (CAST) refers to UDL as "Teaching Every Student," stating that Universal Design for Learning "calls for

- multiple means of representation to give learners various ways of acquiring information and knowledge,
- multiple means of expression to provide learners alternatives for demonstrating what they know, and
- multiple means of engagement to tap into learners' interests, challenge them appropriately, and motivate them to learn." (http://www.cast.org/research/udl/index.html)

Almost every online accessibility accommodation strategy designed for students with disabilities also helps additional students. For example, English language learners (ESL students) frequently use screen readers that were originally created for people who are blind or who have visual impairments. They benefit from hearing the text spoken out loud as they read a passage of text. Overall, UDL assists students with disabilities, certainly, but also assists students who are non-native language speakers, students with different learning styles, students with different levels of Internet connectivity and access to technology, and even students who require more assistance with self-motivation. Let's take a look at different ways to apply Universal Design for Learning to your online course.

## MULTIPLE MEANS OF REPRESENTATION

You probably remember teachers whom you felt gave you everything you needed to succeed when you were a student. These teachers provided handouts in the classroom, links to resources on the Internet, copies of their presentations, and more. You may also remember teachers who did not provide many resources. The resources they did provide may have been text-only documents or handouts that helped a select few students in the class. Perhaps they made one copy of an important set of materials for checkout, requiring you to wait until someone else turned it in before you could review it. This section will give you ideas about ways in which you and, in some cases, your students can provide alternative course materials and resources that increase the number of students who succeed in reaching the objectives.

### Sensory input

First, we need to consider the different ways that people get information into their heads and the types of resources that students prefer. Later, we will discuss ways to help students encode and retain any knowledge or skills that they need to succeed in your class or beyond.

Visual-verbal, or text-based resources, help learners who prefer to read. These are usually the most common type of online learning resource, ranging from documents and presentations to web pages. However, text-based resources must be made accessible to people with visual impairments, such as using Optical Character Recognition (OCR) to convert scanned documents to text.

Saving text-based files or documents in various formats also impacts how many people can use them. Consider which technologies your students can access at home, school, or work. Some instructors conduct a short survey at the beginning of a school term to see which software applications students use. Then they save their files in the most common format for that class. Others will save their course documents and text-based class assignments in multiple formats. such as accessible Portable Document Format (PDF) files, Rich Text Format (RTF) files, Hypertext Markup Language (HTML) files, and Microsoft Word (DOC) files. Still others choose a standard format for the class and inform the students that they will need certain software to read, edit, or save course documents.

Each document format listed above has its limitations, so choosing them may depend on what you want to accomplish.

- Any student can open PDF files with a free application called Adobe Reader, available for download at the Adobe website. If you choose this format, you should also provide your students with a link to the download page. However, if students are required to edit the document or to provide feedback on it, then they will require a different application, Adobe Acrobat, that is not free.
- Almost any word processing application can open RTF files, but saving as an RTF file may remove certain types of advanced formatting. Apart from this limitation, this format provides a great deal of flexibility with the types of tasks accomplished through the documents.
- Students with access to a web browser can open HTML files. If you want students to work on an HTML document, though, they will need a web-based HTML editor, an HTML editing application, or a simple text editor combined with knowledge of HTML code.
- Microsoft Word, or DOC, files offer additional options, such as a feature called tracking that allows students to see feedback and suggested changes.

> Many people have a copy of Microsoft Word, but it is not universal. Student bookstores and some computer stores carry discounted educational licenses. If you are going to require students to use Microsoft Word, let them know of any labs at your school or university that make it available to those who cannot afford it.

Other text-based file types, such as spreadsheets, provide fewer options. The most common spreadsheet format is a Microsoft Excel (XLS) file. All spreadsheet applications should be able to save files as a Comma Separated Values (CSV) file. However, this would strip out any formulas or calculations that you or the students use.

Looking at ways to spread out your workload over time, you can start with the first strategy, or saving files in one or two of the most common formats for your class, and work your way to the second strategy, or saving files in multiple formats, over time. This does not have to be done in a day, but to achieve Universal Design for Learning it is important to consider these strategies from the beginning. The concept is not to try to accommodate all students with one strategy, but to provide alternatives. The key is to let your students know which formats you will use and provide them with avenues to get what they need to read and use the text-based resources.

Visual-nonverbal, or graphic-based resources, assist learners who prefer graphic-based visual resources, such as images, charts, graphs, flow charts, animations, or videos. Many software applications and some websites allow you to embed charts and graphs within the file itself. You can easily insert images in Microsoft Word. Microsoft Excel allows you and students to create different types of graphs from the data tables. If you use a complex image, such as a political map or a diagram of the digestive system, you must still provide a text-based description for students who use screen readers.

You can use different applications, such as Inspiration, to create stand-alone flow charts or concept maps. If you want young students to be able to interact with this type of file or to create their own, there is a version called Kidspiration as well. See the Inspiration website (http://inspiration.com) for more details. By pushing one button, students can convert Inspiration flow chart or brainstorm files to text-based outlines. This helps students with screen readers as well as visual-verbal learners who prefer the text. Other applications like Inspiration include Microsoft Visio, a free application called SmartDraw, and others. For specialized applications, such as engineering, there are even more. Let your students know if they will need to download or buy any additional software for your course, and work with lab managers to install it at your school or campus if budget permits.

Auditory resources provide alternatives to learners who prefer to hear the information, rather than read it. Screen reader software and text-to-speech applications can be used by many students, not just those students with vision impairments. Schools and universities have different ratios or formulas for how many computer lab stations must have this type of software to accommodate special needs. These ratios usually range from one in twelve to one in twenty computers per lab environment.

In addition, there are other avenues to provide auditory resources to students. For decades, students have placed their tape recorders at the front of the classroom to capture what the instructor says for playback later. These days, the instructor can record him or herself and post the audio file online for all students. As with the other file types, it is important that the students can play and use the files you create. Common audio file formats include the Wave (WAV) file created by Microsoft, the Audio Interchange File Format (AIFF) created by Apple, and the Moving Picture Experts Group's Audio Layer-3 (MP3) file.

A recent, popular trend for creating and distributing MP3 audio files is called "podcasting." Different aspects of podcasts and the process of creating and distributing them are described in Chapters 21, Media Selection, and 26, Techno Expression. For our purposes here, it is important to note that you should provide a transcript for any audio files.

Video files also provide appropriate stimuli to auditory learners. Chapter 21, Media Selection, discusses when it is or is not legal to use clips of copyrighted videos as course related resources. One important factor from a UDL standpoint is that streaming video files are often easier for all students to use than downloadable video files. Despite the progress related to high-speed connectivity, not every student has a Digital Subscriber Line (DSL) or equivalent connection at their home, school, or workplace. For students using a dial-up modem, large video files present a very frustrating challenge. Many times the student will spend hours trying to download a large file with no success and will give up. For purposes of accessibility, caption the video or provide a transcript with timecode references to scene changes or other important points.

Tactile/Kinesthetic resources create opportunities for learners who prefer to learn by doing. Resources that accommodate tactile/kinesthetic learners can take different forms. First, you can find or create interactive resources, such as CD-ROMs, websites, or Flash animations, and require the student to follow a linear or non-

linear path through course-specific material. If you do not have time or know how to make these yourself, then you can search a variety of online clearinghouses and repositories for appropriate learning resources. The Multimedia Educational Resource for Learning and Online Teaching, or MERLOT (http://www.merlot.org), is a free website containing thousands of learning resources in the fields of Art, Business, Education, Humanities, Math and Statistics, Science and Technology, and Social Sciences. MERLOT is primarily for higher education instructors, but some materials would be appropriate for secondary school students as well.

Next, you can ask the students to create the resource. In the online environment, this can be as simple as requiring all students to build a glossary of terms for a chapter or topic. You can ask them to send their terms by email, to post them to a threaded discussion, or to post them using a glossary tool that comes with a Learning Management System like Moodle. Other types of student-created resources include databases or spreadsheets containing results of experiments, student or class websites, and student videos.

Finally, more advanced resources act as a framework for student activity, described below. For example, a WebQuest (see http://www.webquest.org) is a web-based research activity that you can find or create for student group work. While most WebQuests are for K–12 students, it is not difficult to create one appropriate for college or university students. The WebQuest is highly interactive and collaborative, making it an ideal online resource for tactile/kinesthetic learners.

Keep in mind that not every resource for students must be stored in the online environment. Some of the most interesting and meaningful lessons require students to interact with the world and then to come back and reflect or report on what they learned. For all types of learners, this increases the number of possible resources to global proportions … literally! Structured activities might involve students performing lab experiments and then completing online lab notebooks; collecting scientific data and then entering it into a communal online database; observing master teachers at a school and then writing a reflective weblog entry; or interviewing an expert and then posting the text, audio, or video file.

Combining strategies means that you can accommodate greater numbers of learning preferences with one resource or activity. For instance, if you use an Excel spreadsheet to demonstrate how increasing and decreasing budgets affected the North and the South in the US Civil War, you can require the students to fill in the annual budget numbers themselves and then to create a graph. This strategy accommodates visual-verbal (text-based) learners, visual-nonverbal (graphic-based) learners and tactile/kinesthetic learners.

### Perception

**Sensory learners** prefer fact-based activities and resources. These resources are easier to provide, as most disciplines from the humanities to the sciences have some facts or details related to the topics within. The easiest resources to provide might be references to the textbook, or links to related websites. More in-depth resources could include optional readings, such as advanced articles that apply the concepts discussed in class.

**Intuitive learners** like reflective activities and resources that require imagination. If you have a topic that requires students to memorize facts to lay a foundation for later application, provide additional, optional resources that introduce the theories related to the facts. You can also encourage students to seek their own connections between theory and facts using an optional activity, such as a discussion forum devoted to a discovery learning approach.

### Organization

**Inductive learners** prefer beginning with meaningful examples before extrapolating the main concepts or theories. In the online environment, you can accommodate inductive learners in both passive and active ways. You can provide a number of examples in a recorded lecturette before describing the concept that they exemplify. In a more active learning activity, you can provide a number of examples and require the students to create a generalization from them by defining patterns. The Biology Success! Project (see the Final Resources section for details) encourages instructors to consider that while inductive activities have been proven to help students with learning disabilities, "it is essential that the instructor create clear guidelines for behavior, provide explicit directions from the outset of the activity, and be prepared to offer extra guidance as necessary."

**Deductive learners** prefer starting with more structure, deriving consequences and applications from the concepts and theories. These learners benefit from demonstrations and opportunities to practise what they have learned. Online "lab" experiences can further strengthen or confirm the learning by deductive learners.

To accommodate both inductive and deductive learners, you can provide case studies, results from previous experiments, and other inductive examples alongside descriptions of the general concepts and theories for the deductive learners. You can assign both in whichever order the students prefer, or alternate the order for

different assignments whenever applicable. Another method to accommodate both types of learners is a "structured inquiry" exercise. Whichever approach and activity you choose, remember to be clear about what is expected or what students should do. Identifying the instructor's expectations is not a discovery learning exercise!

### Processing

Active learners enjoy learning by applying knowledge or by working with others. Providing areas where students can interact online, such as instant message (IM) environments, discussion forums, or wikis, will give these students a way to do this. Learning Management Systems usually contain several of these tools for interaction. These tools can be used to create both general course spaces for interaction—related to coursework only, of course—and specific spaces for particular topics or assignments. It is important to create clear instructions and expectations for each interaction space, so students know its purpose and whether or not participation is required.

Make sure that you test the true accessibility of any technology-based areas for interaction. While many companies state that their web-based tools are accessible or compliant, their products are sometimes difficult to use for students using adaptive technologies. You might want to work with a disability resource centre to do some preliminary testing. Further, interaction tools that use Java-based applets or plug-ins do not work with some older browsers, excluding a different group of your students—those with limited technology or limited access to technology.

Reflective learners prefer to ponder the concepts or topic before engaging with it. If you often use small groups in your course, provide opportunities for individual assignments, even if it is just a precursor to the upcoming group work.

People often see themselves as both active and reflective learners, just as they might consider themselves both sensory and intuitive. Therefore, you can try to accommodate both types of learners by mixing up the types of activities. An active learner might prefer the immediacy of a chat. A reflective learner might prefer the asynchronous nature of a discussion forum, as it allows him or her to think about what they want to write before actually committing the words to print.

### Understanding

Global learners prefer to see the "big picture" first. Therefore, you can help these students by providing resources that summarize a concept before going into details. One of the simplest examples entails creating a table of contents for a presentation that you post online. If you are creating an audio file, take some time to give a brief introduction to the lecturette or presentation before diving into the first section.

Sequential learners prefer a step-by-step approach, understanding each piece before seeing how it fits in a larger context. One way that you can help sequential learners involves referring to a numbered outline so students can keep track of where you are. Be sure to review flow charts, presentations, and other resources to make sure that you have not skipped or glossed over any steps. If creating audio readings, avoid jumping around from topic to topic. Instead, follow the outline that students will use to keep track of their place.

A common piece of advice for people delivering a presentation for the first time is "Summarize what you are going to say, say it, and then summarize what you said." This advice accommodates both global and sequential learners.

### Preparing students to use multiple means of representation

If students are not prepared to use the variety of content choices you provide, then all your work could be wasted. Let them know how important it is for them to understand the concepts of learning preferences and learning needs, how to determine what their preferences and needs are, and how to adopt strategies that accommodate them. Many instructors ask their students to complete a learning styles survey. This idea is described in more detail below. We can include the learning needs of students with disabilities in this same set of activities. Students with various disabilities also may not know what strategies will benefit them in the online environment. Encourage them to explore how they can succeed in the online components of your course, either on their own or with the help of a disability resource centre.

## MULTIPLE MEANS OF EXPRESSION

When we think about asking students to demonstrate what they know, we usually think that each student will take the same test, complete the same essay assignment, or perform the same skill(s). It is not too strange, though, to think that students could use different methods to show that they know the same concept. After all, instructors often ask students to choose one of several essay questions to demonstrate understanding of a major topic. These days, instructors are asking students to submit portfolio pieces, sometimes called "assets" or "artifacts," to show particular competencies. In this process, they may even let the students choose what type of

asset they would prefer to submit or how to best show their knowledge or skills. This last idea exemplifies the principle of "multiple means of expression."

## Individuals

When asking individual students to demonstrate knowledge, skills, and/or attitudes using online mechanisms, it is important to determine to what degree of difficulty you are asking the students to achieve the objectives. There are numerous websites that list the different levels of difficulty related to the three learning domains: Cognitive (knowledge), Psychomotor (skills), and Affective (attitudes) (see description of learning domains and degrees of difficulty http://www.nwlink.com/~donclark/hrd/bloom.html). Once you determine what you want students to do, then you can determine how they will demonstrate it. This book contains more information about student activity (Chapter 20, Instructional Strategies) and assessment (Chapter 14, Assessment and Evaluation).

The first step is to identify alternatives that are equivalent. Taking a multiple choice test does not usually demonstrate the same level of proficiency as writing an essay or performing a task in front of a video camera for evaluation later. Therefore, take a close look at the learning objectives, and then make a list of different ways that students could achieve those objectives. Consider the following example objective, "Students will translate Hamlet's famous 'to be or not to be' soliloquy into modern English (with or without slang)." Equivalent online assessment alternatives might include writing a translation in a discussion forum, posting a translation as an attachment, making an online presentation using Skype or other synchronous conference tool, making and posting an audio recording of the student reading their translation, or making and posting a video presentation. The same evaluation guidelines or rubric could be used to evaluate each one. Hypothetically, then, students could choose how they want to show their ability to translate the soliloquy. This accommodates students with disabilities as well as students with different learning preferences. It also creates an avenue to engage students at a higher level, which is described in depth below.

Of course, you will find that certain alternatives may be less equitable. For example, technologies like video cameras and video editing software could be equally difficult to use due to limited access, unequal proficiency levels, or physical disabilities. This does not mean that you have to immediately remove it from the list of options. However, it might require that you identify a lab that checks out cameras to students and that has computers with video editing applications. Another option might be to have students work in small groups, so they can give each other feedback, share technology resources, and help each other with the technology skills that are not part of your course objectives. For an assessment strategy to be universally accessible, students must be able to attempt each alternative, so you may need to limit the options to those that you know all students can try if they wish.

Even within a standardized test format, there may be ways to offer options to students. In a face-to-face environment there are ways to accommodate different needs without giving test answers to the student. For example, on a test requiring students to identify the different bones in the skull, the instructor can provide a three-dimensional model of a skull for a blind student to use instead of a flat image (see Figure 11.1 below). The same option is possible for an online test, but it would still require the student to have the model skull at an online testing location.

*2-dimensional skull diagram*

*3-dimensional skull model*

*Figure 11.1 Test format options*

As stated earlier in this section, activities that involve specialized software or online environments should be tested for accessibility and assessed related to how many students have access to the software or environment itself. However, many of the tools go beyond the simple process of creating and automatically grading test questions. Learning Management Systems (described in Chapter 7, Learning Management Systems) offer a variety of testing options, such as creating separate versions of a timed test to accommodate students who need extra time for exams. The Biology Success! Teaching Diverse

Learners project (n.d.) gives us "Key Principles of Assessment as Applied to Students with Learning Disabilities" that we can use in the online environment, too:

- Make clear all assessment criteria
- Make assessments frequent
- Allow for ongoing revision of student work
- Use varied and alternative assessments
- [Provide opportunities for student] self-assessment

### Groups

Group work in the online environment provides some real challenges and some tangible benefits. It is sometimes hard to keep track of which student has contributed to the team effort, but students will all gain team-related experience that will help them in research and work environments. One strategy to determine each group member's contributions is to have each student first perform each group task individually. Then each group member can share his or her work online, using a discussion forum, wiki, or other collaboration tool, to combine the best efforts from the team as a whole. Another strategy involves assigning specific roles to each group member. Most WebQuest exercises (briefly described above) require students to take a role and complete tasks accordingly. Then each student's work can be assessed individually, in addition to assessing the level of team or group success.

### Entire class

The whole class can construct knowledge together in various ways. It is difficult to give the entire class multiple, simultaneous avenues to show it can achieve a certain goal. However, you can construct assignments and activities over the course of the term that gives the class different ways to achieve the desired goals. One way to do this is to assign small groups to make presentations about each week's content. As you go through a term, the entire class has an opportunity to add to a growing knowledge base of course-related material.

## MULTIPLE MEANS OF ENGAGEMENT

Just as students have different learning preferences and different learning needs, they have different motivations, and levels of motivation, to be successful learners. A certain number of students may be the first member of their family to attend college, so they want to do well. Some may want to achieve financial independence, so they put in extra effort to have high level skills and high quality products to show potential employers. Others may just have a passion for the discipline or specific course content. The UDL principle, "multiple means of engagement," tells us that we should find out what motivates our students and to challenge them to use those motivations to be successful online learners.

### Involve students in the process

To whatever extent you feel comfortable, involve the students in the process of preparing and conducting the online portion of your course or your fully online course. Just as the chemistry of each face-to-face class is different—sometimes the group is energetic or rambunctious, sometimes the group is quiet and difficult to motivate—each online cohort is different. After defining the course objectives, provide a forum for the students to state their expectations. Most times, you will find that the student expectations are very similar to your objectives, but with a different focus, such as applying the knowledge to get a job or using skills from the course to create a portfolio demonstrating their abilities. Using your syllabus, an opening statement, or other strategy, encourage students with special needs to tell you what strategies they have found helpful for their success in past experiences with online coursework. They may already have accessibility or even UDL solutions that could save you countless hours of research.

Another way to engage students is to involve them in their own learning. In the Multiple Means of Representation subsection above, we cover different ways to accommodate learning styles, learning preferences, learning needs, and so on. However, as an instructor, there is only so much you can do before the student must take responsibility for him or herself. Ask your students to take an Index of Learning Styles (ILS) questionnaire, such as the one created by Richard Felder and Barbara Solomon of North Carolina State University (listed in the Final Resources section) Then have the students report what they find about themselves and identify strategies that they will use to improve their own learning. Sometimes the questionnaire results do not match how we see ourselves. That is okay. Just let your students know that this exercise is to make them aware of different learning possibilities. They should try strategies that accommodate their perceived learning styles as well as the ones that the questionnaire results identify for them.

### Determine what students find meaningful

To keep students motivated to work in the online environment, they will need to find the objectives, topics, resources, and activities meaningful. An instructor-led approach could range from "This material is a prerequisite to other courses in this program" to "These skills will help you get jobs in this field." A student-led ap-

proach could range from "This is how these theories apply to real-world events" to "Some of you will find this really cool!" Both approaches have their merits, so use them together. To determine what real-world events interest students, or to find what they feel is really cool, talk to some of the students before the term gets rolling, or ask the class to send you one idea of each.

### Ask for feedback

In Chapter 24, Evaluating and Improving Online Teaching Effectiveness, we cover a number of ways to get feedback from students. Using those strategies, you can include questions about motivation or engagement to learn how well you are doing to get students more involved in their learning success. Go over the results with the class to come up with additional ideas or inspirations.

## BRINGING IT ALL TOGETHER

Looking at some of the concepts and suggestions in this section, you might be asking yourself, "This is helpful, but what does this have to do with accessibility?" For this book, remember that the term "accessibility" refers to the extent to which it is possible for all students to succeed in our collective online course environments.

# About Web accessibility

## WHAT MAKES A SITE ACCESSIBLE?

Accessibility is about making sure *all the information* on your website is available to *all users*, regardless of any disability they may have or special technology they may be using.

> "Accessibility involves making allowances for characteristics a person cannot readily change"'. (Building Accessible Website, Joe Clark)

## WHY BOTHER?

### Fairness and equality

The simplest and most direct answer to this is that if your site is inaccessible to users with disabilities, you are excluding a section of the population from your content. If your students cannot access the course materials, they could be placed at a distinct disadvantage and their coursework could suffer as a result.

### Accessibility benefits usability

Many site designers and developers drag their feet and grumble when asked to make their site accessible. There is a mistaken perception that "accessibility" means "dumbing down" the site—that they won't be allowed to use any graphics or any multimedia. Frequently, websites address accessibility by making a plain, text-only version of every page and labelling it "accessible". This does no one any favours—it requires the webmaster to maintain twice the number of pages, and provides an inelegant solution that lumps all disabled users into the same category.

The reality is that accessibility is a way of enhancing your web page, and it can be done seamlessly without taking away from the design. Many accessibility recommendations and guidelines actually improve the integrity of your code and the overall usability of your interface. Usability is, simply put, how easy it is for people to use your site.

*Anything you can do to improve accessibility can also improve usability for people* without *disabilities, for online courses or any other kind of website.* Consider these examples:

- you have made the menus consistent on every page—now everybody has an easier time finding their way around your site, because the buttons are always in the same place;
- you have made sure your font size can be adjusted—now older readers with poor vision can increase the size of the text to see it better;
- you have set a unique page title for each page—now search engines can more accurately display your pages in their search results;
- you have added a text description for each image—now someone browsing with images turned off can tell if they are missing an important diagram;
- you have added captioning to a video—now a student using a computer in a public lab can watch it too without needing sound;
- you haveadded an audio reading of an important passage—now a student who learns better aurally can enjoy the reading as well.

### Legal reasons

As we have already discussed, many institutions are obligated to provide accessible content according to national laws.

## ACCESSIBILITY STANDARDS

There is a set of guidelines developed by the World Wide Web Consortium (W3C), a group that establishes specifications, guidelines, software and tools for various aspects of the Web, including file formats and scripting languages. One W3C program is the **Web Accessibility Initiative** (WAI), whose mission is to help make the Web accessible to people with disabilities. The WAI has developed the Web Content Accessibility Guidelines (WCAG) to address the accessibility of information in a website. These guidelines are what we will be using in this chapter, and should always be consulted if you are ever in any doubt of the best technique or the correct syntax of a tag. They are fairly technical, and not a quick read. However, two simplified versions of these guidelines organized by concept do exist as Appendices of WCAG 1.0 (1999a and 1999b), both as a checklist table and as a list of checkpoints. At the time of writing, the current version of the guidelines is WCAG 1.0, and WCAG 2.0 is under review.

These guidelines, relevant to online content developers, help to ensure that Web resources are accessible. However, there is a need to recognize the limitations of these guidelines as well as the available checking tools (Ivory & Chevalier, 2002). Kelly and Sloan (2005) talk about the difficulties of implementing the guidelines, summarizing the concerns in regards to ambiguity, complexity, logical flaws and the level of understanding required to implement them.

Despite the difficulties with the guidelines' implementation and reliability, and the necessity of manual checking for accessibility, WCAG are very helpful in the initial stage of developing an online resource, as a quick checklist of obvious things that need fixing. The guidelines should not be taken as the only set of criteria that needs to be considered. A wider set of issues must be addressed, some of which could be in conflict with the guidelines.

## PRIORITY AND LEVELS OF CONFORMANCE

Each checkpoint has a *priority level* assigned by the working group based on the checkpoint's impact on accessibility.

- **Priority 1**: A Web content developer *must* satisfy this checkpoint. Otherwise, one or more groups will find it impossible to access information in the document. Satisfying this checkpoint is a basic requirement for some groups to be able to use Web documents.
- **Priority 2**: A Web content developer *should* satisfy this checkpoint. Otherwise, one or more groups will find it difficult to access information in the document. Satisfying this checkpoint will remove significant barriers to accessing Web documents.
- **Priority 3**: A Web content developer *may* address this checkpoint. Otherwise, one or more groups will find it somewhat difficult to access information in the document. Satisfying this checkpoint will improve access to Web documents.

Depending on which priority checkpoints a site meets, it can claim to meet a particular *level of conformance*.

- **Conformance Level "A":** all Priority 1 checkpoints are satisfied.
- **Conformance Level "Double-A":** all Priority 1 and 2 checkpoints are satisfied.
- **Conformance Level "Triple-A":** all Priority 1, 2, and 3 checkpoints are satisfied.

## TESTING FOR ACCESSIBILITY

There are a number of tools available to help you check some of the more technical aspects of your website to see if it meets accessibility standards. One of these is WebXact Watchfire (http://webxact.watchfire.com/), previously known as Bobby. It is a very handy tool for double-checking that all your images have **alt text**, or that your data tables are properly labelled.

But these tools are not the whole picture. An accessibility analyzer like Watchfire cannot tell you if the descriptions of your images make sense to a blind user, or if your page titles are meaningful. Your website needs to be considered from a human perspective, and many of the WAI guidelines ask you to examine the context and meaning of your content more carefully.

# Students with disabilities

## WHO IS AFFECTED?

When we talk about making the Web accessible for people with disabilities, who are the people we are talking about? Before we can learn what to do with our web pages, we need to understand what we are doing and who we are doing it for.

**Tip: Simulations**

To help you understand what web navigation is like for people with disabilities, some organizations have developed simulations:

- Inaccessible website demonstration—http://www.drc.gov.uk/newsroom/website1.asp
- WebAIM simulations—http://www.webaim.org/simulations/

## SIGHT

The first group that most people think of when considering accessibility for the Web is the blind and visually impaired.

**Blind**: Users have little or no usable vision. While a few users may use Braille, the majority use a **screen reader**—software that reads text out loud. Some people listen to the Web at speeds that sighted users find completely incomprehensible—the audio equivalent of "skimming" a page. Keep in mind that screen readers read everything that they encounter, and that they read it in the order they find it. In some cases, users with screen readers encounter online multimedia elements that start playing without warning. They must contend with two audio sources at the same time: the screen reader reading the web page text and the multimedia audio.

**Visually impaired**: Users may have some sight, but difficulty focusing or distinguishing small text. They may use a **screen magnifier**—software that enlarges everything on the screen to a more manageable size.

**Colour blind**: Most colour blindness involves difficulties distinguishing red and green. A smaller percentage of people have difficulties with the blue-purple portion of the colour spectrum. Still others are completely colour blind. There is a misconception that accessibility means using only black and white text, and that colour should be avoided. This is not true. The point is not to rely on the requirement of colour perception to reveal information. For example: asking readers (or learners) to "use only words in red to compose a paragraph", or telling readers while filling in the form, that only "blue" fields are required.

As we will find, making the Web's highly visual content accessible is not as daunting a task as it might seem. There are methods in place for providing alternatives for nearly every type of web content, and for making sure your content works well with the specialized hardware and software used.

**Tip**

- Ever wondered what the world looks like to colour-blind people? Test out Vischeck, a colour-blindness simulator, on your site or any image. http://www.vischeck.com
- WebAIM simulations—http://www.webaim.org/simulations/

## HEARING

Since the majority of content on the Web is visual, students who are deaf or hard-of-hearing are not as likely to be affected. However, they often have communication and comprehension difficulties. If audio files or videos are a part of the curriculum, a text alternative should be provided. Many users will also benefit from easily understandable icons and clear terminology.

Ideally, videos should be **captioned**. Professional captioning can be costly, though for course materials requiring extremely high accuracy (such as math and physics equations), it may be the best choice. Software is also available to allow you to include captions in your videos yourself. If captioning is simply not an option, a text **transcript** of the video would be a reasonable alternative.

**Tip**

Hearing people might assume that hard-of-hearing or deaf students would be reluctant to watch a video clip. But on the contrary, many find video and multimedia material entertaining and especially valuable because of all the other non-verbal communication that they convey. Samuel, a hard-of-hearing ESL student in our focus group, greatly preferred videos or webcam interactions to text so that he could see the emotions and gestures of the other person. For students who can lip-read, video is still helpful if the speaker's face is clearly visible at all times.

## MOBILITY

Students with physical disabilities may be affected if their impairment hinders their ability to use a mouse or keyboard. This could be due to having little or no muscle control, nerve damage, or trembling; it could be a temporary problem, a lifelong condition, or the result of aging. Fine motor movements can pose a challenge, such as clicking on a very small icon.

Some users with mobility impairments will use a typical keyboard or mouse, but may take more time to perform tasks. Others use assistive input devices instead or in addition to a keyboard or mouse.

- A standard **trackball** is often easier to control than a mouse. Some students use a standard **graphics tablet** since touching locations directly with a pen is easier for him than sliding a mouse.
- **Alternative keyboards** allow users to position their hands more comfortably, or to press keys more accurately.
- For people who cannot use their hands at all, **head-tracking** allows the user to control the pointer through head movements. Mouse clicks can be replaced with a breath-controlled **sip/puff switch** or tappable **headswitch**.

## LEARNING AND COGNITIVE

While visual, hearing and physical disabilities are the most familiar forms of disability, the majority of students you may encounter who have a registered disability may in fact be learning disabled. **Learning disability** or "learning difficulty" is a broad term that includes dyslexia, brain injury, and aphasia.

> "Dyslexia is the most commonly registered disability within the University and always features in the most commonly asked questions on accessibility issues by staff." (Jeffels & Marston, 2003)

Students affected by learning disabilities may encounter difficulties with some of the following activities, among others:

- spelling
- reading aloud; stuttering
- mathematical calculations
- comprehension of large passages of text
- effective time management or organization
- rote memorization
- concentration and focus

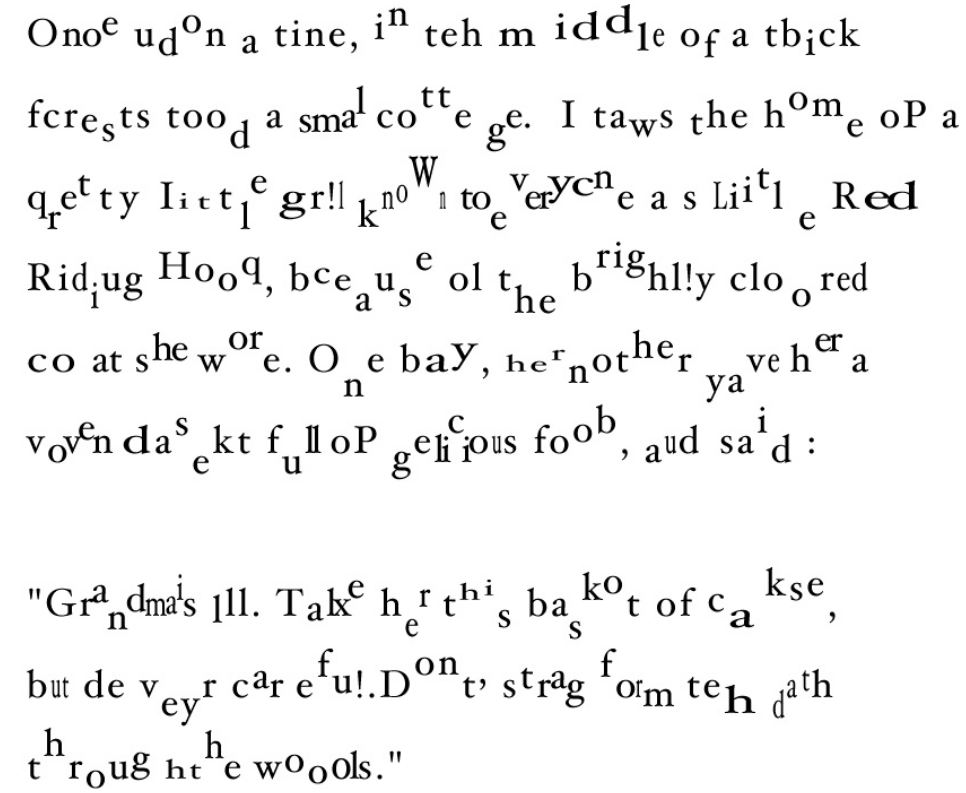



*Figure 11.2 Dancing letters*

Try to read the passage in Figure 11.2. It may give you an idea of the difficulty and frustration experienced by many dyslexic readers, as seemingly normal text requires extra effort and concentration to parse.

Learning and cognitive disabilities are a challenging group to address, as there is no one approach that will suit everyone. Some students may learn just as quickly or more quickly than typical students when information is presented in a different medium. Some use the same technologies used by the visually impaired, such as screen readers and speech recognition software. Nevertheless, clear presentation and good navigation is critical. A variety of multimedia options will apply to different visual, auditory and learning skills.

*Table 11.1. Content developed using traditional approach and suggestions for adaptations*

| Traditional approach | Adapted |
|---|---|
| Lecture type content | Chunks, include questions, statements of clarification and key points |
| Text-based content | Alternative presentation: audio, video, hands-on interaction; scaffold for various resources (preselect them) |
| Reading from a textbook | Offer vocabulary, issues to discuss in the forum, encourage note-taking, using graphic organizers, offer information prompts (self-tests with open ended questions) |
| Assignments: written essay | Offer a choice: written, oral, video or visual presentation |
| Assessment | Offer variety in responses: open-ended questions, oral response<br>Give clear scoring rubrics, be prompt and detailed in giving feedback |

## AGING USERS

When considering accessibility in education, most people assume they will need to prepare for a few isolated examples of students with disabilities: one blind student in a class, or a handful of young students with learning issues. As we age, we may be affected by *any* of these types of disabilities to various degrees. Instructors should be aware that some of their older students may also have problems such as fading eyesight, or difficulty with fine mouse movements.

## ASSISTIVE TECHNOLOGY

We have touched briefly on the idea of assistive technology, which is essentially any software or hardware that can be used to help overcome a disability.

**Tip**
A pair of glasses could be considered assistive technology, as it helps the user overcome poor vision.

Instead of thinking about assistive technology in terms of types of disabilities it assists, let's look at it from the point of view what kind of help it offers. Assistive technology could provide:

- help with accessing a computer
- help with reading
- help with writing (composing, spelling, typing)
- help with communication
- help with learning
- help with hearing and vision

Figure 11.3 lists many of the computing issues for users with disabilities, and suggests some of the common hardware and software solutions used to overcome these problems.

# Designing and structuring online content

## DESIGN AND STRUCTURE

Don't throw away your art supplies!

One of the most common misconceptions about accessible web design is that in order for a site to be accessible, it must have a simple, plain design with few or no images. Another myth is that an adequate, accessible site can be made by providing a "text-only" version of an existing website. This is a nuisance to maintain, as it requires you to keep not one but *two* versions of every single page.

Remember, not all disabled students are blind! People with mobility or hearing issues and even poor eyesight will certainly appreciate a well-thought-out, aesthetically pleasing website as much as anyone. As you'll see, many of your accessibility changes will be tucked away in the code of your pages, where they will be a benefit to disabled users without detracting from your site in any way.

| Activity | Issue | Assistive Technology Examples |
|---|---|---|
|  Computer Access | When a student cannot access a computer with a standard keyboard and a mouse, he may need special input devices. These devices are commonly used by students with physical, visual or cognitive disabilities. | **Software**: OS accessibility features, word prediction, keystroke reduction, voice recognition, on-screen keyboard<br><br>**Hardware**: Keyguard, arm support, trackball, trackpad, joystick, alternative keyboard, switch with Morse code, switch with scanning |
|  Communication | For many autistic people and some with learning disabilities, augmentative & alternative communication devices may be helpful. They use symbols, pictures and printed words. | **Software**: Symbol browser, art activities, games on the computer<br><br>**Hardware**: Voice output devices or devices with speech synthesis for typing |
|  Reading | The low resolution of monitors can cause fatigue and eye strain for all users. For those with vision or learning issues, reading onscreen can be an added deterrent. Keeping track, following a line of text, understanding and remembering can be problematic. | **Software**: Talking electronic device/software to "pronounce" challenging words, electronic books, mindmapping, talking calculator, voice recognition<br><br>**Hardware**: Single word scanners, scanner with OCR and talking word processor, hand-held scanners, hand-held computers |
|  Writing | There are two different accessibility issues when using computers for writing:<br>1) physical problems with typing; and<br>2) cognitive problems with composing and organizing ideas and converting them into written expression. | **Software**: Templates, word processors, voice recognition, talking dictionary, spelling & grammar checker, multimedia software for expression of ideas<br><br>**Hardware**: Alternative keyboards and input devices used as for Computer Access (above) |
|  Learning | Students with learning difficulties may have problems with attention and with organizing ideas. | **Software**: Multimedia software for expression of ideas, mindmapping, electronic organizers<br><br>**Hardware**: Hand-held computers |
|  Hearing & Vision | Assistive technologies for visually and hearing impaired students may either increase the signal or replace it with something else. | **Software**: Screen magnifier, screen color contrast, screen reader, captioning, computer-aided note taking<br><br>**Hardware**: Braille/tactile labels, alternative keyboard with enlarged keys, Braille keyboard and note taker, signaling device, phone amplifier, personal amplification system/hearing aid, FM or loop system |

*Figure 11.3 Assistive technologies*

## STRUCTURING YOUR CONTENT

Before you begin to write a single line of HTML or even start writing your course content, you should think about how your course is going to be structured. Will you have a lot of material to read, or just a little? Will there be many pages or subpages?

The easier you can make it for students to find and read your course material, the easier it will be for them to learn.

## MENUS AND NAVIGATION

The way you plan your site's navigation will affect your site's usability for your entire audience. A good approach is to write down the different categories that apply to each of your pages, and then group the pages into these categories. The key is to find an intuitive balance between overwhelming the user with too many options, and burying important information too deep in the site.

For example, if your site is made up of these pages, you are running the risk of creating a very cluttered and busy navigation:

- Course Content
- Guidelines
- Syllabus
- Schedule
- Messageboard
- Chat
- Mail
- Submit Assignments
- Assignment #1
- Assignment #2
- Assignment #3
- Assignment #4
- Grading
- Help

You could try grouping your pages into these categories, and create subcategories within this structure:

- About the Course—clicking reveals Guidelines, Syllabus, Schedule
- Course Content
- Assignments—clicking reveals Assignments #1–4, Grading, Submit Assignments
- Communicate—clicking reveals Messageboard, Chat, Mail
- Help

Now your students only have to sort through five links instead of fourteen.

Use common sense when defining categories—there may be some links that a student might use several times a day, so you might want them to sit on the top level for quick and easy access. Be careful when making exceptions to your rules, though—if you do this too many times, everything becomes an exception, and you have got a cluttered site again!

When you are designing your site, and choosing where to place your navigation, keep these questions in mind:

- Are the links grouped together in one place, where they can be easily found?
- Are there so many links on the page that it becomes confusing?

## WRITING FOR THE WEB

Typically, users viewing websites do not read text as thoroughly as they do when reading printed text. Monitors have a lower resolution than printed material, which makes it less comfortable to stare at for long periods of time. Most online readers develop the habit of skimming the screen looking for key points rather than studying in detail. If it is necessary to read lengthy, wordy passages or papers, many users will print out the information to read it in comfort offline.

You can make it easier for readers to find what they need by:

- Keeping your **paragraphs short**—one idea per paragraph
- Using **headers** to announce and reinforce new themes
- Using **bulleted lists** to group ideas into a simple, easy-to-read format

## WRITING FOR LEARNING-DISABLED STUDENTS

Being learning disabled doesn't mean a student can't learn—it may just mean that traditional learning methods are particularly difficult for that individual. Some students with difficulty reading may learn the same material just as well upon hearing it, or after seeing a graphic that explains the concept. For this reason, it can be helpful to explain key ideas in multiple different ways: text *and* a graphic or video that reinforces what is being taught.

The same principle applies to how you ask your students to express their understanding. For many students, the choice of whether to write a paper or give an

oral presentation can make a huge difference in their ability to communicate what they have learned.

One of the biggest difficulties encountered by learning-disabled students is in interpreting academic demands and expectations. This can often be addressed by building checkpoints into assignments, such as "Submit a plan describing how you will approach this project." This allows the instructor to assess whether the student has understood what is expected of them, before the student has invested too much time into a project that may be on the wrong track.

Clear, explicit instructions are of course vital, but they alone are not the solution—the student must actively engage and interpret the tasks and requirements themselves.

## ADDITIONAL CONSIDERATIONS

Some students with disabilities may require additional time to complete tasks such as self-tests and quizzes. A student using an alternative keyboard may not be able to type as fast as his classmates. Extend the allotted time for that student, or remove the time requirement.

Chat rooms are often inaccessible to users reading screen readers. Make sure that chat room participation is not a course requirement, or make arrangements for a disabled student to participate using other means such as a discussion room.

## USING CORRECT CODE: XHTML AND CSS

HTML (Hypertext Markup Language) is the code used to describe web pages so they can be rendered in a browser. When HTML was created many years ago, no one could have predicted the sorts of dynamic, interactive pages that they would eventually be used to create. While HTML was easy to learn and fairly flexible, it had some significant limitations: for example, objects could not be placed anywhere on a page, but had to flow in a linear fashion, one item before the next. Creative designers found ways around these limitations: the TABLE tag was manipulated to allow precise placement of text and graphics.

But these clever fixes came with their own set of problems. Redesigning a website meant rewriting and rebuilding every single page of HTML on the site. Visually simple designs often required complex, bloated HTML. If code was written inaccurately, the web browser had to interpret the code as well as it could, slowing down the rendering of the page.

**Tip**

- Intermediate users: We recommend using Macromedia Dreamweaver to assist you in writing accessible code.
- Novice users: If you're not comfortable writing HTML code at all, we suggest Course Genie, a package from Horizon Wimba, which allows you to convert a Word document into a well-coded, accessible website that can be uploaded to WebCT.

To address these issues, HTML was given a fresh start by rewriting it using another language—XML, or eXtensible Markup Language. The result is called **XHTML**. Superficially, XHTML is not terribly different from HTML: the syntax is stricter, and some tags and attributes have been removed, but much of it is the same. The key is in the "extensible". XHTML essentially lets you ***define new classes of objects.***

What does this mean? Suppose you need all news-related images (but no others!) to be surrounded by a five-pixel blue border. Using old-style HTML, you would do this by wrapping every news image in a table tag.

```
<table border="5" bordercolor="blue">
    <tr>
        <td>
            <img src="images/news.jpg" width="200" height="100"
            alt="Top story: man bites dog">
        </td>
    </tr>
</table>
```

Every single image that needs a border would have to be treated this way.

Using XHTML saves you time and space. First define a class called "news" as having a five-pixel blue border.

```
.news {
    border: 5px solid blue;
}
```

Then add an attribute to any image tag that needs to be in class "news".

```
<img src="images/news.jpg" width="200" height="100" alt="Top
story: man bites dog" class="news" />
```

How does this work? The classes are defined within Cascading Stylesheets (CSS)—stylesheets, because they define the style of a page; cascading, because you can

apply multiple stylesheets. You can define any style once and apply it throughout your entire site.

**Tip**
A site that may help you visualize this process is CSS Zen Garden (http://www.csszengarden.com). Every design on the site uses the same XHTML code to define the different areas of the page. By swapping out only the stylesheet, the appearance of the site changes dramatically.

So with a single CSS file, you can now define the look and feel of an entire website consisting of hundreds of pages.

## WHY CAN'T I DO THINGS THE OLD WAY?

Feel free to skip this section if you are new to building web pages or are already familiar with XHTML and CSS.

## TABLES AREN'T MEANT FOR LAYOUT

If you ever built a website before CSS became widely accepted, chances are you built it using tables. You probably took a large image and chopped it up in an image editing program, then placed each chunk of the image into a borderless table to lay it out exactly where you wanted.

The first reason to avoid tables is that it'll make redesigning your site much easier in the future. You won't have to chop up new designs and recreate every page of your site any more—you can do it all with one change of your CSS sheet and maybe a few changes to the HTML.

But the main reason is that it simply isn't all that accessible. Screen readers approach tables in a linear fashion; that is, they read out each column, left to right, and each row, top to bottom. If your table-based layout doesn't correspond to this model, blind users may not receive the information in the order you intended it. They may hear the menu read out in pieces, in between parts of your main content, and as you can imagine, it isvery confusing to navigate a page like this.

## MANY OLD TAGS HAVE BEEN DEPRECATED

XHTML no longer contains several tags that address the appearance of a site. The FONT tag, which used to be the only way to set the font appearance on a page, has been removed from HTML. This is because fonts can be much more efficiently defined and updated using CSS. Similarly, the CENTER tag has gone away, to be replaced by CSS formatting.

**Tip**
There are many excellent resources, both online and offline, for learning XHTML and CSS. Here are some tutorials to get you started:

- Introduction to CSS
  http://www.w3schools.com/css
- Introduction to XHTML
  http://www.w3schools.com/xhtml

## ACCESSIBILITY IN XHTML

For the rest of this section, we will use XHTML and HTML interchangeably; the basic principles are the same, and most of the differences are in the accuracy and consistency of the code.

### Text

Text makes the World Wide Web go 'round. The greatest amount of content on the Web is basic, plain text. Text is the most accessible media format there is—it is easy for all browsers and screen readers to handle.

There is one big thing you need to be most careful of, and that is the **visibility of your text**. Aging users, people with poor vision, or even people using a small monitor may not see your site's text with the same clarity that you do. They may need to enlarge the size of the text to be able to read it better.

There are a few ways to do this. A **screen magnifier**, such as ZoomText, will make a screen behave much as if a giant magnifying glass has been placed between the screen and the user. An even simpler way is to use the text size settings in the browser to increase the font size on the page.

When you define the appearance of your text in CSS, you have a choice between absolute or relative font sizes.

- **Absolute font sizes** (pixels, points) should appear at the exact same size in every browser and every configuration. Text that is set to "12px" will appear as 12 pixels high. Designers often prefer absolute font sizes because they have greater control over the appearance of the text, and can dictate how much space a given block of text will occupy.
- **Relative font sizes** (percentages, "em") appear at a size relative to the user's font settings. Text that is set to "90%" will appear at 90 percent of the current text size. If the user changes their font size to "larger", the size of the text on the page will increase.

What is the implication here? **Use relative font sizes at all times.** Some browsers will allow absolute font sizes

to scale up with the user settings, but not all. Your eyesight may be much better than that of some of your users, and what looks fine to you might cause problems for someone else. Make sure you give *them* the control of their screen.

## EXAMPLE

```
body, p {
    font-family: Arial, Helvetica, sans-serif;
    font-size: 0.9em;
    color: #333333;
}
```

This will make the text for a page 0.9 em, or 90 percent, of its default size.

Be careful with the **contrast and colours** of your text. Whether your text is light on a dark background or dark on a light background, you need to make sure there is enough contrast between the text and the background for users with weaker vision to distinguish clearly. Additionally, if any information is conveyed by colour alone, reinforce the information with another method. In the example shown in Figure 11.4, the required fields are marked not only by a change in colour, but by bold text and an asterisk.

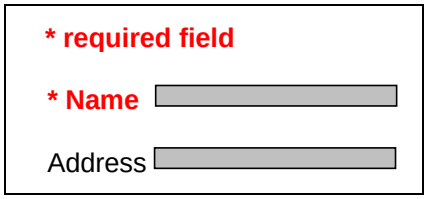



*Figure 11.4*

## IMAGES

### Alt text

There is a very simple, built-in way to make sure your images are accessible: use **ALT text**. Figure 11.5 would be coded as follows:

```
<img src="images/horse.jpg" width="240" height="180" alt="Racehorse warming up at track" />
```

When a screen reader encounters an alt attribute, it substitutes the text for the image, reading the text out loud. In order to make this as useful as possible for your users, you should choose text that is appropriately descriptive of the image. Include any details that are necessary to make the image make sense; don't bother with trivial descriptions if they don't add useful information.

*Figure 11.5*

### Empty descriptions

There are some cases where an image does not require a description at all, or where a description would clutter the audio reading of the page.

Spacer (or transparent) images are typically 1x1 transparent images that are used to control the layout of a table-based website by pushing elements of the site into place. If your site is entirely CSS-based, you won't really need these. If you are working on an older site, though, you may still be using them.

Decorative bullet graphics are often used in lists to illustrate a point.


*Figure 11.6 Decorative bullet graphics*

Figure 11.6 shows three decorative bullets, which many people would mistakenly code as follows:

```
<img src="bullet.gif" width="5" height="5" alt="Red bullet" />
Marketing plan<br />
<img src="bullet.gif" width="5" height="5" alt="Blue bullet" />
Promotion plan<br />
<img src="bullet.gif" width="5" height="5" alt="Yellow bullet" />
Licensing plan<br />
```

With code like this, a screen reader user will hear: "red

bullet marketing plan blue bullet promotion plan yellow bullet licensing plan".

Even though you don't want screen readers to attempt to describe these images, you still need to define their alt text, or the screen reader will read out the filename instead. The alt text on a spacer image or a decorative graphic should be empty, i.e., alt=" ".

**Tip**
Visually impaired users aren't the only ones to benefit from ALT text—you will too! By describing your images, you'll make it easier for search engines such as Google to index your content, and it'll be easier for other users to find the content on your site.

### Long descriptions

Alt text is good for a short sentence, but sometimes a complicated diagram or graph cannot be thoroughly described in one line of text. When this happens, use the ALT attribute for a quick summary, and the **LONGDESC** attribute:

```
<img src="images/chart1.jpg" width="350" height="150" alt="Increase in readership over past 5 years" longdesc="chart1.html" />
```

The longdesc attribute is the URL for another web page, which should contain a complete description of the image in question.

### Imagemaps

Imagemaps are just as easy to make accessible: add the alt text to the AREA tag for each clickable area within the map.

## LINKS

We have already talked about menus and navigation and the importance of thinking about links. Here are a few additional considerations:

- **Link size**: If the images are graphic links, are they big enough so that users can easily click on them, even if they have poor motor control in their hands?
- **Descriptive link text:** If your link text is taken out of context, will it make sense? Many screen readers allow the user to pop up a list of *only* the links from the page. This is a useful way for a blind reader to navigate—unless your link text says "Click here"! Make sure your link includes enough text to clearly define the link, such as "Click here for the full schedule" or even "Full schedule".
- **Unique link names**: Similarly, if your link text is taken out of context, will a user see the same link text multiple times? Ten links that all say "Click here", but point to different pages, would be frustrating.
- **Link separators:** Link in a menu should be separated by more than just whitespace, for visually impaired users to better distinguish links from each other. Additionally, some older screen readers incorrectly read adjacent links as the same link.

**Tip**
On the Web, links are usually underlined. Most web users are accustomed to clicking on underlined links. To this end, it is best not to underline anything that is *not* a link unless conventional style requires it.

```
<a href="about.html">About</a> <a href="bio.html">Bio</a> <a href="contact.html">Contact</a>
```

This can be done by using a separator:

```
<a href="about.html">About</a> | <a href="bio.html">Bio</a> | <a href="contact.html">Contact</a>
```

Another alternative is to make each link into an item in an unordered list, and then use CSS to style the links. A screenreader will pause between list items, making the links more "listenable".

To do this, you will need this CSS:

```
ul {
    list-style: none;
}
ul li {
    display: inline;
    padding-right: 10px;
}
```

and this HTML:

```
<ul>
    <li><a href="about.html">About</a></li>
    <li><a href="bio.html">Bio</a></li>
    <li><a href="contact.html">Contact</a></li>
</ul>
```

Setting list-style to "none" will remove the bullets that are displayed by default before each list item, and setting display to "inline" will place all the list items on the same

line. You can continue to style the list items with margin and padding settings as needed.

## THE TITLE ATTRIBUTE

Similar to ALT text for images, the TITLE attribute can be used to make a link URL clearer. A person using a screen reader can set an option to read TITLE texts out loud instead of the link text. Most browsers display the TITLE text as a "tooltip", or small popup, that appears for a few seconds when the link is moused over.

The TITLE attribute can actually be validly applied to most HTML elements, but is best supported in the A (hyperlink) tag.

## JAVASCRIPT AND DHTML

Many people are fond of "drop-down" or rollout menus, which appear when the user moves the cursor over a top-level category. For many users, they are a quick way to jump straight to the page they need.

Many of these menus create accessibility issues. Some are very sensitive to mouse movement and will "roll up" the instant the mouse drifts outside the box—which can be a serious problem for users whose hands cannot control the mouse precisely. In addition, some of the **Javascript** and **Dynamic HTML** (DHTML) code needed to generate these menus is not understood by screen readers, and will be ignored. This can prevent many users from using the menus at all!

This doesn't mean you can't use Javascript or DHTML, but if you are using it for important functions like navigation, be sure that you have a fallback plan for browsers without Javascript. You can usually test this yourself by turning Javascript off in your browser.

## POPUP WINDOWS

Popup windows have their purposes:

- displaying extra information without making the user lose their place on the page
- letting the user open a link to another site that they can look at later
- advertising (often unwelcome)

Consider what happens when a screen reader encounters a new window. It will first announce that the new window has opened, and then shift focus to that window, reading out the new content. A blind user cannot quickly glance at the new window and put it aside for later; they must hear the content, decide whether or not it is relevant, and choose which window to continue reading.

Unexpected popups can also be a problem for users with learning disabilities, as the sudden appearance of a new window can be distracting and make them lose their place on the previous page.

As a general rule, warn the user if a link will open a new pop-up window. Additionally, consider whether the pop-up window is absolutely necessary. Traditionally, links to external sites were opened in new browser windows. This is preferred by many, but it is better to let the user choose: nearly all browsers let you right-click (or Control-click, if you are a Mac user) a link to open it in a new window.

## DATA TABLES

We have established that you shouldn't use tables for graphic layout, but that doesn't mean you can't use tables at all. Tables are indispensable for their original intended purpose: displaying tabular data in an organized and legible format.

Sighted users can easily glance at a data table, see where the row and column headers are, and find the piece of data they are seeking. But when a screen reader encounters a table, it reads it out in a linear fashion: row by row, each cell in order. If the table is very large, it is easy to lose track of which column you are listening to. And if the table is very complex, with merged cells that overlap multiple rows or columns, it may not make much sense when read out loud.

Figure 11.7 gives an example.

Schedule Results

099 Schedule

| | Stop #2112 WESTBOUND E BROADWAY AT COMMERCIAL DR BAY1 | Stop #924 WESTBOUND E BROADWAY AT CLARK DR | Stop #9052 WESTBOUND E BROADWAY AT MAIN ST | Stop #9053 WESTBOUND W BROADWAY AT CAMBIE ST | Stop #9054 WESTBOUND W BROADWAY AT WILLOW ST |
|---|---|---|---|---|---|
| | 9:10a | 9:11a | 9:15a | 9:17a | 9:19a |
| | - | - | 9:16a | 9:18a | 9:20a |
| | 9:12a | 9:13a | 9:17a | 9:19a | 9:21a |
| | 9:14a | 9:15a | 9:19a | 9:21a | 9:23a |
| | 9:16a | 9:17a | 9:21a | 9:23a | 9:25a |
| | 9:20a | 9:21a | 9:25a | 9:27a | 9:29a |
| | 9:22a | 9:23a | 9:27a | 9:29a | 9:31a |
| | 9:24a | 9:25a | 9:29a | 9:31a | 9:33a |
| | - | - | 9:32a | 9:34a | 9:36a |
| | 9:28a | 9:29a | 9:33a | 9:35a | 9:37a |

*Figure 11.7 A table with a bus schedule*

## TABLE HEADERS

Every table should have clearly labelled table headers. Often developers have done this just by colouring the background of the header cells or making the text bold, but as we know, this visual information will be lost when run through a screen reader.

So how can we tell the browser itself where the table headers are? This can be done with the <th> tag, which works exactly like the <td> tag except it makes the distinction that the cell is a header. Plus, you can still style the <th> tag using CSS to make the headers look however you want.

## CAPTION AND SUMMARY

The <caption> attribute gives all users a quick definition of the table. The <summary> attribute provides more detail for screen readers.

```
<table summary="The schedule for the westbound 99 B-Line, with stops at Commercial, Clark, Main, Cambie, Willow, Granville, Macdonald, Alma, Sasamat, and UBC.">
<caption>Schedule for the 99 B-Line</caption>
<thead>
<tr>
<th> …
```

## SCOPE

The <scope> attribute goes into a table header to tell the browser which header is associated with a given row or column. This helps remove ambiguity and allows the screen reader to provide the user more information about the given table. Two of the options are scope="row" or scope="col".

*Table 11.2. Student graduation data*

| | Graduation year | GPA |
|---|---|---|
| Bob Smith | 2002 | 3.4 |
| Sara Miller | 2004 | 3.8 |

This would be written as follows:

```
<table summary="Graduation year and GPA for each student enrolled in the program.">
    <caption>Table 1: Student graduation data</caption>
    <tr>
    <td></td>
        <th scope="col">Graduation year</th>
        <th scope="col">GPA</th>
    </tr>
    <tr>
    <th scope="row">Bob Smith</th>
        <td>2002</td>
        <td>3.4</td>
    </tr>
    <tr>
    <th scope="row">Sara Miller</th>
        <td>2004</td>
        <td>3.8</td>
    </tr>
</table>
```

## COMPLEX TABLES

Tables with multiple layers of headers and categories can become quite complicated. XHTML does allow for further description of complex tables, including grouping sets of rows and associating cells with headings. These ideas may be of interest if you have many data tables. Here are some resources for complex tables:

- http://www.usability.com.au/resources/tables.cfm
- http://jimthatcher.com/webcourse9.htm.

## ACCESSIBILITY FEATURES

Most of the changes we have talked about will improve your site's accessibility without changing its functionality in any way. Now we are going to discuss a few things you can add to your site that will be of extra benefit to disabled users.

## SKIP TO CONTENT

While many experienced screen reader users listen to websites at very high speeds, there is still no audio equivalent to skimming the page. Sighted users can easily ignore any part of a website that is of no interest to them, or something they have seen before, such as the navigation.

One feature that will improve your website's usability is a **skip to content** option. This is a link, coded to appear invisible to sighted users, that screen reader users can click to skip any navigation menus that they have already encountered and don't need right now.

There are three steps to creating a skip navigation option.

(1) Add an anchor link just before your main content starts:

```
<a name="maincontent"></a>
```

(2) Add a new class in your CSS:

```
.skiplink {display:none}
```

Now, anything that you assign to class "skiplink" will not be displayed in the browser.

(3) Add this link right after the <body> declaration of your page:

```
<a class="skiplink" href="#startcontent">Skip over navigation</a>
```

### KEYBOARD SHORTCUTS

The accesskey attribute allows you to predefine keyboard shortcuts to specific pages or form fields on your website. This is especially beneficial to anyone who navigates your site using only a keyboard, or whose use of a mouse is limited. Accesskeys are triggered by the user holding down ALT and pressing the specified key.

Simply define the key within an existing link to that page:

```
<a href="about.html" accesskey="1">About This Site</a>
```

Be careful not to override existing browser keyboard shortcuts that appear in the browser toolbar, such as F (File), E (Edit), V (View). To be certain, use only numbers as access keys; you are less likely to conflict with existing shortcut definitions. There is no automatic listing of what access keys are defined on a site, so you will have to list the keys that you have defined either on a separate page of your site or next to the appropriate links.

There are a few conventional shortcuts:

- ALT-1: Home page
- ALT-2: Skip to main content
- ALT-9: Feedback

Not all browsers support accesskey yet, but those that don't will simply ignore the attribute.

## Multimedia

We use the term "multimedia" to refer to audio, video, PDF and Flash: any content on the Web that is not text, HTML, or a graphic.

**Tip**
Different people have different learning styles; every time you present your content in a different medium, you *increase* the accessibility of your site. Developing accessible sites does not mean making every type of media usable, it means making all the *information* available to everyone.

Multimedia can create some of the richest and most engaging experiences on the Web. For this very reason, it is also the most challenging aspect of web accessibility. The simplest rule to follow for rich media is: *provide an alternative*.

### AUDIO

For audio, the accessibility alternative may be relatively simple; if the audio file in question is spoken word, it is sufficient to provide a text transcript. For music, provide lyrics and, if appropriate, a description of the piece and an explanation of its significance.

Audio can be used to benefit learning-disabled users. Consider offering a reading of key passages or especially difficult text. In returning to our original point that improvements made with accessibility in mind will help non-disabled users as well, consider how an audio reading will assist someone who is not fluent in the language. There are parts of language that are not well conveyed by text, such as correct pronunciation, and language flow.

### VIDEO

Video files are a great way to present information. These can be short video clips that you create yourself, or links to web-based videos that a peer has made. A Chemistry professor at San Francisco State University has created a captioned video showing each step of his lab experiments. He reports fewer questions about the procedures and positive feedback from students. If you use a video file that has no audio track, let your students know that there is no audio right in the link to the file (e.g., "Video of amoeba movement via temporary projections called pseudopods—no audio"). That way the students will know that they do not need speakers and deaf and hard of hearing students will know that they do not need captions.

When adding video to your site, accommodations need to be made for both vision and hearing-impaired users. For visually impaired users, **audio description** (AD) of the contents of a scene is important. In twenty-five words or less, an audio description is a narrator providing a spoken context for anything that the viewer cannot understand by listening to the soundtrack. For hearing impaired users, any key information provided in the video should be represented in the text equivalent. Perhaps in the picture there is a sign placed prominently that the viewer is expected to read, or people in the video are reacting to a sound heard off-camera. These details affect the viewer's understanding of the material,

and you need to ensure that all visitors to your site are able to get this information.

## TRANSCRIPTS VS. CAPTIONS/SUBTITLES

A transcript is one way that you can provide your audience with a second format for your content. Transcripts are easy, and can be created by anyone. If you are the creator of the video, chances are you have a script that you can provide. In some cases, a script may not need any modifications to be a full transcript. If you need to write a transcript from scratch, it isn't hard, but it is time-consuming. Load up the video, and your word processor and get typing. Before long you will have a transcript to publish.

A transcript usually consists of one file with the whole content of the video. On the other hand, captions and subtitles are synchronized with the video stream, and as such require more effort, and time to create.

**Tip**

You may want to consider using speech recognition software such as Dragon NaturallySpeaking. The authors of this chapter have had very good results with NaturallySpeaking. One of the big advantages of using speech recognition is that it keeps your hands free to do other things while transcribing, such as control the playback rate, and replay a section of the video). In some cases, you will find that transcription using speech recognition can actually be faster than manual input via the keyboard!

## CAPTIONING VS. SUBTITLING

Subtitles are a textual representation of the speech in a video clip. The focus of subtitles is to state what is said, not what is audible. Subtitling does not attempt to provide information about other aural cues, such as a ringing doorbell.

**Tip**

If you wish to show a clip, which has dialogue in another language, consider captioning in your audience's primary language! By doing this, you can aid language comprehension, for students that understand some of the primary language. For students that don't speak the clip's primary language, they will now be able to understand what is said in the video.

Captions attempt to provide a textual representation of all the audio in a video clip. This may include speech as well as sound effects (for example, a ringing doorbell) and background music. Writing video captions can come down to a matter of style. As with everything else in accessibility, you need to use common sense when making decisions about how much has to be captioned. Be thorough without overwhelming the user with unnecessary details.

If you are looking to provide a base level of enhancement, start with a transcript of the video. For a more interactive approach, subtitling or captioning can greatly increase the video's comprehensibility for people who struggle with the language spoken. Reading the text while hearing the dialogue can be very helpful when learning a language.

**Tip**

Open vs Closed Captioning: Closed captioning is a technology that an individual user enables, to see the captioning for a given video. Common applications of this are in: News broadcasting, and on VHS/DVD movies. With open captioning, the video's picture has the textual representation directly ingrained into it. Users cannot choose whether they see the captions or not; they are always enabled. A common application of open captioning is for videos in another language.

Captioning is something that you can do yourself, but due to the amount of time necessary it may be more practical to hire a professional captioning company to caption your video. This can be expensive, but in the end you may find the price worthwhile. Video alternatives should be considered part of the cost of building and maintaining your site.

## FLASH

**Tip**

Caution: Avoid building your entire website in Flash. Yes, you can make some visually impressive pages doing so. Yes, Flash sites can have a certain cool-factor, unachievable with HTML. It simply remains that most Flash sites are not as accessible as HTML sites.

Like all other forms of multimedia, Flash can improve accessibility for some users and degrade it for others. It can be easier to demonstrate concepts with interactivity

and animation than with text and images. A well-designed Flash demonstration can have enormous benefits for students, especially those with learning disabilities. Yet it can be a problem for users with visual or physical handicaps. Some problem areas include:

- representing information only as graphics—see the discussion regarding images without alternative text
- small buttons, or buttons that cannot be navigated to using the keyboard—users with physical disabilities may have trouble using the interface

## FLASH AND SCREEN READERS

Since Flash generally does not present text in a linear fashion, often screen readers cannot synthesize speech in a manner that makes sense to the user. Blocks of text can change over time, be randomized, and appear at differing locations of the screen. Users must also have an up-to-date screen reader that works with the current version of Flash.

When creating content in Flash for screen readers, keep the following questions in mind:

- Does the reading order make sense? Flash objects are read in the order in which they were created, rather than the order in which they appear visually on the screen.
- When an event occurs on the screen, does the screen reader start reading again from the start? You don't want to bombard the user with repeated information (recall the discussion on navigation in the XHTML/CSS section above).
- Do you *need* to display your content in Flash, or will a standard web page do just as nicely?

**Note**: This doesn't mean you should *never* use Flash. It means that if your entire site consists of three buttons and a block of text, Flash is probably overkill. If you want some special animations, consider making them in a JavaScript-enabled HTML web page. A screen reader will ignore the animations but can read any text-based information.

Adobe offers suggestions and best practices for accessibility in Flash and other products on their website at http://www.adobe.com/accessibility/.

## PORTABLE DOCUMENT FORMAT (PDF)

The primary challenge of PDF files is to make sure that the text of your document is encoded as text, not as a graphic. If you scan a document onto your computer and directly output it to a PDF file, the contents of the file will be encoded graphically. If you want to create a PDF file from a text document you have scanned, be sure to use Optical Character Recognition (OCR) software. OCR software converts graphical lettering to text. PDF viewers (such as Adobe Reader) cannot analyze graphics for text, so this must be done when creating the PDF file.

The PDF format is used frequently online, but often unnecessarily. In many cases it is used to avoid creating a web page, or to ensure that the layout of the information is exactly as the designer wants it. In these cases, the information could be better conveyed in simple HTML, without forcing the user to download and view an extra file.

Of course, there are valid reasons to use the PDF format, which we will consider here.

### Footnoting

HTML does not provide support for footnoting, or referencing. If you only need to cite one reference, including that information at the bottom of the web page may be sufficient. But if you are working on a document that requires extensive footnoting, the PDF format may be a better solution.

### Annotating forms

If you require that other people fill out and return a form online, the PDF format has some extra features that may be useful. However, you should consider whether a web form with submission would accomplish your task.

### Printing

The PDF format makes considerations for documents that are designed for reading on paper. HTML doesn't, as it was designed to be a web/online format. As a result, HTML has no concept of print margins, page sizes, etc. Even the most savvy web designers will tell you that multi-column web pages can be quirky at the best of times.

### Uneditable content

For official documents, journal articles and copyright-sensitive materials, PDF is often preferred as the end user is unable to make any edits or changes to the document.

There is a difference between *wanting* and *needing* to format your document using multiple columns. If you just want to use multiple columns, but it is not crucial to the information in the document, go brush up on your XHTML/CSS skills, and stay away from PDF. However, there are situations where the columnar layout and print format of the document is crucial, and in these cases

usage of the PDF format is fine (e.g., academic articles, order forms).

### Specialized notation

If you need to share a document with some specific notation (e.g., mathematics or another language), there are some specific technologies you should consider before jumping to PDF.

In the case of mathematics, if you are working on a file with fairly standard math notation in it, you may not need to use PDF: MathML might be enough. MathML is a specialized markup language developed by the W3C for displaying mathematics. The downside of MathML, is that your target audience must install the MathML fonts on their computer.

In the case of other languages, the Unicode character-encoding format may provide the characters you need. Fortunately, modern operating systems (Windows XP, Mac OS X) have support for Unicode built in.

If you need to display some other notation, PDF is probably a suitable choice, since it has roots as a graphical file format. The primary advantage of these other technologies is that the user does not have to launch a different piece of software to view your document. MathML and Unicode can be drawn natively in your audience's web browser.

### PDF and screen readers

Adobe Acrobat has been able to function as a screen reader since version 6. So for the purposes of testing your PDF files, checking what Acrobat says (literally) is the first point to test.

### Tagging PDF files

Tags are extra information about the content of a document. Tags allow the document creator to specify alternative text of images, and to denote specific pieces of text as headings. Tags are similar to attributes in HTML—they provide extra information about an item in the document.

**Quick Tip!**
Google for the URL of your PDF files. The HTML output that Google outputs is usually a fairly good indication of the accessibility of your PDF files. You should also try using the search function in your PDF viewer. If the search function works, chances are good that a screen reader will be able to interpret the text of the document. As with all other methods of validation, use it to check for technical problems only, then rethink the problem areas.

**Adding tags in Microsoft Word (2000 or newer)**
To add alternative text to a graphic:
(1) Right click on your image.
(2) Format picture.
(3) Go to the Web tab.
(4) Type your text under "Alternative Text".

Specifying headings is also easy; just use the Word text style for headings. The added benefit for you, the document maintainer, is that now should you want to change the formatting of headers, you only have to change the formatting once. Using Word's styles is akin to using Cascading Style Sheets (CSS) to format HTML pages.

When you are working on a document that requires multiple column formatting, use Word's column function. Acrobat will automatically recognize the columnar arrangement, and correctly generate the reading order for software such as screen readers.

Full procedures for tagging are beyond the scope of this manual. For more information, Adobe provides a how-to guide on creating accessible PDF files (both from your initial source, and retrofitting) on their website (http://www.adobe.com/enterprise/accessibility/pdfs/acro7_pg_ue.pdf).

As with many other forms of accessibility, spending the time to increase the ease of use for disabled people improves the accessibility for other users as well. By adding tags to your PDF documents, now your documents are viewable on other devices, such as personal digital assistants (PDAs). Joe Clark wrote a very solid article on PDF accessibility, which discusses the appropriate usage of PDF files (at http://www.alistapart.com/articles/pdf_accessibility/).

# Testing your site

## ACCESSIBILITY CHECKERS AND THE HUMAN FACTOR

There are some useful tools available for testing the accessibility of your site. They will examine your code and look for items like missing alternative (ALT) text or table headers, and make recommendations on improvements that will help your site meet each priority level. Accessibility checkers, such as Watchfire WebXact or UsableNet LIFT Machine, can be an invaluable help in identifying accessibility gaps in your web pages. Products or application plug-ins, such as UsableNet LIFT for Dreamweaver, allow you to check the accessibility before you even post the final page to the Web. You may notice that they will also issue a list of warnings, regard-

less of your website's actual accessibility results. Why is this?

There are simply too many accessibility standards that only humans can test. No software can tell you if your site's menu navigation is intuitive, or if the ALT text you have included is sufficient to describe the image. Use an accessibility checker *first* to make sure you have covered everything you can, and then work through the warnings it provides, looking at your site critically.

**Tip**

XHTML/CSS Validators—If you are building your site from scratch as described in Chapter 13, Planning Your Online Course, you should test the validity of your code using an XHTML and CSS validator. This will help ensure that your site works well with all browsers, including screen readers.

- XHTML: http://validator.w3.org/
- CSS: http://jigsaw.w3.org/css-validator/

**The best way to test your site for accessibility is to ask a user with disabilities to try it**. Only a human, examining both the context and the content of a page, can fully assess your site's accessibility. It is hard, as a sighted user, to imagine navigating a website only by voice; as a user with full mobility, it is hard to imagine the frustration of trying to click on a link that is too small. If you truly want to know if your site is accessible, bring it to the people who experience the problems you are trying to address.

## EVALUATION CHART

We have included a checklist of the most common and significant accessibility issues that you should look for when evaluating your site. Some of these guidelines can be tested using an accessibility checker as mentioned above; others you will have to look at objectively and decide for yourself whether they are adequately met.

You can use this chart to evaluate an existing website before making accessibility changes, or to see how well you have done after "accessifying" your existing site or building a new one.

*Table 11.3. Accessibility evaluation chart*

| Category | Description | Vision (V) Hearing (H) Motor (M) Cognitive (C ) | Notes | Rating (1–5)* |
|---|---|---|---|---|
| Structure & appearance | Navigation links and placement consistent on each page. | M,C | | |
| | Text good contrast to the background | V,C | | |
| | Each page has a unique descriptive title | V,C | | |
| | Valid XHTML/CSS used throughout the site | V,M,C | | |
| | | | | |
| Images | All images have ALT text that either clearly describes the image, or in the case of decorative images, contains a space (alt=" ") to prevent the screen reader from describing the image. | V | | |
| | Images that cannot be adequately described in ALT text (charts, graphs) are further described on a LONGDESC page. | V | | |
| | Links in imagemaps also have ALT text | V | | |
| | | | | |

| Category | Description | Vision (V) Hearing (H) Motor (M) Cognitive (C ) | Notes | Rating (1–5)* |
|---|---|---|---|---|
| Text & links | Fonts use a relative font size (em, %), not absolute (px, pt) | V,M,C | | |
| | Heading tags (H1, H2) used correctly as headers, not to format font | V,M,C | | |
| | Ability to skip navigation | V | | |
| | Links separated by more than just whitespace | V | | |
| | Colour not used to convey information, or reinforced by other visual cues | V | | |
| | Underline not used on non-linked text | C | | |
| | Link text does not repeat on the same page (e.g., "click here") but is unique to each link. | V | | |
| | TITLE attribute added to ambiguous links. | V | | |
| | Lists use the UL/OL and LI tags, not bullet images | V,C | | |
| | Coding should not prevent user from changing colours with own stylesheets | V,C | | |
| | | | | |
| Tables | Tables used for data, not for layout | V | | |
| | Table row or column headers indicated using the TH tag. | V,C | | |
| | Table summary provided | V,C | | |
| | | | | |
| Forms | Forms can be navigated in the correct order using the TAB key | V,M | | |
| | Each form field has an associated LABEL tag | V | | |
| | Enough time given to fill out forms | V,M,C | | |
| | Required fields noted as such before the form label, and marked with asterisk or bold | V | | |
| | | | | |
| Multimedia | Transcripts available for all audio | H | | |
| | Transcripts or captioning available for all video | V,H | | |
| | Content presented in Flash described in an alternative format as well | V,H,C | | |
| | Avoid distracting animations, scrolling text | V,C | | |
| | Links provided to download any necessary plug-ins | V,H,M,C | | |
| | PDFs accessible or plain text made available | V | | |
| | Content in applets and plug-ins accessible or else not required | V,M,C | | |
| | If alert sounds are used, reinforce the sound using visual notification | H | | |
| | | | | |

| Category | Description | Vision (V) Hearing (H) Motor (M) Cognitive (C ) | Notes | Rating (1–5)* |
|---|---|---|---|---|
| Javascript | Site navigation still works with Javascript turned off. | V,C | | |
| | Drop-down menus do not require difficult, precise mouse movement. | M, C | | |
| | | | | |
| General | Passes automated accessibility validator such as Watchfire WebXact | V,H,M,C | | |
| | Site can be navigated by keyboard only | V,M | | |
| | User notified if pop-up windows are to be used | V,M,C | | |
| | External windows do not open pop-up windows | V,M,C | | |
| | No autoplay of music, or ability to turn off music easily | V | | |
| | If frames must be used, they are clearly titled | V | | |
| | Page still usable with stylesheets turned off | V,C | | |
| | Site includes search engine | V,M,C | | |
| | Distracting animations avoided | V,C | | |
| | Pages do not automatically refresh | V,M,C | | |
| | | | | |
| General Notes | | | | |

## RATING SCALE

5 = Excellent. Meets or exceeds the relevant accessibility guideline.
4 = Good. Meets the guideline, but could be further improved for better accessibility.
3 = Incomplete. Some effort has been made to meet the guideline, but not all instances of this item have been addressed.
2 = Poor. Guideline has been inconsistently or incorrectly applied.
1 = **Failed**. Completely ignored or unimplemented.

# Further design resources

During our research, we have collected a great number of online resources as guides and references. We hope that you will find them to be a valuable aid to your exploration of accessible course design.

**Tip**

- Accessibility is vital for educational materials.
- Accessibility aids usability for all.
- Making your site accessible isn't all that difficult, and can be done in stages.
- Redundant media is a good thing.

## Fundamentals

These sites are good general starting points when studying accessibility.

- **W3C Web Accessibility Initiative (WAI)**
  http://www.w3.org/WAI/
  The Web Accessibility Initiative (WAI) works with organizations around the world to develop strategies, guidelines, and resources to help make the Web accessible to people with disabilities. They developed:
- **WCAG Guidelines 1.0**
  http://www.w3.org/TR/WAI-WEBCONTENT/
- **Accessify**
  http://www.accessify.com
  News & articles, tutorials, discussion forum.
- **Dive Into Accessibility**
  http://www.diveintoaccessibility.org
  Easy step-by-step guide to improving the accessibility of your site or blog.
- **Center for Applied Special Technology (CAST): Universal Design for Learning**
  http://cast.org/research/udl/index.html
  "Founded in 1984 as the Center for Applied Special Technology, CAST has earned international recognition for its development of innovative, technology-based educational resources and strategies based on the principles of Universal Design for Learning (UDL)."

## Technical

Introductions to creating valid XHTML and CSS, and how to use it in the process of creating valid, accessible websites.

- **XHTML Tutorial**
  http://www.w3schools.com/xhtml/default.asp
- **CSS Tutorial**
  http://www.w3schools.com/css/default.asp
- **Zen Garden**
  http://www.csszengarden.com/
- **Creating Accessible Page Layouts**
  http://www.utoronto.ca/atrc/tutorials/actable/index.html
  How and why to avoid using tables for layout.
- **PDF Accessibility**
  http://www.alistapart.com/articles/pdf_accessibility
  Editorial about specific purposes for which you should use PDF files, and reasons why for everything else you should leave it alone.
- **Flash Accessibility**
  http://www.webaim.org/techniques/Flash/
  IMS Guidelines for Developing Accessible Learning Applications
- http://ncam.wgbh.org/salt/guidelines/
- http://www.macromedia.com/resources/accessibility/

## Tools and validators

These handy assistants can be very useful for testing your site.

- **Watchfire WebXACT (previously known as Bobby)**
  http://webxact.watchfire.com/
  "WebXACT is a free online service that lets you test single pages of web content for quality, accessibility, and privacy issues."
- **CSS Validator**
  http://jigsaw.w3.org/css-validator/
- **XHTML Validator**
  http://validator.w3.org/
- **Vischeck**
  http://www.vischeck.com/vischeck/
  See what images and web pages look like to people with different types of colourblindness.
- **Lynx Viewer**
  http://www.yellowpipe.com/yis/tools/lynx/lynx_viewer.php
  See what your web page would look like in a text only web browser.

## Other

- **Developing sites for users with cognitive/learning disabilities**
  http://juicystudio.com/article/cognitive-impairment.php
- **Richard Felder—Index of Learning Styles**
  http://www.ncsu.edu/felder-public/ILSpage.html
  "The Index of Learning Styles is an on-line instrument used to assess preferences on four dimensions (active/reflective, sensing/intuitive, visual/verbal, and sequential/global) of a learning style model formu-

lated by Richard M. Felder and Linda K. Silverman. The instrument was developed by Richard M. Felder and Barbara A. Soloman of North Carolina State University."

- **Biology Success! Teaching Diverse Learners**
  http://www.landmarkcollege.org/institute/grants%5Fresearch/biology%5Fsuccess/book.html
  "Biology Success! is an innovative project based at Landmark College in Putney, VT and funded by the National Science Foundation's Research in Disabilities Education program (HRD No. 0004264). Biology Success! asserts that students with learning differences can succeed in high school and college introductory biology courses when the curriculum has been designed to respond to their learning needs."

# Summary

Web accessibility is especially critical in education to ensure that all students have fair and equivalent access to learning materials. Government institutions in the US and UK are required by law to make their web content accessible. Standards and practices for accessibility are agreed upon by the W3C and implemented by the WAI.

Sight, hearing, mobility, and learning disabilities can affect how your students access and interpret information on the Web. Assistive technologies can help with some of the difficulties faced; some must be addressed by your website itself. When making an accessible site, start by thinking about its design, structure, and content.

It is neither quick nor easy to create multiple pathways to reach learning objectives in the online environment. It will take time to build up a set of online materials, activities, and assessment strategies that accommodates the wide variety of learning needs of students with disabilities and learning preferences of all students. Your efforts will create an inclusive space for everyone, including students traditionally marginalized by their needs in the online environment.

As the old saying goes, "You cannot please all of the people, all of the time." In our case here, we are just trying to increase the probability that each student will succeed in our online course area, regardless of his or her disabilities, learning preferences, or life situation. We do this by increasing the number of methods by which students get and use the content. We do this, whenever possible, by giving options to students regarding how we will evaluate their performance. We do this by taking the time to engage students in different ways and at different levels. We do this by applying UDL principles to online teaching and learning.

Once you have taken UDL principles into consideration when developing your course materials, use correct XHTML and CSS—or a program that can generate this for you—to build or modify the site according to the guidelines provided by the WCAG. This will help to ensure that the technology does not create barriers for students with disabilities.

# Glossary

**accessibility**: the practice of making web pages and other computer-based media accessible to all users, ensuring that those with disabilities have equivalent access as those without

**ADA**: Americans with Disabilities Act

**alt text**: alternative text, displayed in place of an image

**assistive technology** (or adaptive technology): software or hardware that enables people with disabilities to perform tasks that would be difficult or impossible with the assistance of technology

**audio description**: an additional narration track for the visually impaired, accompanying television and movies. A narrator describes the action in the scene during pauses in the audio.

**caption**: 1. on-screen description of all significant audio content in a video. 2. HTML attribute to describe a table, displayed with the table.

**Cascading Style Sheets (CSS):** code used to define the presentation of a document written in HTML or XHTML

**CMS**: content management system, used to more easily maintain pages on a website

**deductive learners:** students who prefer starting with more structure, deriving consequences and applications from the concepts and theories

**Dynamic HTML (DHTML):** a collection of technologies, such as HTML and Javascript, used to create interactive or animated websites.

**headtracking**: controlling the mouse pointer by use of head motion

**headswitch:** a button that can be activated with light pressure from the head or any body part that can be moved accurately and reliably

**Hypertext Markup Language (HTML):** a markup language used to create documents on the Web containing text, graphics, sound, video, and/or hyperlinks

**inductive learners:** students who prefer beginning with meaningful examples before extrapolating the main concepts or theories

**intuitive learners:** students who prefer reflective activities and resources that require imagination

**JavaScript**: a Web scripting language that can be used to create interactive content on a web page

**learning disability**: a psychological or neurological condition that affects a person's ability to communicate and/or learn effectively. Includes conditions such as dyslexia (reading difficulty), dysgraphia (writing difficulty), dyscalculia (difficulty with mathematics), and aphasia (problems comprehending language)

**longdesc** (long description): a separate HTML document containing the description of an image or media when the description is too long to be contained in the alternative text

**Macromedia Flash**: a multimedia authoring program used primarily for web content

**Portable Document Format (PDF):** a platform-independent file format developed by Adobe Systems

**predictive typing**: software that offers the user a choice of words at each point in a sentence, according to what words are statistically most likely to appear in a given context

**screen reader**: text-to-speech software that reads aloud what is being displayed on the screen

**screen magnifier**: software that displays an enlarged view of the current screen on a standard monitor

**Section 508:** an amendment to the Rehabilitation Act of 1973, which states that electronic and information technology developed or maintained by any agency or department of the United States Federal Government must be accessible to people with disabilities

**sensory learners:** students who prefer fact-based activities and resources.

**sip/puff switch:** a two-position switching device that can be activated by sipping or puffing and allows the user to control electronic devices

**subtitles**: on-screen translation of dialogue and on-screen text

**tablet**: an alternative pointing device where the user uses a stylus on a pointing surface, like a pen on paper

**trackball**: an alternative pointing device where the user rolls a ball in a holder

**transcript**: a textual version of audio- or video-based material, including speeches, conversations, television and movies

**usability**: the ease of interaction between a human and a computer interface

**UDL**: Universal Design for Learning

**World Wide Web Consortium (W3C):** a group that establishes specifications, guidelines, software and tools for various aspects of the Web, including file formats and scripting languages

**WAI**: Web Accessibility Initiative

**WCAG**: Web Content Accessibility Guidelines—developed by the W3C

**XHTML**: eXtensible Hypertext Markup Language

# Appendix

The following is a short ten-point checklist which you can use to help guide your site towards better accessibility. This is not a complete list, but draws ideas from Priority 1 and Priority 2 checkpoints.

Examine each of the elements of your site as described in the chart. Decide for yourself how well they meet the criteria, then give each item a rating. Low rated elements should be revisited and improved in order for your site to be considered accessible.

### Rating scale

5 = **Excellent.** Meets or exceeds the relevant accessibility guideline.

4 = **Good.** Meets the guideline, but could be further improved for better accessibility.

3 = **Incomplete.** Some effort has been made to meet the guideline, but not all instances of this item have been addressed.

2 = **Poor.** Guideline has been inconsistently or incorrectly applied.

1 = **Failed.** Completely ignored or unimplemented.

| | Description | Rating details | Rating (1–5) | Notes |
|---|---|---|---|---|
| 1 | **Text alternatives**<br>Text equivalent provided for every non-text element, including: images, graphical representations of text and symbols, imagemaps, animations, applets and programmatic objects, frames, scripts, graphical buttons, audio and video.<br>*Assists:* Vision, Cognitive | 5—Complete and correct alternative text provided for all elements.<br>3—Alternative text available for some but not all elements.<br>1—Alternative text is missing, incomplete, or incorrect. | | |
| 2 | **Text**<br>Fonts can be resized using the browser. Text is high-contrast.<br>*Assists:* Vision, Cognitive | 5—Text is easy to read and resize<br>3—Text can be resized, but may cause problems in layout when enlarged; some text may be hard to read<br>1—Text cannot be resized, and/or is hard to read due to size, colour or contrast | | |
| 3 | **Links**<br>Link text makes sense out of context and does not repeat<br>*Assists:* Vision, Cognitive | 5—Each link has clear and unique link text<br>3—Some link text repeats or is vague (e.g., "click here")<br>1—Links cannot be understood when taken out of context | | |
| 4 | **Colour**<br>All information conveyed with colour is also available without colour, for example from context or markup.<br>*Assists:* Vision (colourblindness) | 5—Colour used appropriately<br>3—Colour used to convey information, but the content has alternative explanation/description. (e.g., A pie-chart with the colour and the percentage).<br>1—Colour used to convey information (e.g., "click the red link") | | |
| 5 | **Distraction**<br>No screen flickering, refreshing or distracting animations. If pop-up windows must be used, user is notified in advance.<br>*Assists:* Vision, Cognitive | 5—No flickering or distractions<br>3—Some animations may be distracting<br>1—Unexpected pop-ups; screen is distracting and chaotic | | |
| 6 | **Clarity & consistency**<br>Clear and simple language used, as appropriate for site content. Navigation stays consistent across the site.<br>*Assists:* Vision, Cognitive | 5—Content is written at the appropriate level for site visitors. Site is easy to navigate.<br>3—Some content or menus may be confusing<br>1—Language too difficult for site visitors to understand; menus change from page to page | | |
| 7 | **Data Tables**<br>Row and column headers identified.<br>For complex tables, data cells are associated with header cells.<br>*Assists:* Vision, Cognitive | 5—Headers complete and complex cells associated with headers<br>3—Incomplete or incorrect headers<br>1—No headers provided | | |
| 8 | **Frames**<br>If frames must be used, all frames clearly titled.<br>*Assists:* Vision, Cognitive | 5—Frames correctly titled<br>3—Some frames titled, or ambiguously titled<br>1—Frames used without titles | | |

| | Description | Rating details | Rating (1–5) | Notes |
|---|---|---|---|---|
| 9 | **Plugins, applets & scripts**<br>Pages are usable when scripts, applets, or other programmatic objects are turned off or not supported.<br>*Assists:* Vision, Cognitive, Motion, Hearing | 5—Turning off plugin/script leads to fallback alternative<br>3—Turning off plugin/script loses functionality, but site is still otherwise usable<br>1—Site cannot be used without plugin/script | | |
| 10 | **"Last resort"**<br>If, after best efforts, the material cannot be made accessible, a link is provided to an alternative, accessible page that has equivalent information (or functionality), and is updated as often as the inaccessible (original) page.<br>*Assists:* Vision, Cognitive, Motion, Hearing | 5—Original pages adequate, or alternative pages provided when necessary<br>3—Alternative page provided, but not equivalent<br>1—No alternative pages provided when needed, or alternative pages provided when original pages could be made accessible | | |

*Table 11.4. Accessibility evaluation chart—detailed*

# Case studies

From 2005–2006, the University of British Columbia was involved in a BCcampus-funded project on web accessibility in online learning. During the project, we created a focus group of people with different disabilities. Based on their comments, modifications and redesigns were done on five courses that were piloted in summer 2006 as "accessible courses". Where possible, we asked the participants to use their own computers at home, which were already adapted according to their usage and personal preferences. When in the office, we tried to imitate their home setting, giving them a choice of using Windows or Mac OS and their preferred browser. We wanted to avoid the additional barriers of working on a new computer in an unknown environment, and for participants to experience the same situation as our registered students. Therefore, our introductions and instructions were limited to what they would get from an instructor in advance. We only limited their browsing by asking them to focus on specific pages rather than reading the whole course content. Focus group members were interviewed individually before and after the modifications. The first set of questions was about how their disability affected their ability to navigate the course material and what improvements would make the material more accessible for them. Questions after the modifications involved quality of the presentation, usability of the interface and usefulness of the system.

In our consultations with the participants, we asked them for their oral or written feedback and opinions on their experience. The names in these cases have been changed for privacy reasons.

## CASE 1: SAMUEL

**Description.** Samuel is a hard-of-hearing English as a Second Language (ESL) student from Korea. Online courses had been recommended to him as a good choice to remove the barrier of his impairment.

**Issues.** Samuel was surprised and disappointed with the amount of text-based material in the courses that he took. He compared them with the online courses in Korea, which included a considerable amount of video excerpts. Because English is not his native language, Samuel struggles in traditional classroom classes. Despite that, he would rather meet face-to-face, or use a webcam to see emotions and gestures, than attempt to pick them up from text alone.

**Comment and recommendation.** Making content text-only does not necessarily make it more accessible. It works well with a screen reader, but there is no benefit for a hearing-impaired student. Instead of omitting all the media, more attention should be devoted to providing alternatives to pure audio, such as transcripts, or captions for video components. See the example in Figure 11.7 where a video segment is accompanied by transcripts and audio.

Webcam support is a common feature in instant messaging software, and students are increasingly comfortable with its use. While not every student can reasonably be expected to own a webcam, video messaging supported by text messaging would be of greater benefit to Samuel than a standard text-based forum, allowing him not only to see others' facial expressions, but also to encounter and practise spoken English at a functional level.

## CASE 2: TED

**Description.** Ted is an ESL teacher with a condition which causes his eyeballs to continue rotating when focusing on an object. He does not often use a computer, as he has to learn programs by memory rather than use visual cues. He finds himself lost when searching on the Internet.

**Issues.** For Ted, text tends to wobble: small text is very difficult to read, and line spacing must be great enough to clearly separate the lines. Ted increases the font size in his browser when reading from the Web.

**Comment and recommendation.** One of the main goals here was to help Ted focus on the page. The layout of the pages was improved and made easier to read, with shorter line length and greater line spacing. The graphics that are too small have a "magnifying glass" option to zoom the image. See example in Figure 11.8.

Location cues are critically important for Ted. This was implemented by highlighting the title of the current page in the left-hand navigation menu, which can be seen in Figure 2. This is a benefit not only for those with visual impairments, who can refer to the highlighted line as a visual bookmark, but also for people with learning disabilities or those whose native language is not English, who benefit from the reinforcement of location information in the title and navigation menu of the page.

Use of a screen reader, such as Wynn, is recommended. The tool highlights the lines of text currently being read. Ted uses his finger to follow the line of text. This software will help his eyes focus on the highlighted portion of the content, as well as provide an audio option.

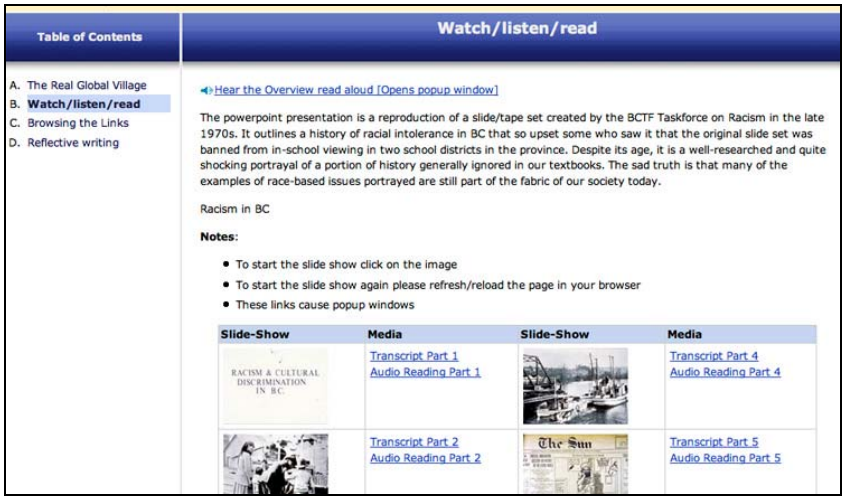



*Figure 11.7. Providing audio and transcripts with a media component*

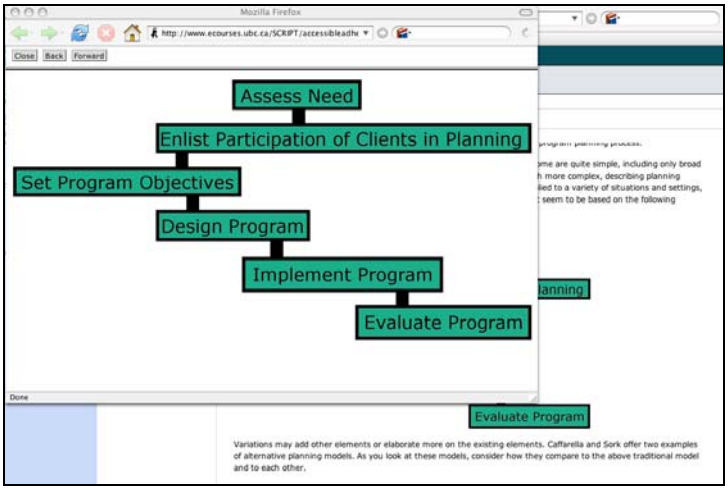



*Figure 11.8 Enabling "magnifying glass" to zoom the image*

## CASE 3: ROBERT

**Description.** Robert had nerve damage to his right hand and cannot use a standard keyboard. A standard mouse is also difficult for him to use, so he usually uses a tablet. He recently acquired a Frogpad, a one-handed, 20-key keyboard that uses key combinations. So far he can type about 10 to 20 words per minute.

**Issues.** Robert requires additional time when writing exams, especially when handwriting; he prefers to type even though it is still slow. He says he would be unlikely to use a discussion board or chat room. To date, he has not used voice tools, but says he could not use them in a crowded lab.

**Comment and recommendation.** Making special arrangements for assignments, such as extending the deadline, or submitting it in a different format is a solution that has to be discussed with an instructor. Students who have problems and need special accommodations often do not report them to their instructors. A note coming from the instructor or administrator at the beginning of the course, explaining the possibilities of those accommodations, will encourage students to express their concerns.

Introducing audio tools, such as voice discussion boards or voice instant messaging, may save Robert's typing time and effort. If access to the necessary hardware could be obtained, assignments that can optionally be submitted in alternative formats, such as audio or video presentations, may also be appropriate.

## CASE 4: GEORGE

**Description.** George has been blind since birth, and relies on a computer with JAWS for Windows, a talking screen reader program, which enables him to access the Internet as well as many other PC applications.

**Issues.** George has taken courses online in the past, but finds WebCT cumbersome to navigate. The popular course management system is based on framesets, which are not optimal for JAWS, as when a single frame updates it is difficult for a blind listener to determine what has changed on the page. Navigation is distributed across multiple framesets and implemented in JavaScript, which behaves differently in the JAWS reader than standard HTML.

**Comment and recommendation.** Many of the improvements that can help students such as George are the familiar guidelines of the WCAG. Here, the challenge is not simply to adapt the material, but to make course developers aware that these changes are necessary.

One such example is a diagram that is not easily described with a few words in Figure 4, a longer description was needed. This piece of text explains the diagram, ensuring that no relevant information is lost.

George, who is interested in a radio broadcasting career, was asked if he would prefer to submit assignments as audio readings rather than written assignments. He responded that the material for an audio reading must either be prepared as written text in advance or else the final audio must be edited, which is a less accessible option for a blind user than a standard text editor. Nevertheless, he was appreciative of the idea of offering students alternatives.

# References


*A profile of disability in Canada*, 2001. Retrieved May 16, 2006, from Statistics Canada website: http://www.statcan.ca/english/freepub/89-577-XIE/canada.htm

Draffan, E. A. & Reinger, P. (2006). A model for the identification of challenges to blended learning. *ALT-J.*

*Faculty & Staff Disability Resources: Accommodating students with disabilities*. (n.d.) Retrieved May 16, 2006, from University of British Columbia, Student Services website: http://students.ubc.ca/facultystaff/disability.cfm?page=students

Ivory, M. & Chevalier, A. (2002). A study of automated web site evaluation tools. Technical Report UW-CSE-02-10-01. University of Washington, Department of Computer Science and Engineering. Retrieved March 2006, http://scholar.google.com/url?sa=U&q=ftp://ftp.cs.washington.edu/tr/2002/10/UW-CSE-02-10-01.pdf

Jeffels, P. (2005). Usability, the practical approach to accessibility. *ALT-N online 1.*

Jeffels, P. & Marston, P. (2003). Accessibility of online learning materials. SCROLLA Invited Paper

Kelly, B. & Sloan, D. (2005). Forcing Standardization or Accommodating Diversity? A Framework for Applying the WCAG in the Real World. Paper presented at International Cross-Disciplinary Workshop on Web Accessibility. Chiba, Japan on May 20, 2005. Retrieved March 2006, http://www.ukoln.ac.uk/web-focus/papers/w4a-2005/html/

Microsoft Accessibility: Technology for Everyone (2005). Renton Technical College Pilot Project Provides Accessible Technology to Help Overcome Barriers to Learning. Retrieved June 2006, http://www.microsoft.com/enable/casestudy/rtc.aspx

Muir, Adrienne & Oppenheim, Charles. (2001, September). Report on Developments World-Wide on National Information Policy. Department of Information Science, Loughborough University. Retrieved August

6, 2006, http://www.la-hq.org.uk/directory/prof_issues/nip/universal.htm

*Section 508 Standards* (2006, January 23). Retrieved May 16, 2006, http://www.section508.gov/index.cfm?FuseAction=Content&ID=12

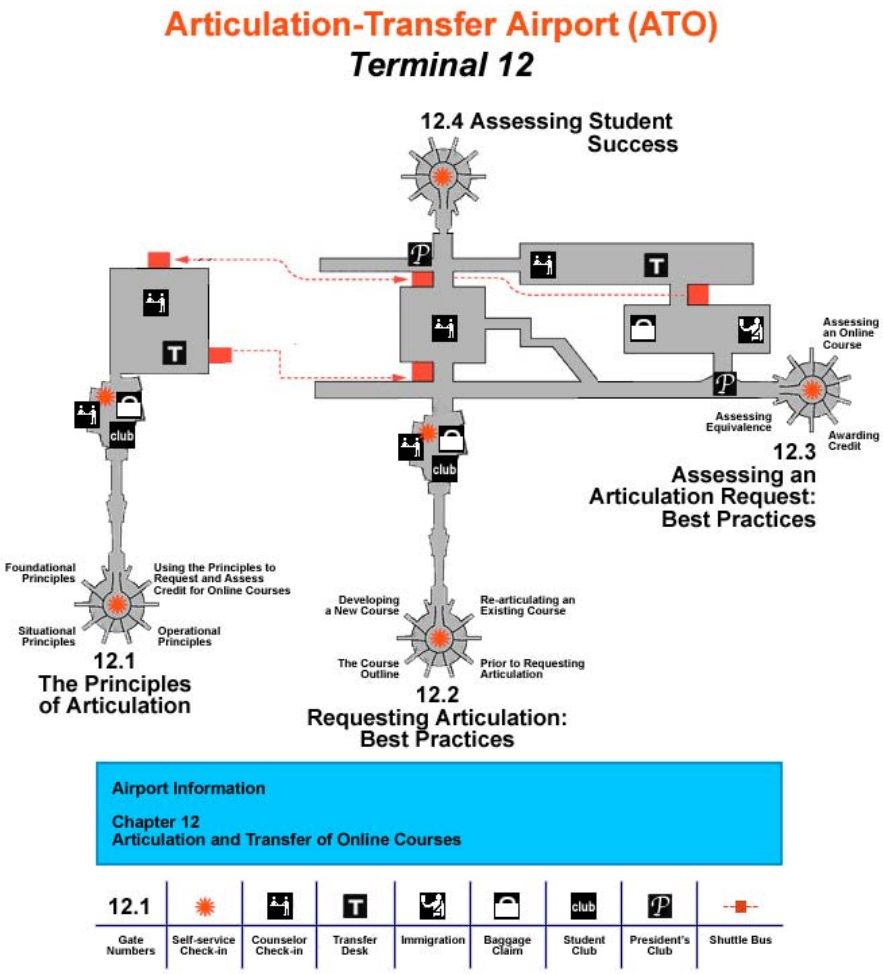
W3C. (1999a). Checklist of Checkpoints for Web Content Accessibility Guidelines 1.0. Retrieved August 5, 2006, http://www.w3.org/TR/WAI-WEBCONTENT/full-checklist.html

W3C. (1999b). List of Checkpoints for Web Content Accessibility Guidelines 1.0. Retrieved August 5, 2006, http://www.w3.org/TR/WAI-WEBCONTENT/checkpoint-list.html

# 12
# *Articulation and Transfer of Online Courses*

Finola Finlay

'Cause it ain't transfer any more: it's mobility. – Clifford Adelman, Senior Associate at the Institute for Higher Education Policy, Former Senior Research Analyst, US Department of Education



# Learning outcomes

After completing this chapter, you should be able to:

- Identify the important characteristics of an online course outline.
- Use sound principles to articulate an online course for transfer credit.
- Minimize transfer difficulties for students who take online courses.

# Introduction

As the quote from Dr. Adelman[15] illustrates, students are mobile. They move between post-secondary institutions, carrying their accumulated credits with them in the expectation that the learning they have acquired will be acknowledged by the next institution they attend, that they will receive appropriate transfer credit for relevant courses they have taken and be able to apply that credit to fulfill program requirements. Formal transfer systems have been a feature of the higher education landscape for at least 50 years in North America, and are rapidly developing in Europe (though the European Credit Transfer System) and elsewhere. Online learning has had a significant impact on mobility and transfer: students can and do access high quality courses from all over the world, and deserve to be awarded transfer credit for their learning, where it fits with their educational program.

In any post-secondary environment where transfer of credits is permitted and encouraged, transfer credit is based on course equivalency. Within a provincial, state or national transfer system, course-to-course transfer credit is often established as soon as a new course is developed, in advance of any student enrolling. The process begins when the sending institution submits a course to the receiving institution, with a request that the receiving institution assess the course for equivalence to one of its own courses. Once that assessment has taken place, and transfer credit awarded, a course is said to be "articulated." For example, a college course on the Sociology of the Family, Soci 220, may be assessed as equivalent to a university course called The Modern Family with the number Soc 235. Or, there may be no direct equivalent at the university, and the transfer credit awarded might be for "three credits in second year sociology". The transfer credit is listed in the institution's database, and students know in advance what credit they will receive after transfer for the sociology course they have taken.

In some jurisdictions higher level articulation agreements are often negotiated, such as 2+2 agreements (associate degree to degree, diploma to degree) or agreements about the general education curriculum. Such agreements can be local or statewide but the principle at the heart of the transaction remains the same: transfer is awarded when an assessment of the curriculum, program or courses at the sending institution reveals an appropriate match with that at the receiving institution. The other common way in which transfer credit is assigned is on the basis of a student request: the student presents a transcript, and an analysis is conducted of the equivalence of the courses he or she has taken to those in the institution to which he or she is transferring. Such case-by-case assessments may remain one-off, but may also result in formal or recorded articulation agreements.

Articulation, then, is a process of jointing two or more elements, to allow them to function as a coherent whole (as the femur is articulated with the tibia to form the main structure of the leg) and through this process students can move from institution to institution while maintaining a sound educational program and working towards their chosen credential. Articulation agreements, whether course-to-course or higher level, have traditionally been negotiated locally, either between a university and its nearest feeder institutions, or within a state or provincial transfer system in which institutions are familiar to each other, and relationships and infrastructure are developed to support the transfer environment. They have also predominantly been concerned with the assessment of courses offered in the traditional and familiar face-to-face classroom environment.

Increasingly, however, institutions are being asked to assess the equivalence of courses taught in online formats. Herein lies a central dilemma for a transfer environment—transfer systems are organized locally, but online education is developed and delivered globally.

Faculty who assess online courses may be faced with several challenges: the time available for the task, the level of information available about the course and the institution delivering it, their own understanding of the norms of an online environment, their own commitment to online learning, and their institution's policy regarding the acceptability of online courses or regarding the accreditation status of the sending institution.

[15] *Building a Culture of Transfer*. Keynote address, Fourth Biennial Conference on Articulation and Transfer, Tempe, Arizona, July 2007.

Even within an integrated post-secondary environment characterized by open and transparent articulation relationship, faculty frequently raise the question of whether mode of delivery can affect, or should affect, the articulation of a course. For example, in British Columbia, faculty members from each institution in the BC Transfer System meet every year in discipline-based groups, known as Articulation Committees. These committees operate under the aegis of the British Columbia Council on Admissions and Transfer (BCCAT). Meeting minutes collected by BCCAT reveal that the articulation of online courses is often debated (BCCAT 2005). Issues and concerns are varied:

- Many groups are enthusiastic about converting their curriculum to online delivery formats, and see this mode of delivery as attractive to potential students
- Concerns are raised about quality control, and about assessment methods used in online courses and how student evaluation is safeguarded and authenticated
- Some faculty worry about the use of online delivery for students who need intrinsic motivation, structure and an encouraging classroom atmosphere, especially academically fragile students in developmental programs
- Faculty query how lab, field work, practica, and other non-classroom experiences can best be organized in online courses.

Where such discussions become problematic is where, in the absence of reliable information and processes for assessing equivalence, faculty and administrators with concerns about online learning deny transfer credit to students who have successfully completed online courses.

In some cases, the accreditation of the institution delivering the online courses is cited as the reason for denying transfer credit. In this scenario, the courses are often not assessed. Rather, credit is denied on the basis of where the course was taken, regardless of its quality or content. Carnevale (2002) outlines the "rude surprise" awaiting students who try to transfer such courses.

Concerns will always exist about the quality of some deliverers of courses and programs, including online courses. However, for legitimate institutions and their students, it is vital that evaluators can rely on excellent information about the online courses and can call on sound principles and processes to evaluate them for transfer credit. In this transaction, both deliverer and evaluators have parts to play. The ultimate beneficiaries of a sound articulation process, however, are the students, who can be assured that their learning will be appropriately recognized. All articulation should, after all, support the fundamental principles of equity on which an articulation environment is built: *that students should not have to repeat content which they have already mastered, nor be denied credit because of technicalities. Nor should they be credited with learning they have not acquired, especially if that learning is fundamental to their advancement to further study, or a required element of their program* (Finlay 2005, p. 7).

Many jurisdictions and organizations publish "best practice" statements for online education. For a good example see the Commission on Institutions of Higher Education (CIHE, no date) *Best Practices for Electronically Offered Degree and Certificate Programs.* Others provide sets of guidelines exhorting their members to be fair and reasonable. However, most of these documents provide little guidance as to what "fair and reasonable" actually looks like in practice. Few resources exist that will assist practitioners at sending institutions to ensure the successful articulation of their online courses, and give the assessors at receiving institutions the tools they need to make confident decisions. This chapter aims to fill that gap.

# The principles of articulation

When considering how to articulate a course for transfer credit, evaluators are faced with numerous decisions. Fortunately, they can turn to a number of principles to guide them as they try to ensure that courses are articulated fairly and consistently. These can be divided into *foundational principles, operating principles,* and *provisional principles*.

## FOUNDATIONAL PRINCIPLES

Foundational principles are those which lie at the core of decisions about *all* articulation of courses and programs.

- ***Equivalence:*** Equivalent means "equal in value".[16] A course submitted for articulation will likely never be identical to the corresponding course at the receiving institution. The assessment of equivalence involves identifying the degree to which it matches in content or outcomes. Discipline and program contexts will dictate the relative importance of the similarity.
- ***In lieu:*** The act of awarding transfer credit implies the acceptance of a course *in place of* a course or program requirement offered at the receiving institution. The course to be transferred does not have to be

[16] *Oxford Dictionary.*

identical to the course for which transfer credit is granted, but the degree of similarity should ensure that students will have the necessary knowledge and background to be successful in more advanced courses.
- ***Applicability:*** It is appropriate to award transfer credit for courses that can be used to fulfill the specific or general requirements of a credential or program at the receiving institution.
- ***Fairness:*** Provisos and restrictions (such as adding a specific grade requirement) should not be placed on equivalent courses unless those same restrictions apply at the institution awarding the transfer credit, or there are clear and defensible reasons for doing so.

### SITUATIONAL PRINCIPLES

Situational principles provide useful guidance but are not universally applicable. While they form part of the decision-making toolkit for articulation, situations and contexts create provisos for their application. Two such principles are relevant to the articulation of online courses.

- ***Pedagogy:*** Under some circumstances it is appropriate to consider *how* a course is taught. Factors such as cultural sensitivity, or opportunities for practising skills, may be integral to content mastery. See "Awarding Credit" below, for more on pedagogy.
- ***Delivery:*** How a course is delivered is normally immaterial to its articulation, since teaching a course in a distance delivery format (as opposed to face-to-face) should not affect its equivalence. However, there may be occasions where the content is intrinsically linked to delivery, and an alternative mode impacts on equivalence. It may also be relevant whether a course is offered only online, or if an online course is a version of a course normally delivered in a traditional classroom.

### OPERATIONAL PRINCIPLES

Operational principles refer to practices and attitudes that will facilitate articulation. In the case of online courses the following two are relevant:

- ***Comparability:*** Since it should be possible to compare courses, the elements of the course must be clearly outlined and should be interpretable by faculty in the same or a related field. The best assurance of comparability is a course outline that is comprehensive enough to allow for the assessment of equivalence, and that conforms broadly or specifically to the local norms of course description.
- ***Transparency:*** Assessment practices should be open to scrutiny. Any individual who assigns transfer credit based on the assessment of a course should be prepared to explain the reasons for the decision, including any influencing factors.

### USING THE PRINCIPLES TO REQUEST AND ASSESS CREDIT FOR ONLINE COURSES

The course developer (at the sending institution) and the course assessor (at the receiving institution) both have a part to play in ensuring that appropriate transfer credit will be allocated when a student transfers. The onus is on the course developer to provide accurate, detailed and honest information about the course, while the assessor must base his or her decision on sound principles, and act fairly and in the best interests of the student.

## Requesting articulation: best practices

### DEVELOPING A NEW COURSE

Every course fulfills multiple objectives for students, instructors, departments, and institutions, and all those objectives must be taken into account as the course is being developed. Sometimes other objectives are more important than that of transferability. For example, if a college has determined that students have difficulty with certain content, it may develop a remedial course designed to bring them up to the standard of knowledge required for subsequent success in the discipline. This is sound pedagogical practice, even though the course may be denied transfer credit because it is viewed as preparatory. There are other reasons why a course may be difficult to articulate: it may be unique in the system, for example, or may be offered in response to localized social or economic conditions, or to take advantage of faculty specialization. At the same time, if a course *is* designed to transfer, it must be consistent with the norms, content and standards of the receiving institutions with which articulation is sought. It does not have to be identical to a course at a receiving institution—in fact, if it is to articulate widely, it must often integrate aspects of similar courses at several institutions.

### THE COURSE OUTLINE

A detailed course outline is the starting point of any articulation process, since articulation demands a close examination of course elements in order to establish

equivalence.[17] While most institutions have developed satisfactory course outline templates for traditional courses, they do not always contain the level of detail necessary to establish equivalence. In the case of an outline for a new online course, besides ensuring it contains all the necessary information to ensure that an assessor can determine equivalence, special attention should be paid to the following course elements:

- Student evaluation, including how exams are safeguarded, and authentication measures to identify students taking exams. The importance of providing this information can not be overstated. The CIHE Best Practices document states:

  > When examinations are employed (paper, online, demonstrations of competency, etc.), they take place in circumstances that include firm student identification. The institution otherwise seeks to assure the integrity of student work.

- If proctoring is used, what are the procedures for selecting proctors, establishing student identity, assuring security of test instruments, administering the examinations, and assuring secure and prompt evaluation?
- If other methods are used to identify those who take the examination, how is identification firmly established? How are the conditions of the examination (security, time limits, etc.) controlled?
- Does the institution have in place effective policies and procedures to assure the integrity of student work?
- How hours are assessed, and what is expected from the student for hours of learning versus hours of instruction.
- How labs, practica, field work, or other non-classroom requirements are supervised and assessed.
- Expectation regarding academic honesty. For example, the student Handbook for Charter Oak College in Connecticut (http://www.charteroak.edu) states:

  > Charter Oak State College may discipline a student in the following situations:
  >
  > For academic dishonesty, which shall in general mean conduct, which has as its intent or effect the false misrepresentation of a student's academic performance including but not limited to: (a) cheating on examination; (b) plagiarizing, including submission of another's ideas or papers as one's own; (c) stealing or having unauthorized access to examinations; (d) falsifying records, transcripts, test scores or other data or (being represented by another individual for all or part of a distance learning course.
  >
  > By registering for a Distance Learning course, a student attests that all assignments submitted and examinations completed are the work of the enrolled student. Dishonesty will result in an "F" in the course and may incur other disciplinary action for Charter Oak State College students including dismissal from the College.

- How student learning is supported in the online environment, including provision for collaboration between students and interaction with instructors.
- How library or other learning resources are accessed and used and the expectations for original research and use of such resources.
- Links to institutional and program URLs, and to any additional helpful information such as institutional policies regarding instructor credentials, lists of faculty associated with the program, or institutional or program accreditation or authorization.
- Whenever possible, a statement specifying what general or specific transfer credit the course should be awarded, including the year level credit. If the course has already been offered, existing articulations should be listed, along with a link to any online transfer guide containing that listing.

All course outlines should provide a detailed list of the topics covered, even if learning outcomes are also specified. Faculty members at institutions that do not design their courses from an outcomes perspective need detailed topic-based information to determine the best transfer equivalence.

## PRIOR TO REQUESTING ARTICULATION

***Check existing articulations.*** Search your state or provincial transfer guides, or those for nearby institutions, for similar courses. By this means it is possible to establish which other sending institutions have equivalent

[17] A *Transfer-Friendly Course Outline Form* can be found online at www.bccat.bc.ca/outline. This resource was developed to help reduce the number of situations where transfer is denied because of inadequate content and detail in the outline.

courses already receiving transfer credit. Those course outlines may be instructive, since they already receive the desired credit.

***Consult colleagues***. Once a draft course outline is ready, a developer can use the expertise of articulation committee members or willing colleagues for advice or feedback.

***Reflect on, and balance advice received.*** Asking for advice and feedback on a course can be a sensitive area for faculty. Professional responsibility and autonomy include the freedom to develop and teach a course according to one's professional judgment. Requesting advice from a faculty member at the receiving institution acknowledges that the receiving institution may exert some influence over the content or the structure of the course. Occasionally, a faculty member from a receiving institution responds by requesting modifications that may be unacceptable to the sending institution or that may compromise the transferability of the course at other institutions. In these instances, best practice involves communicating as diplomatically as possible and seeking a mutually acceptable solution.

***Decide when "no credit" is acceptable.*** It is recognized that in some instances an award of "no credit" is appropriate, and is acceptable to the sending institution. For example, it may be important that students understand clearly that a course will not receive transfer credit at certain institutions, since they will then be in a better position to plan their transfer program. If an award of "no credit" is not acceptable, continued negotiation will be necessary.

***Ensure that students are clear about transfer credit***. Many student complaints about transfer credit occur because of a false expectation that a course will transfer, or will transfer as *assigned credit* rather than *unassigned credit*, or will satisfy a program requirement. Instructors should include information regarding course transferability in course syllabi, wherever possible.

## RE-ARTICULATING AN EXISTING COURSE

Many online courses have already been delivered for years in traditional face-to-face mode. When a course has been redeveloped for online delivery, the question arises whether or not it should be re-articulated. However, once a course has been articulated and transfer credit established, it should be re-articulated *only* if the redevelopment results in *substantive* change.

- *Substantive change to content or subject matter, or to objectives or outcomes*. Course articulation is based on the principle of the equivalence of academic achievement and of knowledge and skills. Substantive changes, therefore, are changes to the content, subject matter, topics covered, or objectives/outcomes that will alter the equivalence of the course and therefore will likely the transfer credit which the course is awarded at other institutions. This is not intended to include relatively minor changes in topics, changes in texts, materials, or assignments, reasonable modifications to learning outcomes, or changes intended to update the course or keep it in line with the evolving norms of the discipline. Nor is it intended to include change in delivery mode, unless that change substantively affects the elements listed above.
- *Substantive changes to assessment criteria or evaluation methods, only if certain assessment methods or weighting are integral to the articulation of a course.* For example, some institutions require all courses, or certain courses, to have a final exam, and some require that a percentage of the final grade be based on a final exam. In the case of online courses, changes in evaluation methods may be considered substantive if, for example, they impact on the perceived integrity of the exams or assignments.
- *Changes to the number of credits assigned to the course, or to the number of contact hours.* Normally, a change to credit hours signals that content has been added or subtracted. Such changes affect equivalence and in turn the transfer credit assigned to the courses, including the number of credits awarded. Therefore re-articulation is appropriate.

# Assessing an articulation request: best practices

In each discipline the traditions, norms, and body of knowledge of that discipline exercise a broad influence over what is appropriate to cover in introductory, intermediate and advanced levels. Additionally, each institution's academic governance normally scrutinizes and approves every new course and program, and assesses its suitability for inclusion in the calendar. At the same time, the norms of academic autonomy include the right and responsibility of faculty members to design and teach a course according to their own professional judgment, faculty teaching the same course in the same institution may choose different texts, readings, assignments, exercises, topics and evaluation methods. In the same way, a post-secondary course with the same name or title will not be identical from one institution to another, and the degree of similarity may vary according to the discipline.

## ASSESSING EQUIVALENCE

There are several approaches to assessing equivalence.

- *Content:* There is no universal rule regarding the percentage of match since it is recognized that an appropriate match can vary from discipline to discipline. In some disciplines, where mastery of key concepts is prerequisite to success in subsequent courses, it may be vital to have a substantial match of content in courses. Some institutions or disciplines have developed a rule of thumb for the percentage of match while others make case-by-case judgments. Best practice, however, is to avoid inflexible rules about percentage of match, and to focus on discipline and context-appropriate content.
- *Outcomes:* Courses can have similar goals, objectives, aims, and outcomes, even if the content varies. For example, two writing courses may use different texts, assignments, instructional styles, methods of delivery, and evaluation and grading practices, and yet have the same goal of teaching students to write at a post-secondary level.
- *Level:* A course which has no equivalent in the calendar of an institution may still be suitable to satisfy some of the elective requirements of a credential. For example, some institutions may not offer linguistics, criminology, religious studies, archaeology, languages, or courses in applied and professional studies. However, if a course is taught at the appropriate level and the standard expected of students is equivalent to that of the credential to which the credit can be applied, it can be deemed equivalent for the purposes of awarding unassigned or elective transfer credit.

## ASSESSING AN ONLINE COURSE

Evaluating a course for transfer credit involves assessing its equivalence to a specific course at the receiving institution. Evaluators must take a fair and balanced approach to the assessment of all courses, and this should be no different for online courses. The assessment must be based on the variables of equivalence, as outlined above, and delivery mode should only be taken into account if it appears likely that it unduly impacts on the equivalence of the course to possible matching courses at the evaluating institution.

If a realistic assessment is not possible, because of the paucity of information provided by the sending institution or the student, reasonable efforts should be made to request a satisfactory course outline, upon which a sound decision can be based. While the onus for procuring this has often been placed on the student, electronic communication methods have made this easier. However, the reality is that an evaluator only has so much time for the assessment task, and cannot be expected to hunt down information. Given this, it is fair to reject a request for transfer credit if the evidence presented does not allow for an adequate assessment of equivalence, or raises unanswered questions about the integrity of exams, the hours of learning expected, or any other variable deemed as a *sine qua non* in a reasonable assessment process.

## AWARDING CREDIT

For a student, the best type of transfer credit is assigned credit. Transfer credit is assigned when a course is assessed as being equivalent to a specific course at a receiving institution. For example, College X MATH 111 = University Y MATH 100.

Most credentials require that students complete certain courses at each level. Awarding *assigned* credit allows students to demonstrate that they have fulfilled requirements. Therefore, it is sound practice to award assigned credit wherever possible.

If the course is appropriate for credit in the discipline, but no close match can be established with a department's courses, then "unassigned" discipline-specific transfer credit can be awarded. This type of credit verifies that the course is taught at the expected level and standard, that it conforms to the norms of the discipline, and that it is suitable as an elective credit within a degree program. Students can usually use unassigned credit to fulfill general program requirements. More general designations, such as "Arts (3)" or "Humanities (3)" can be used where the receiving institution does not have a corresponding discipline, but the course is identifiable as appropriate for elective credit within a faculty or program. If the course has no corresponding discipline, program, or faculty, but is obviously at the appropriate academic level, the receiving institution can use a designation such as "general elective." In rare cases, an institution may use this more general designation for a course for which they have a corresponding discipline, but which appears to fall outside the norm for how similar courses are delivered or organized at the institution.

"No credit" is an articulation, and will appear in the institutional or provincial/state transfer guide. Awarding "no credit" means that a student is denied credit for learning achieved, and must replace that credit with additional coursework. This is expensive for the student, the institution, and the system. Where an institution does not offer a similar course or program, every effort should be made to award a minimum of elective credit.

There are two situations in which it is acceptable to award "no credit".

- The course is not taught at the post-secondary level. A course which appears to be English composition, but which is really English as a Second Language, will be evaluated as being preparatory. Many courses are not designed for transfer (e.g., purely vocational courses such as welding, or preparatory courses such as high school algebra) except to similar programs at other institutions. Occasionally such courses are submitted for articulation in error.
- A "no credit" is appropriate when it is clear that there is no possibility of the student applying credit for the course towards any program at that institution. For example, a specialized course in a technology, a practicum course for a professional program, or a studio or field course in a subject not congruent with the programs at the receiving institution may not be applicable to any credential.

A word about pedagogy: normally, *how* a course is taught is assumed to be immaterial to the assessment of equivalence, but there are some cases where the manner in which a course is structured and taught is integral to content mastery. For example, at one university, in order to assign a W ("writing intensive") designation to a course, a committee assesses the nature and number of opportunities for students to write and revise. In some First Nations courses culturally sensitive pedagogy may be inextricably linked to course content. In such cases, best practice requires the receiving institution to communicate its expectations clearly.

# Assessing student success

In the British Columbia Transfer System, as in many other systems, the effectiveness of the transfer system is subject to intense examination. One approach to this is to assess the performance of students after transfer, to evaluate the extent to which their sending institution has prepared them well for more advanced courses, and by extension whether the articulation process can hold up to scrutiny. Numerous research approaches have demonstrated consistently that the transfer system in British Columbia is very effective indeed. Students graduate at similar rates to those students who enter universities directly from secondary school (direct entrants), and achieve comparable grades. Five years after graduation, transfer students are virtually indistinguishable from direct entrants.

In one case, however, research into student performance pointed to an issue affecting an online course: students were enrolling in suspiciously large numbers for a English course offered online by a college, and achieving higher grades than appeared warranted by their scores in English placement tests. Due to effective communication between the institutions involved, the issue was addressed immediately by the responsible institution and steps were taken to rectify the situation, caused by insufficient oversight of student assignments and exams. However, such instances can shake the faith of many in the system in online course integrity and contribute to the hesitancy with which some evaluators approach the awarding of transfer credit for online learning. It is imperative that, in an articulated system, both sending and receiving institutions are open to scrutinizing the effectiveness of their transfer agreements, and the integrity of their course delivery methodologies.

# Summary

Best practice in articulation refers equally to online courses as to face-to-face courses. Course developers should ensure that they do their homework in advance of requesting credit or offering the course, to ensure that the course, and the students who take it, will receive appropriate transfer credit. Once the course is underway, instructors must ensure that all possible safeguards are in place to maintain the integrity of evaluation of student performance. Evaluators, on the other hand, need to make decisions based on sound principles, and to judge a course by what is really germane to its equivalence, and not allow themselves to be inappropriately influenced by its delivery mode. Working with the institutional research office to keep track of the subsequent performance of transfer students, including those with online courses, will build faith in the articulation process and help it stay on track.

As online learning increases in popularity and availability, it will become more and more important to ensure that descriptions of online courses are honest, detailed and accurate, and that decisions regarding transfer credit are sound, transparent, fair, and defensible. Paying close attention to both sides of the articulation equation will ensure that students can use online learning most effectively as they progress towards their educational goals.

> "The new electronic independence re-creates the world in the image of a global village". – Marshall McLuhan

# Glossary

**Articulation.** The process used by post-secondary institutions to determine which courses are equivalent to one another. Articulation is normally a course-to-course analysis or comparison, but it can also involve whole programs. By extension, articulation refers to the development and implementation of agreements that provide for inter-institutional movement of students or the connecting of two or more educational systems.

**Assigned credit.** Transfer credit is assigned when a course is assessed as being equivalent to a specific course at a receiving institution.

**Course outline.** A description of the main content, organization and expected outcomes of a course, normally including the number of credits awarded for successful completion, hours of class time required, evaluation procedures, assignments, texts, and readings. In this chapter, a course is assumed to be the "official" description of a course upon which articulation decisions are based. (See also: **syllabus**)

**Credit.** The value assigned to a course. For example, many courses are valued at three credits. Most credentials specify the number of credits to be earned.

**Receiving institution.** The institution to which a student intends to transfer. In an articulation agreement, it is the institution which grants credit for course work completed at a sending institution.

**Sending institution.** The institution from which a student is transferring. In a transfer agreement, it is the institution where the courses were completed.

**Syllabus.** An individual instructor's version of the official course outline (See: **Course outline**), normally distributed to students at the first class.

**Transfer Credit.** The granting of credit towards a credential by one institution for programs or courses completed at another.

**Unassigned credit.** Transfer credit is unassigned when a course is assessed as being of a university level but not equivalent to a specific course at a receiving institution.

# References

BCCAT 2005. *Articulation Committee Meeting Summary*, available online at http://www.bccat.bc.ca/articulation/summary.cfm.

Carnevale, Dan 2002. *Missed Connections" Online colleges complain about traditional institutions' tough credit-transfer policies*. The Chronicle of Higher Education, Volume 49, Issue 8, Page A35.

CIHE, no date. *Best Practices for Electronically Offered Degree and Certificate Programs,* available online at http://www.neasc.org/cihe/best_practices_electronically_offered_degree.htm.

Finlay, Finola 2005. How to Articulate: Requesting and Assessing Credit in the BC Transfer System. BC Council on Admissions and Transfer, Vancouver.

# 13
# *Planning Your Online Course*

June Kaminski and Sylvia Currie

Designers must do two seemingly contradictory things at the same time: They must design for perfection, and they must design as though errors are inevitable. And they must do the second without compromising the first. – Bob Colwell (2002)

# Learning outcomes

After completing this chapter, you should be able to:

- Identify the primary considerations for planning an online course.
- Distinguish among design approaches.
- Apply the planning phase to your own course design context.
- Map your course elements and identify needs to support your design approach.

# Introduction

> "The more you plan, the more room you leave for spontaneity". – *Vella (2006)*

Where does the process of planning a course begin? Where does it end? What does a course plan look like, and how does it differ from a course design?

This chapter provides an overview of the broad considerations in preparing an online course plan. A plan is a starting point for moving forward with the design, implementation, and evaluation of an online course:

- Who will you work with to design the course?
- Who will take the course and why?
- What do we know about the learners?
- How do instructor styles factor into the planning?
- What are the main components of the course?
- How will the course be organized?

Even the most open-ended learning activities begin with a plan. However, a plan will, and should be, refined and adjusted during implementation. In this sense a plan evolves, but it continues to provide a sidebar of sorts; something to guide the decisions about the design work that needs be carried out. A plan can be both an ongoing reality check, and way to focus on important elements of a course design.

# Can you make patterns from clouds?

> "Part of the plan is knowing that the situation will compel you to change your plan". – Vella (2006)

A course plan can take on a variety of shapes, and is always informed by context: the audience, the venue, and the resources you have available to you. It is also informed by the educational values, beliefs, and philosophies of the design team. With so many possibilities and unknowns, how can we work towards a common language of what planning is all about?

The most basic question to begin with is, *why design* an online course. The emphasis here can be on the word *why,* or on the word *design*. A very common response to the question *why* is that learners will be geographically distributed, and having a course online is an obvious solution. However, an online course, or a course enhanced with online resources and communication tools, will add educational value to any face-to-face course by making resources available to learners and by providing opportunities to deepen learning through dialogue and sharing. In this sense the divisions between online courses and campus-based courses are becoming hazy. So the question of *why* is shifting from technology as a means to change the delivery method to technology as a means to enhance learning.

A more philosophical but very practical question emphasizes the word *design*. Is it important to create a structure in a virtual environment? How much design work should be done before involving the learners in the curriculum process? These questions have challenged educators for some time, and they seem especially complex when applied to designing online courses. Where then do we turn for guidance?

Some would argue that instructional design literature does little to guide the process of planning online courses because there is insufficient consideration for the social context of learning (Le Blanc, 2003). Furthermore, the recent advances in technologies to support networked learning,[18] or more informal connections among people and information, are challenging our notions about advance planning and fixed design of online spaces. Consider this description by George Siemens:

> By recognizing learning as a messy, nebulous, informal, chaotic process, we need to rethink how we design our instruction.
>
> Instruction is currently largely housed in courses and other artificial constructs of information organization and presentation. Leaving this theory behind and moving towards a networked model requires that we place less emphasis on our tasks of presenting information, and more empha-

[18] For interesting discussions and resources related to networked learning see the work of Leigh Blackall http://leighblackall.wikispaces.org/

sis on building the learner's ability to navigate the information—or **connectivism**.

Blogs, wikis, and other open, collaborative platforms are reshaping learning as a two-way process. Instead of presenting content/information/knowledge in a linear sequential manner, learners can be provided with a rich array of tools and information sources to use in creating their own learning pathways. The instructor or institution can still ensure that critical learning elements are achieved by focusing instead on the creation of the knowledge ecology. The links and connections are formed by the learners themselves. (Siemens, 2002)

The best plan will anticipate learner experiences, but provide plenty of opportunities for learner-defined goals and assessments. In broad terms, this would be called design for flexible learning. However, in practice, a systems and linear approach is often favoured because it ensures consistency and is more easily administered and supported at the organizational level. By planning out each **module** carefully in terms of instructional goals, content, assignments, and assessments, each course can undergo rigorous quality control.

Flexible and **systems approaches** represent opposite ends of the course planning spectrum, one more learner-centred (or more favourably referred to by Jane Vella (2001) as *learning*-centred ), and the other more teacher-centred. With each approach there are obvious considerations for your own context. While a systems approach may require substantial resources, it may be more effective for managing quality control and for preparing and supporting instructors. Brent Wilson (1995), a pioneer in e-learning, has been cautioning online course designers about the downside of a systems approach for the past decade: An environment that is good for learning cannot be fully prepackaged and defined A more **flexible approach** will open the doors to more possibilities based on learner goals and needs. However, as pointed out by Bates and Poole (2003), "a flexible approach requires a high level of skill to be effective".

So to revisit the central question: Can we work towards a common language of what planning is all about? What are the patterns in the clouds?

There are many helpful models to guide the design process, each informed by learning theory and each providing a set of actions by phase (often overlapping) in the design process. There are too many to expand on in this short chapter—an Internet search on "instructional design models" will yield a dozen or more.[19] A model is useful for providing a framework for managing course design and ensuring that all decisions are attended to. Furthermore, a good model is cyclical so that evaluation and reflection on implementation will always inform the next iteration of the course design. Keep in mind that while learning theory and prescriptive models help to guide the work, a model "should be used only to the extent that it is manageable for the particular situation or task". In other words, context is always at the core of the planning and design process.

*Figure 13.1. Photo "Mother and Child" by Joka http://flickr.com/photos/joka2000/*

Prepare by considering these four tips:

(1) Begin with relevant metaphors for learning. Often the language commonly used to describe e-learning dismisses the notion that learning with technology is a valuable experience in its own right. When we speak about "distance learning", "covering course content", and "delivering courses" we are imposing an intent and framework for learning that calls for little involvement from the learner.
(2) The focus should be first on the learning, and second on the technologies that will support that learning. Think of your primary role in the planning process as keeping learning, and not technology, at the centre of the design process. Plan to include team members in the design process who can provide the expertise required to carry out your plan and also take full advantage of the medium.
(3) Creating good online learning experiences requires effort. While the basic planning guidelines are the same for both face-to-face and online courses, "the process of planning a quality e-learning experience is very likely to be more complex and time-consuming

[19] See http://carbon.cudenver.edu/%7Emryder/itc_data/idmodels.html for a comprehensive list.

than planning a conventional classroom experience. (Anderson & Elloumi, 2004)

(4) Context is king! You can choose an instructional model that suits your project and personal beliefs about teaching and learning, but always be prepared to adapt.

# What are the roles of the design team?

> "The project management approach to developing and delivering technology-based teaching and learning ensures that resources are used efficiently and that individual team members contribute appropriate skills and knowledge to the project". (Bates, 2000, p. 68).

## OVERVIEW OF THE DESIGN TEAM

Online courses are designed using a variety of configurations. For quite some time, a very common approach focused on the single instructor acting as content expert, course writer, and designer. This approach is what has been popularly called the "Lone Ranger" or "laissez-faire" style (Bates, 2000). "Certainly, there is a time in an organization when the laissez-faire or Lone Ranger approach may be suitable, and that is when a university or college is just beginning to commit to the use of new technologies" (p. 66).

A number of factors favoured this approach to design, most notably, cost and workload issues. The 'going it alone' approach is still alive and well in the e-learning landscape, but some experts stress that the disadvantages of this method far outweigh the benefits. "It is too hit and miss. It wastes resources, ignores the experience and many lessons that have been learned outside the higher education sector about how to design and develop creative media products and services, and above all fails to ensure high-quality, technology-based teaching in any consistent or widespread form" (Bates, 2000, p. 66). On the other hand, there are expert instructors who do have the pedagogical, technical, and content expertise to create viable and high quality courses on their own (Struthers, 2002). However, in reality, there are several different configurations adopted by various institutions, ranging from the single-course author supported by information technology experts to the extensive project team approach described in this section.

Current instructional design and e-learning research and practice usually stress the need for a project team approach, where a diverse variety of experts work together to create high quality, pedagogically sound courses and programs. This project team can be made up of a number of people filling specific team roles, the most common include a project manager, content or subject matter expert, a content writer, a **multimedia** developer, an editor, and an instructional designer. Often, a concurrent instructional design approach is used, where each member works on their portion of the project simultaneously or "as needed", creating a modulated, synergistic milieu for designing the course or program. For instance, once the content expert and writer have determined the desired topics and inherent content, the multimedia and/or graphic designer can begin to work on the supportive visual and multi-sensory content or learning objects to augment the foundational content.

There are some drawbacks to using the project team approach to course design. The biggest hurdle may well be teacher buy-in. Most faculty, especially in higher education, are used to functioning autonomously, and may be resistant to sharing the design of a course because of intellectual property considerations. "The project management approach is often seen as a bureaucratic, expensive, and unnecessarily complicated process, and a process that restricts the freedom and autonomy of the teacher" (Bates, 2000, p. 72).

Another possible drawback is the notion that project management can restrict the creativity and/or originality of the course designer. Obviously, there needs to be open communication between administration and the various members of the project team to be able to design a top quality course together successfully. As long as each member of the team is respected for their own expertise and contribution, and the issues of ownership and copyright are amicably decided, most teachers feel some relief that creative and knowledgeable team members support their efforts. Unless an individual course designer is multi-talented, with skills in content writing, editing, multimedia design, and so on, it is unlikely that a truly interactive, original, dynamic course can be created all alone.

## HUMAN INFRASTRUCTURE

Four levels of human infrastructure support are fundamental to the development of any course or program, especially when done at an across-institutional, regional or national level (Bates, 2001). These include:

- **technology infrastructure support people** (design, maintain the learning network)
- **educational technology infrastructure support people** (design, maintain the learning interface structure such as navigation, screen components)

- **instructional design infrastructure support people** (coordinate the actual online course components and structure such as structure of learning activities or modules)
- **subject expert infrastructure support people** (design content, provide instruction).

## INSTRUCTIONAL DESIGN TEAM ROLES

Often, the human infrastructure needed to design a high quality course is best achieved by appointing a diverse instructional design team. Each member of the instructional design team fulfills specific roles.

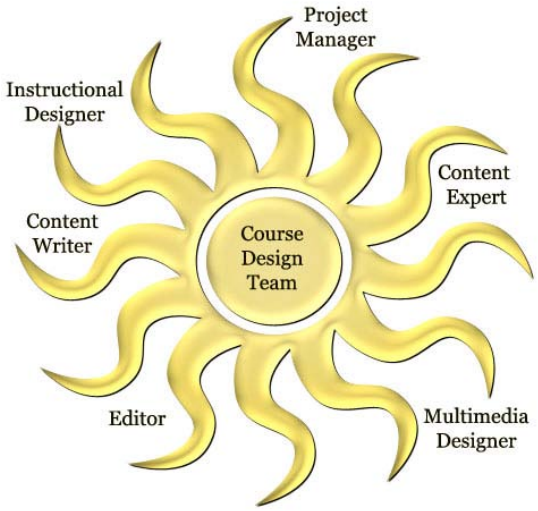



*Figure 13.2. The ideal instructional design team work together in synergy.*

### Project manager

The project manager or leader often applies project management methodology to organize the project plan in conjunction with the rest of the design team. Often, the project manager liaisons with the instructional designer to set project start and end dates, determine what resources are needed to fulfill each project task, and set the project goals, challenges, milestones, and needs. The project manager is also responsible for ensuring that all team members are able to fulfill their tasks on time, and responds to challenges as they occur across the project timeline. The manager also coordinates copyright adherence and final details of the course project.

### Instructional designer

The instructional designer is responsible for the course layout, branching, and positioning the written content within the online environment. Often the designer is involved with determining the course module or lesson objectives, the evaluative components, and may help the content writer and/or expert to develop the content. The instructional designer also works with the multimedia/graphics designer to determine the specific graphics, audio, video, movie and other multi-sensory components to augment the content. The role of coordination is often shared between the instructional designer and the project manager, to ensure consistency across the team, and to help identify problems and obstacles that emerge as the design process progresses.

### Content or subject matter expert

The content expert is the team member who has well developed knowledge about the subject content. The content expert usually works very closely with the writer to ensure that the core essentials of the determined content are current, accurate, and meet the learning objectives of the course or program. The content expert also assesses the written content to verify that it addresses the intended audience, and, in conjunction with the instructional designer, helps to decide what multimedia and graphical objects are required to make the learning experience rich and meaningful for the learners.

### Content writer

The content writer is the member who brings expertise in writing content for the course. Sometimes, one team member serves as both the content writer and subject matter expert. Their role entails researching the content, incorporating the input from the subject matter expert into the written component of the course (or sometimes, rewriting and editing existing content), and fashioning the content so that it suits the online course environment. The content writer works with the rest of the team to determine course and individual lesson objectives and other components, and selects the supportive materials such as text books and readings, usually with the content expert, instructional designer, and project manager.

### Multimedia and graphics designer/technologist

The multimedia designer is responsible for designing the animations, visual graphics, audio segments, and other multi-sensory objects that will support the instructional requirements of the course. Working with all members of the team, especially the course writer, expert, and instructional designer, the multimedia designer helps to bring the course to life, providing a robustness and aesthetic appeal to the course design.

### Editor or technical writer

The editor is responsible for ensuring that the content is well written and meets quality standards. The editor edits the course content for spelling, grammar, tone, and general usability, usually working closely with the content writer and the instructional designer.

> "Communication is human nature. Knowledge sharing is human nurture". – Alison Tucker, Buckman Laboratories.

# Who's the audience?

## GENERATIONAL COHORTS

One of the key tenets of sound online course design (and implementation) is that courses should be learner-centred. This can be a challenge, since online learners can come from a variety of age groups, sociocultural backgrounds, and lifestyles. Adult learners, for example, can belong to any one of four recognized generational cohort groups: silent generation, baby boomers, generation X, or the millennials (generation Y) (Raines, 2003). If teaching children, you may also be working with the group sometimes called the neo-millennials (Dede, 2007).

It is helpful to identify which generational groups will be taking the course you design in order to meet their individual and collective learning needs and preferences. The heart of this notion is that a generational cohort is a group of individuals born within the same range of years or era, who experienced common historical events and socio-economic (including technological and educational) developments as they grew from infanthood through adulthood. This commonality leads to the development of a similar overall world-view, and experience of the social environment around them. This concept was first introduced by Karl Mannheim (1936) and has been expanded by numerous scholars and analysts. Please note, that the notion of generational cohorts is not an exact science. The range of years for each generational cohort is quite varied, depending on the source consulted.

Common lifestyle expectations go hand in hand with these generational groups, which can range from single, young, still-living-with-parents learners through to sandwich generation learners (Statistics Canada, 2004) who are raising a family as they care for parents or other members of the older generation, as well as tending to their own career and education. On top of this, several demographic and socio-economic factors can distinguish the level of access to technology and educational/media resources, including economic status, gender, level of education, and geographic location. Thus, it is important to study your projected learners' characteristics in order to optimally meet their learning needs. (Sims, 2006) Table 13.1 below gives a tentative summary of our interpretation of the five generational cohorts who participate in the current educational landscape in one form or another.

> "A typical life-long learner is someone working mainly full-time, in a high-tech or service industry, with a family and a rich social and personal life. Such a learner requires "just in time" and personally relevant content delivered conveniently and flexibly. If they are professionals, they need access to the latest research and developments in their field". (Bates, 2001, p. 25)

## AUDIENCE ANALYSIS

An audience (or learner) analysis is an important part of designing online courses (Sims, 2006). Particulars that are important include the learner's motivation for taking the course, the course's role in their career preparation, the purpose for taking the course (is it an enrichment course that helps to keep professionals current in their field, or perhaps a self-development course meant for personal enjoyment?), and whether the learners need to engage in cognitive, affective, and psychomotor activities in order to master the contents. All of these considerations are important and should guide team decisions related to e-learning and teaching styles, the presentation of the course, and exactly what content to include and to embellish with supportive graphics and multimedia objects. All of these considerations are easier to reflect on and address if the course components, audience, and other details are mapped visually in some way.

*Table 13.1. Generational cohort characteristics*

| LEARNING GENERATIONAL COHORT | | |
|---|---|---|
| **GENERATION** | **YEAR RANGE** | **LEARNING NEEDS** |
| NEO-MILLENNIALS | 2000 to Present | Non-linear learners |
| | | Even more social, interactive |
| | | Seamlessly connected, networked |
| | | "Naturally" technology-savvy |
| | | Will grow up with high-definition network TV, Mp3s, mobile PCs, 3D wireless interactive games, wireless networks, initial agent technology, initial virtual reality |
| | | Relate to rich multi-media, multi-sensory learning |
| MILLENNIALS (or GENERATION Y or NET GENERATION) | 1982–1999 | Consumers of knowledge |
| | | Multi-taskers yet task-oriented |
| | | High achievers, like personalization |
| | | Prefer interactive, attentive instructors |
| | | Highly social, interactive |
| | | Highly connected, networked |
| | | Have high technology-savvy |
| | | Grew up with colour, cable TV, PCs, 3D video games, initial wireless, primitive virtual reality |
| | | Expect some multi-media learning/enrichment |
| | | Enjoy group work, experiential activities |
| GENERATION X | 1965–1981 | Self reliant and directed, individualistic |
| | | Prefer flexibility and choice in learning |
| | | Reject rigidity and authoritative approaches |
| | | Expect expert, focused instructor |
| | | Learning should be enjoyable, even fun |
| | | Learning should increase their marketability |
| | | Good to high technology-savvy |
| | | Grew up with colour TV, PCs, 2D video games |
| BABY BOOMERS (or SANDWICH GENERATION) | 1946–1964 | Multiple responsibilities, high commuters |
| | | High work ethic, dedicated achievers |
| | | Prefer structured group work, crave feedback |
| | | Use relationship-building activities |
| | | Value creative and personal fulfillment activities |
| | | Learning should be personally meaningful |
| | | Fair to high technology-savvy |
| | | Grew up with B&W, later colour TV and radio |
| SILENT GENERATION (or VETERANS or TRADITIONALS) | 1925–1945 | Most are retired now |
| | | Prefer traditional learning environment |
| | | Need risk-free learning |
| | | Non-existent to good technology-savvy |
| | | Grew up with radio and initial B&W TV (later years) |

# How do we move from concepts to mapping?

**Tip**
A common organizational and orientating technique used by individual course designers as well as instructional design teams is the use of visual models that serve to clearly outline the details, concepts, and content of the course being planned. Designers use various visual approaches, ranging from simple matrix tables to complex concept maps and storyboards.

## CONCEPT MAPPING

The practice of concept mapping was first originated in the 1960s.by Joseph Novak (1977), while he was a professor at Cornell University. Many instructors are familiar with the use of concept maps for student learning, especially to help students investigate and brainstorm conceptual ideas. **Concept maps** consist of nodes (often drawn as ovals, circles or squares) that represent concepts, and connector links drawn as arcs, lines or arrows to represent the relationships between the nodes. The concept nodes are labelled, one for each idea or concept. Sometimes, the connector lines are also labelled.

Concept maps can also be used to plan educational experiences and provide a visual representation of the planned course objectives, outcomes, activities, resources, and evaluation. They help the design team visualize how the content should be linked and sequenced. As a team activity, concept mapping can help all members brainstorm ways to create a dynamic environment for learning the course-specific content. This mapping process produces a formal, step-by-step visual representation of the key components, and the connections and leveling between the components.

The ultimate structure and linking arrangement is very similar to the way a website is planned by designers. It is very helpful to the entire team to be able to see how the various course components should be arranged for effective learning and ease of use. Since Novak (1977) first introduced concept mapping, a variety of styles have emerged. The most common is called a spider concept map where a key overall concept is placed in a large oval or square node that then branches out to smaller nodes. The links that connect these nodes create an image that looks like a spider's web. Other configurations include hierarchical maps, landscape maps (an example is the image map at the beginning of this chapter), and systems maps.

> "Concept mapping is useful for knowledge management as a vehicle for externalizing "internal" expert knowledge, to allow that knowledge to be examined, refined, and reused". (Canas, Leake & Wilson, 1999, p. 14)

## CONCEPT MAP CREATION

Every concept map possesses four core elements:

- **Patterns**—the overall structure of the map, e.g., a circular, central hub structure; a top-down hierarchical structure, a mandala (a complex geometric shape), a flow-chart, and so on.
- **Nodes**—the geometric shapes such as ovals or rectangles used to represent the individual concepts. Often these nodes are colour-coded to signify importance of or relationships among the various concepts
- **Connector links—**the lines, arrows, and curves used to indicate the relationships between concept nodes. Often a solid line is used to show a distinct relationship; an arrow refers to a causal relationship; while a dotted line shows a weaker, secondary relationship. An arc often represents a circular flow between concepts.
- **Connector words**—help to clarify the relationships between concept nodes. Common connector words include: based on, controlled by, including, may lead to, recognizes, part of, next step, recognizes, validates, stored in.

The first step in using concept mapping for course design is to create a textual structure of the course concepts, both major and supportive. Usually, these concepts are arranged in a list that shows the basic foundational order and relationships of the concepts to be covered in the content. Once this is done, the concept map can be initiated. For example, if a design team were planning to design a course on how to plan an online course, the main concepts might include:

*Table 13. 2. Concepts used for spider concept map*

| ONLINE COURSE PLANNING |
|---|
| Rationale |
| Instructional Design Models |
| Instructional Design Team |
| Audience Analysis |
| Concept Mapping |
| E-learning Styles |
| E-teaching Styles |
| Packaging |

The concepts in Table 13.2 are already mapped, using a landscape map approach discussed at the beginning of this chapter. If a spider map pattern had been used, the map might look like Figure 13.3 below. This sort of map is useful when first brainstorming the initial concepts of a course or design process. It will also appeal to design team members who like to plan and brainstorm in flexible, circular (rather than linear) ways. In order to incorporate a complete curricular plan for a course, a more complex spider concept map would be needed. This could result in a very meaningful, intricate map or it might be construed as too complex and confusing to people who prefer a more linear approach.

The spider map below has only one layer of surrounding concepts. It could be made much larger both vertically and horizontally by adding other layers of relevant concepts, connectors, and connecting words around the periphery of the existing map.


*Figure 13.3. Spider map of online course planning*

For teams that prefer a more linear visual organizer, a hierarchical, or a flow-chart, concept map would be more appropriate since both are organized to allow more layers and the connections and sections are clearly visible. These types of concept maps are linear, which may appear less creative to some team members. However, they afford a straightforward visual organizer to incorporate all of the processes of the course plan within the concept map, Figure 13.4 illustrates a simple hierarchical concept map of a short course with four modules consisting of three to five lessons each. The right column includes various multimedia and graphic objects that can be interwoven into the lessons and modules.

"The most powerful designs are always the result of a continuous process of simplification and refinement". – Kevin Mullet & Darrel Sano (1995)

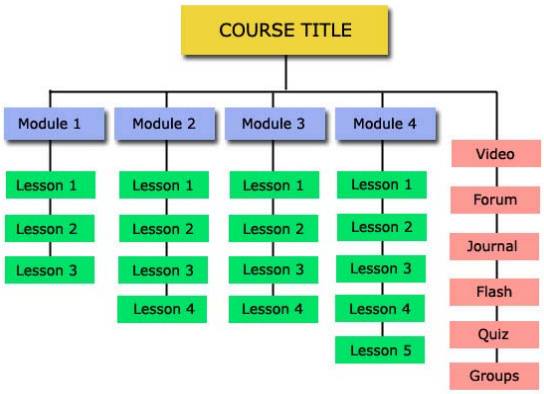



*Figure 13.4. Hierarchical concept map of short course plan*

## STORYBOARDING YOUR COURSE PLAN

**Storyboard**s are visual organizers that have been used by developers of films, videos, television shows, and multimedia for years. Most likely, your team's multimedia or graphic developer will use some version of storyboarding to plan the designated multimedia and video components of your course. This method can also be used by the entire design team to plan the actual course. There are various versions of storyboards. Professional audio-visual production teams often use ones that feature a rectangle for the actual drawing of a particular frame or scene, with lines to one side or below for data, ideas, and other textual reminders related to the appropriate scene. Figure 13.5 illustrates one row of a multimedia storyboard.

Some design teams prefer to use this layout for their storyboards, usually with more appropriate text headings in the lined area for writing notes. Figure 13.6 gives an example of this method. There are a number of different ways that storyboards can be incorporated into your design process. One popular method is the use of a flow-chart sort of storyboard, consisting of a connected geometric shape (often a rectangle) connected with arrows to detail the course design process. Figure 13.7 illustrates this particular type of storyboard graphic.

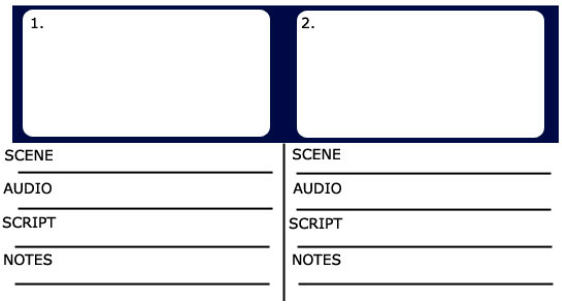



*Figure 13.5. Multimedia planning storyboard section*

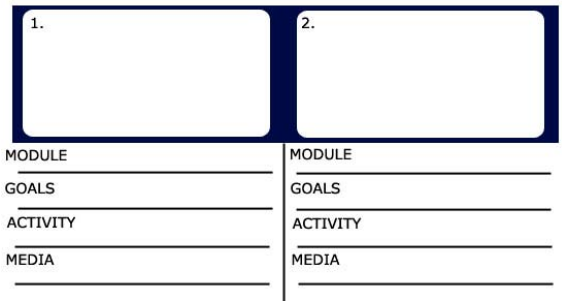



*Figure 13.6. Course planning storyboard section*

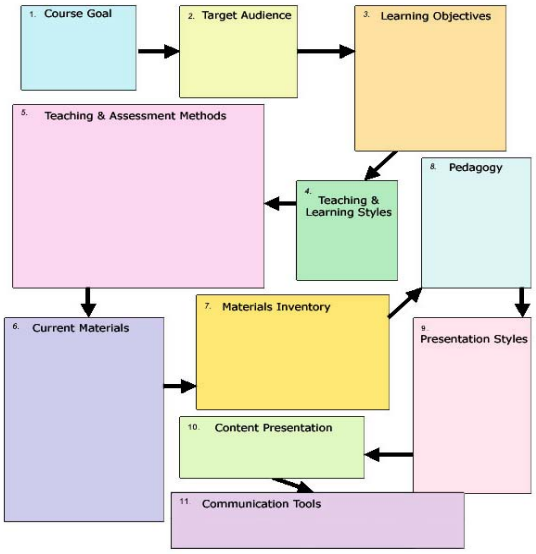



*Figure 13.7. Flow chart style storyboard*

# Why should we consider e-learning styles?

Over the past three decades, a dozen or more learning style taxonomies have been created by various educational researchers. For example, Howard Gardner of Harvard University (Multiple Intelligences Profile) based his taxonomy on mind psychology, and David Kolb (1984) of Yale University and the Bates Institute (LSI—Learning Styles Inventory) based his on experiential learning.

The latter two and other learning style inventories based on them, such as the Honey and Mumford Learning Styles model (1992). based on Kolb's work; and Neil Fleming's VARK (Visual, Auditory, Reading/Writing and Kinesthetic) (2001) of Lincoln University in New Zealand, and the Memletics Accelerated Learning Styles (Advantogy, 2003) models, both similar to Gardner's Multiple Intelligences taxonomy, are particularly suited to online course delivery. All of these learning style models highlight student preferences and natural tendencies for processing information and understanding content. E-learning offers a rich medium for appealing to the diversity of learning styles if used in inventive, adaptive, and creative ways. The time to consider this is at the course planning stage, as the design team chooses the components and activities during the development process.

## MULTIPLE INTELLIGENCES

> "We are all able to know the world through language, logical mathematical analysis, spatial representation, musical thinking, the use of the body to solve problems or to make things, and an understanding of ourselves and of others. Where individuals differ is in the strength of these intelligences: the so-called profile of intelligences—and in the way such intelligences are invoked and combined to carry out different tasks, solve diverse problems, and progress in various domains". (Howard Gardner, 1991)

Howard Gardner, a professor at Harvard University, hypothesized that people are capable of eight unique ways of information processing, which he called multiple intelligence theory. Information processing is the person's preferred intellectual approach to assimilating facts, information, and knowledge. Gardner suggested that individuals should be encouraged to apply their preferred intelligences in learning. Learners who have an

understanding of their own particular learning styles can reflect on how to use their learning strengths and cultivate their less dominant ones. A key point in multiple intelligence theory is that most people can develop all eight of the intelligences to a relatively competent level of mastery.

Gardner's eight unique intelligences are:

(1) linguistic—verbal
(2) visual—spatial
(3) logical-mathematical
(4) bodily—kinesthetic
(5) musical
(6) interpersonal
(7) intrapersonal
(8) naturalistic

As online courses become more prevalent, new research is being done on how the multiple intelligences can be cultivated, and appealed to through the use of technology and multimedia in education (Veenema & Gardner, 1996). Since it is unrealistic to expect that the design team will know the learners' preferred learning styles beforehand, it makes sense to design activities and resources that can tap the strengths and meet the needs of all eight intelligences (Sims, 2006). Table 13.4 below provides some suggestions to guide this process.

*Table 13.4 Multiple intelligences in online course planning*

| INTELLIGENCE | PREFERENCES | APPEALING ONLINE ACTIVITIES |
|---|---|---|
| Linguistic—Verbal | Written and spoken word, language, Literary activities, reading | Text, journals, forums, chats, wiki, blogs, written assignments, audio, dialogue, stories, debates |
| Visual—Spatial | Visual and spatial thinkers, sensitive to colour, line, shape, form, space and the relationships between these | graphics, movies, Flash, photos, multimedia, 3D modelling, design, charts, concept maps, diagrams |
| Logical—Mathematical | Detects patterns, scientific reasoning, deduction, mathematical calculations, cause and effect relationships | Socratic questioning, problem based, pattern pames, puzzles, experiments, statistics, matrices |
| Bodily—Kinesthetic | Fine and gross motor movements, sense of timing, and direction. Also physical coordination, balance, dexterity, strength, speed, flexibility, and proprioceptive, tactile, and haptic capacities | Role playing, psychomotor skills, demonstration, simulations, virtual reality, cooperative games, video games, ergonomic awareness |
| Musical | Musical ability and appreciation, Recognizes rhythmic patterns, pitch, melody, timbre, and tone colour | Audio, sound and music recording, rhymes, background music, chants, raps, create music |
| Interpersonal | The capacity to interact with others, to understand them, and to interpret their behaviour accurately. The ability to notice distinctions among other people, and to recognize their moods, temperaments, motivations, and intentions. A sensitivity to other's facial expressions, voices, and gestures, and the ability to respond effectively to these cues | Group projects, forums, Chats, email, cooperative work, teams, interviews, coaching, counseling, listening, clubs, drills, community involvement |
| Intrapersonal | The ability to sense one's inner being—to discover who we are, what feelings we have, and why we are the way the way we are. It represents our self –knowledge and our ability to act adaptively on the basis of this knowledge. It is our reflective self. Enables an accurate picture of the inner self, strengths and weaknesses, inner moods, goals, intentions, motivations, temperament, beliefs, and desires | Journals, reflective activities, independent study, autobiography, portfolio, concentration work, metacognition techniques, personal growth activities, narratives |
| Naturalistic | Awareness of the forces, principles, and laws of nature. Recognize relationships among species, enjoy nature-related classification systems. Promotes ecological awareness and stewardship | Ecological study, biology, natural sciences, charts, diagrams, taxonomies, genetic models, virtual field trips, systems, pattern recognition, nature analogies |

## KOLB'S LEARNING STYLES MODEL

David Kolb's learning style model is also quite amenable to course design planning. As well, this model provides a sort of developmental map for the cultivation of experiential learning throughout the human life span. Kolb described experiential learning as consisting of four stages: experiencing, reflecting, thinking, and acting. Kolb's experiential learning taxonomy comprises four distinct activities:

- concrete experience—(CE)
- reflective observation—(RO)
- abstract conceptualization—(AC)
- active experimentation—(AE)

and a four-type definition of learning styles (each representing the combination of two preferred styles, rather like a two-by-two matrix of the four-stage cycle styles, as illustrated in Table 13.5 below), for which Kolb used the terms:

- diverging (CE/RO)
- assimilating (AC/RO)
- converging (AC/AE)
- accommodating (CE/AE)

**Diverging** (concrete, reflective). A characteristic question of this learning type is "Why?" These learners respond well to explanations of how course material relates to their experience, their interests, and their future careers. These learners prefer an instructor who functions as a **Motivator.**

**Assimilating** (abstract, reflective). A characteristic question of this learning type is "What?" These learners respond to information presented in an organized, logical fashion and benefit if they have time for reflection. To be effective, the instructor should function as an **Expert.**

**Converging** (abstract, active). A characteristic question of this learning type is "How?" These learners respond to opportunities to work actively on well-defined tasks and to learn by trial-and-error in an environment that allows them to fail safely. To be effective, the instructor should function as a **Coach,** providing guided practice and feedback.

**Accommodating** (concrete, active). A characteristic question of this learning type is "What if?" These learners like applying course material in new situations to solve real problems. To be effective, the instructor should adopt a supportive **Constructivist** role, giving opportunities for the students to discover things for themselves.

## LEARNER INTERACTIVITY PREFERENCES

> "Interactivity is not simply a function of computer-based transactions, but a fundamental success factor for teaching and learning, especially when implemented in an online context. In most cases, regardless of any virtual community that exists, the learner will be working independently and therefore the effectiveness of those communications (interactions) will ultimately determine the effectiveness and efficiency of the learning environment" (Sims, Dobbs & Hand, 2001, p. 514).

The theory of learner **interactivity** preferences (developed by Rhodes and Azball in 1985) also has meaning to the course design team. Again, it is difficult to predict the actual preferences of future learners, but measures can be taken to promote all three levels within the course design. These three levels are **reactive, co-active and proactive** interactivity preferences in structure and presentation, which correspond to each learner's cognitive activity. This theory described interactivity according to three different levels of quality. Later, other researchers added a fourth level, **reciprocal** interactivity (Sims, 1997; Sims, 2006). The four preferences are described on five functional levels through the following transactions: confirmation, pacing, navigation, inquiry, and elaboration.

### Reactive interaction

A reactive interaction is a behaviourist response to presented stimuli, for instance, providing an answer to a question. This level of interaction within an online course structure shows very little learner control over content structure with program-directed options and feedback, the course components and activities are completely predetermined by the design team and instructor.

*Table 13.5. Kolb's learning styles model*

| | **Active Experimentation**—AE—DOING | **Reflective Observation**—RO—WATCHING |
|---|---|---|
| **Concrete Experience**—CE—FEELING | **Accommodating** (CE/AE) | **Diverging** (CE/RO) |
| **Abstract Conceptualization**—AC—THINKING | **Converging** (AC/AE) | **Assimilating** (AC/RO) |

### Co-active interaction

A co-active interaction preference means the learner prefers more opportunities for choice and setting the pace for their own learning. A co-active online course design allows more control, providing learner control for sequence, pace and style of interaction within the online environment.

### Proactive interaction

> "Proactive interaction is constructivist: the learner prefers to both construct and generate activities to support their learning. A proactive course design enables the learner's actions to go beyond selecting available information and reacting to existing structures, and generate individual constructions and elaborations beyond the rules set up by the design team and instructor" (Sims, 1997, p. 160).

### Reciprocal interaction

Reciprocal interaction preferences means the learner wants a dialogue-like, reciprocity- based interaction with the online course interface and participants. This sort of interaction is usually found only in designs where artificial intelligence or virtual reality are situated. In these learning environments, both learner and system reciprocally adapt to one other. This level of interaction is rare in online courses, but is anticipated to be much more feasible in the not so distant future.

## READINESS FOR E-LEARNING

Design teams can help their prospective learners prepare for, or at the least assess their own **readiness** to learn within an online environment. Research supports this as a critical consideration, since an individual learner's success in an online course often hinges on this foundation of readiness. Readiness entails three dimensions to assess: the learners' computer or technical skill, learning skills, as well as their time management behaviours.

**Computer/technical skills:** The more experience a student has in using basic computer skills (use of networks, word processing and other software applications, ability to upload and download files, use of the World Wide Web and email, accessing online libraries and other resource databases, and experience with online forums and other discussion applications, the more ready they are to take an online course. Other foundational requirements include access to a stable Internet connection and dependable computer and printer.

**Learning skills:** Readiness is fortified by the ability to work independently, be self-moivated, possess mature reading and writing skills, and a proactive approach to learning, and a positive attitude.

**Time management skills:** Readiness is evident when a learner can safely plan blocks of time for participation and study within their existing lifestyle and commitments. Managing one's time in order to complete an online course requires a respectable level of commitment and discipline.

### Recommended online tools for gauging e-learning readiness

There are some excellent free online tools available for students to use (and design teams to examine) in gauging readiness for e-learning. Three highly recommended ones include:

- Novosel, S. (2000). *Readiness Index for Learning Online (RILO).* Indiana University School of Nursing. http://nursing.iupui.edu/About/default.asp?/About/CTLL/Online/RILO.htm
- Schrum, L. (2001). *SORT: Student Online Readiness Tool.* University of Georgia. http://www.alt.usg.edu/sort/
- DeSantis, C. (2002). *eLearners Advisor.* University of Guelph. http://www.elearnersadvisor.com

# How does e-teaching style affect design?

The design team needs to consider the teaching styles promoted by the philosophy of the institution, the styles exhibited by the program's instructors, and expert knowledge about effective and empowering e-learning and e-teaching theory. Grasha (2002) identified several categories of teaching styles that are relenant when planning online courses. Characteristics of Grasha's teaching style model are summarized in Table 13.6.

## GRASHA'S TEACHING STYLE CHARACTERISTICS

Table 13.6 provides some general considerations for the design of the course environment. Interactivity capabilities are important; the means to give immediate feedback and foster both group and individual interaction and dialogue are also critical to effective teaching; as is the ability for creative and appealing organization of course content. Dynamism can be supported with the inclusion of multimedia and other multi-sensory content. Discussion functions such as forums, journals, chat-rooms and group work areas all need to be robust,

reliable, easily accessible, and seamless to support spontaneous as well as planned interaction activities.

*Table 13.6. Teacher style characteristics (adapted from Grasha, 2002, p. 24)*

| CHARACTERISTIC | DEFINITION |
|---|---|
| Analytic/Synthetic Approach | The ability to present and discuss theoretical issues and new discoveries from a wide-scope perspective, addressing a variety of views; and contrasting implications of a variety of theories |
| Organization and Clarity | Course objectives and organization is clear, materials are well-prepared and learner-friendly |
| Teacher—Group Interaction | Discussions and mutual sharing of ideas are supported within the learning environment |
| Teacher—Individual Learner Interaction | Teacher is approachable and accessible; lines of communication are seamless and can occur at the learner's discretion; good feedback mechanisms in place |
| Dynamism and Enthusiasm | Degree that the teaching is energetic, stimulating, enjoyable |
| General Teaching Ability | Teacher's expertise, consistency, adaptability |
| Overload | Amount of assigned course work, level of difficulty |
| Structure | Ability to plan lesson details, organize course within milieu |
| Quality | Expectations for learner work quality and performance |
| Learner—Teacher Rapport | Nature and quality of interactions; interactivity level of online milieu |

Grasha (2002) also identified four psychological temperaments that teachers exhibit, which are loosely based on Carl Jung's (1971) work These four temperaments are summarized in Table 13.7. Again, the design team can ensure that all temperaments are supported within the course design.

The four temperaments mentioned in Table 13.7 culminate in being expressed within five teaching styles, according to Grasha (2002). These styles include the expert, formal authority, personal model, facilitator, and delegator (see Table 13.8 for more detail on how the design team can facilitate the teaching styles of the future instructors who will teach the course.

*Table 13.7. Teacher psychological temperament and course design (adapted from Grasha, 2002, pp. 44–45)*

| Teacher Psychological Temperament | Design Considerations |
|---|---|
| Dionysian: Sensation-Perception (SP) | Enable group projects, demonstrations, games, multimedia, practical quizzes and tests, spontaneous action, proactive interactivity, chatrooms, forums, journals, seamless emails |
| Epimethean: Sensation-Judging (SJ) | Enable lecture/text areas, demonstrations, tests and quizzes, high organization, needs structure and control, prefers record of learner activity, outcomes, methodical, Socratic dialogue |
| Promethean: Intuitive-Thinking (NT) | Promote learner independence, individual projects, reports, high standards and mechanisms for giving formal feedback |
| Apollonian: Intuitive-Feeling (NF) | Enable small and large group projects, discussions, simulations, self discovery learning experiences, spontaneous personable interaction with learners, workshops, emotional values-focused expression |

*Table 13.8. Grasha's (2002) teaching styles and design team considerations*

| Teaching Style | Design Considerations |
|---|---|
| Expert | Interesting information transmittal venues, robust resources for learning, high standards |
| Formal Authority | Feedback mechanisms important, high organization and structure, formal evaluation |
| Personal Model | Stimulating, multi-sensory milieu, spontaneity, demonstrations, observation, simulations |
| Facilitator | Personable interaction, support learner independence, Group Project work, Flexibility |
| Delegator | Empowers learner autonomy, independent projects, spontaneous interaction |

## CONSTRUCTIVIST APPROACHES TO DESIGN DECISIONS

Current educational literature purports that a constructivist approach to e-teaching is recommended in order to meet the needs of 21st century learners (Sims, 2006). "Constructivist epistemology assumes that learners construct their own knowledge on the basis of interaction with their environment. Four epistemological assumptions are at the heart of what we refer to as "constructivist learning":

- "Knowledge is physically constructed by learners who are involved in active learning.

- Knowledge is symbolically constructed by learners who are making their own representations of action.
- Knowledge is socially constructed by learners who convey their meaning making to others.
- Knowledge is theoretically constructed by learners who try to explain things they don't completely understand" (Gagnon and Colley, 2001, p. 1)

Colon et al. (2000, p. 9) described how constructivist instructional design can be applied to support this style of teaching and learning. The authors outlined the fundamental creation tasks of the course design:

- **surface characteristics**—screen layout, typography, language, graphics, illustrations, sound;
- **interface**—look and feel, user interaction, help, support, navigation, metaphors;
- **scenario**—sequence of video cases, options/choices, comparisons;
- **supporting hypertext and hypermedia instructional content**;
- **instructional strategies—"chunking**" of content.

It can be concluded that both e-learning and e-teaching styles are important considerations for the design team to keep in mind as they collaborate to plan the course creation. This is facilitated through attending to the structure and organization of the course content and environment—in other words, in the packaging.

# How important is the packaging?

> "Imitating paper on a computer screen is like tearing the wings off a 747 and using it as a bus on the highway." (Ted Nelson, 1999)

The final step of the planning process is a fundamental and critical one: choosing the packaging of the course. There are a variety of elements that are important in this process including the general content structure, sequence, flow, and pacing. Presentation structure is also important, and includes considerations such as the tone and mood projected in the text and 'feel' of the site, including the coherence, consistency, navigation, aesthetic use of colours and graphics, and the text fonts used in the overall course site interface. The important components are discussed in the following section.

## UNITS OF STUDY

A uniform approach to presenting the units of study not only makes sense, but helps reinforce learning. A common mode of organization is a hierarchical *module—sections—lessons—supportive activities* approach. Within each learning activity, uniformity also helps to guide students through the content. One easy way to organize the units is from general to specific, beginning with units focused on basic principles then working up to unique and specific content topics. For example, a course on research design might begin with units focused on the general research process, literature searches and the like, then move on to specific research design processes such as experimental quantitative design or phenomenological qualitative methods.

## STRUCTURE

A consistent structure should be used to present the units of study. Information, help, resource, and other sections need to be positioned in the same area of the page, across screens and sections. The generous use of white space helps to keep this structure accessible and visually appealing for the learners. The learning activities should also have a consistent structure. One common method is to use a lesson template including such headings as *Overview, Objectives, In Preparation, Class and Individual Activities, Reflection, Enrichment Activities or Resources, and References.*

The back-end structure that supports the learner environment should be carefully thought out as well. Folders or databases are needed for each group or cluster of files. A common practice is to group all images in an image database or folder; all multimedia in a multimedia database or folder; all audio in a separate folder, and so on. This not only helps the instructor find necessary components, but also facilitates upgrades and editing, and facilitates downloading and uploading of files from the course website.

## SEQUENCE

A plan to present all content and activities in a sequential flow is important to ensure learners have instant access to current and archived content, and do not miss critical pieces. Sequencing would follow the units of study and structure determined beforehand, moving from general to specific. This sequencing is best viewed as a specific menu or site map, where students can get a view of the entire course content on one screen.

## FLOW

Flow is achieved by presenting the sequential content in an intuitive yet logical manner. It is also boosted by clear, consistent navigation and positioning of screen elements. The learner should immediately know where to go next, without confusion or resorting to trial and error clicking on various navigation buttons or titles.

## PACING

It is best to keep the text areas small, so that the course content is presented in chunks, limiting the amount of text that is presented on each screen. Short lines of 40 to 60 characters each are best. The use of tables, charts, bulleted lists, and other organizers help to increase the visible appeal and reinforce learning. If possible, avoid long vertical scrolling pages; at all costs.

## TONE

The design team should find ways to present help files, course content, and other textual prompts using an active voice, second person, present tense and a conversational tone in the course design. Language should be concise and consistent. It is also best to avoid language and examples that will inhibit the "shelf-life" of the site, such as "Now in 2008 …".

## COHERENCE

The design team should ensure that the layout of each screen is clear, pleasing to the eye, and conforms to the Western text layout of left-to-right, top-to-bottom text standards, since this is how learners usually read. It can be very confusing if their eyes need to dart all over the screen to understand what is before them: this can cause both dissonance and confusion.

## CONSISTENCY

It is important to keep the general layout design of the course screens consistent in size, structure, colour, placement of elements and font usage. It is also important to make sure that the appearance and utility of the site is consistent across browsers (e.g., the site should look and act the same in Internet Explorer and Firefox). Efforts should be made to facilitate download and screen loading times across Internet access modes, including broadband and dial-up access. This means keeping the size of graphic, audio, multimedia, and text files compact and reasonable in size, and optimized for quick loading and downloading. As well, learners should be able to upload files to the course area within a few seconds, and without crashing their systems or freezing the web browser screen.

## NAVIGATION

Navigation online is like the nervous system of the human body. It connects all of the course elements, allowing movement and flow as the learners explore the course. The key to designing navigation is to pick one uniform method, and stick to it consistently throughout the course site. Navigation can be as simple as a set of uniform buttons placed strategically in the same place on every page. Or it can consist of Java based panels or animated Flash "hot spots" on an image map.

Graphical menus and navigational elements help to intuitively guide the learner through the course online environment. It is best to plan the navigation to give the learner control over what sections they can select for navigation but to also provide a "road map" with suggested navigation sequences. Navigational linked sections should somehow be distinguishable from static non-linked portions of the site (for instance, use a different colour, specific icons, underlining, or roll-over text changes). Consistency in navigation is important to reduce learner frustration and to maximize the learning experience. Navigation buttons should be clearly labelled, consistent across pages, and easy to view and access.

## COLOUR

> "Color is born of the interpenetration of light and dark". (Sam Francis, 2003)

Colour is an important feature of effective course design. First off, it is best to choose colours that are included in the 216-colour cross-browser platform colour palette. Although this precaution is becoming less critical, since the majority of modern computers will support millions of colours, it is safe to stick to this rule to ensure that the learners will be able to access the general 256 colour palette common on most computers made within the past ten years or so.

Colours on the Web are always a mixture of R (Red), G (Green) and B (Blue). The R or G or B value can range from 0 to 255, with 0 meaning the colour value (e.g., the R) is off, and 255 meaning the value is fully on. Every screen colour has a value that tells the designer how much of the R, G, and B is showing or absent. In website development, red, green, and blue values are written as six-digit hexadecimal coding: a combination of numbers from 0 to 9 and letters from A to F. For example, pure blue has a hexadecimal value of 0000FF, and so on. To

ensure that the colours are visible as intended, it is wise to stick to the web-safe palette of hues. This is because browser-safe colours don't *dither*. Dithering is what happens when a colour is not available in the web palette, so the browser tries to compensate by combining pixels of other colours to substitute. Dithered colours look rough and spotty: browser-safe colours stay smooth and even looking.

Colour is also a very important consideration to set the mood, tone, and visual appeal of a course site learner interface. If it is possible to customize the colour scheme for each course, spend time as a team to visualize the landscape or metaphor that is suggested by the course content. For instance, a general biology course might suggest the use of greens offset with browns and white; while a course on metaphysics might suggest the use of purples, lilacs, rich blues offset with white. If you want to wake up your learner audience, to initiate action or stimulate emotions, a warm colour scheme works best. Reds, oranges, yellows all do the trick. If your intended mood is one of calm, leisure, or dignified refinement, use cooler colours—blues, purples, greens. If your statement is bold and to the point, sharp contrasting colours such as black and white or blue and orange work well.

## Basic colour theory

Colour theory focuses on how colour manifests on the spectrum. Colour psychology goes one step further to assign common meaning or moods to specific colours. To apply these to the course design, the team should explore the meaning of primary, secondary and tertiary colours which are the most common colours used on the World Wide Web. Figure 13.9 illustrates the 12 basic colours of the colour wheel.

*Figure 13.9. The colour wheel*

**Primary colours** are the three pigment colours that cannot be mixed or formed by any combination of other colours. All other colours are derived from these three: red, blue and yellow. Each of these pure colours stir up different moods and feelings in a viewer. Figure 13.10 illustrates the primary colours.

- **Red—**hot, fire, daring, lush, aggressive, power, excitement, dominating, warning.
- **Blue—**peaceful, water, calm, wisdom, trust, loyalty, dedication, productivity.
- **Yellow—**happy, sunny, cheerful, alert, concentration, bright, warm, creative, playful.

*Figure 13.10. The primary colours*

**Secondary colours** are formed by mixing two of the primary colours together. These mixed colours also evoke particular moods. Figure 13.11 illustrates the secondary colours from the mixture of two primary colours.

- **Green (blue and yellow)**—pastoral, spring, fertility, jealousy, novice, youth, hope, life, money
- **Orange (red and yellow)**—warm, autumn, generous, strong, fruitful, appetizing
- **Purple (red and blue)**—royal, mysterious, pride, luxury, wealth, sophistication

*Figure 13.11. The secondary colours*

**Tertiary colours** are formed by mixing the secondary colours with primary colours. The olour wheel, illustrated in Figure 13.9 gives examples of the six tertiary colours between the three primary and three secondary colours.

- Yellow-orange
- Red-orange
- Red-purple
- Blue-purple
- Blue-green
- Yellow-green

**Analogous colours** are any three colours which are side by side on a 12-part colour wheel. **Complementary colours** are any two colours which are directly opposite each other, such as red and green.

Of course there are also **black and white,** both very common colours used in course designs.

*Figure 13.12. Black, white and gray*

Black is the absence of red, blue, and green light while white is the purest saturation of all three. Black and white plus gray are known as non-chromatic hues.

- **Black** represents style, dark, mystery, formal, powerful, authority.
- **White** is clean, pure, chastity, innocence, cool, refreshing.
- **Gray** is neutral, conservative, formal colour. Gray ranges from sophisticated charcoal gray to active, energizing silver. It also represents maturity, dependability, and security.

## FONTS

Finally, text fonts and embellishments can be used to help improve the comprehensiveness, presentation and accessibility of the content. Use a consistent font (common ones include two sans serif fonts: Arial and Verdana, and two serif fonts, Times New Roman and Georgia) throughout the text. Figure 13.14 shows examples of these four common fonts. Use bold and italic embellishments for emphasis. Only use underlines for actual links. Avoid using all capital letters. A good rule of thumb is to use size 11 for general text font, 14 for subheadings, 16 for titles. It is best to avoid blinking text, as this can produce eye fatigue and may annoy the learners. As well, graphical dingbat fonts can be used to create icons, and other supportive graphics (Figure 13.13).

*Figure 13.13. Examples of dingbat font images created using the* Wingding *font.*

This is an example of Arial 18 point font

This is an example of Verdana 18 point font

This is an example of Times New Roman 18 point font

This is an example of Georgia 18 point font

*Figure 13.14. Examples of Arial, Verdana, Times New Roman and Georgia text fonts*

# Summary

> "Step back … Before you get started putting your course online, you will want to take a step back to examine the big picture of what it is you want to do". (Elbaum et al., 2002)

Planning an online course involves identifying and communicating the preliminary considerations that will guide course design and implementation. At the core, planning requires an examination of individual circumstances, philosophies, and skills. There is no single course planning worksheet that will suit all design projects.

This chapter began with an overview of how the planning process is influenced by context and trends. There is a continuum of design approaches ranging from flexible to linear, and emerging opinions about how our learning spaces should be shaped. Although learning-centred design is commonly acknowledged as central to the success of online courses, and a team of individuals with specific areas of expertise is ideal for effective design, in reality there are often gaps in the necessary resources, skills and knowledge to accomplish everything we need or want to do.

Certain learner characteristics can often be identified early on in the design process, but this is not always the case. Age, socio-cultural backgrounds, and lifestyles of the audience are all important considerations for course design. E-learning offers more opportunities to cater to individual learning styles by combining text and multimedia, planning for exploration, and designing activities to engage learners in a variety of ways.

Likewise, e-teaching style influences design, yet this is another element that can be unknown during the planning stage. An awareness of the general teaching style characteristics and how they influence practice will help to guide the design process.

Communicating our course design plans using mapping tools can serve to identify the important components and relationships among them. Visually organizing design ideas in this manner is particularly suitable for on-

line courses because it can translate well into a website design. Different types of mapping tools can support the various design approaches, some being more linear than others.

The final step of the planning process, the packaging, is a culmination of all steps. Presentation, pacing, flow, and general look and feel of the course is informed by educational philosophies and beliefs of the design team, the audience, teaching and learning styles, and a preliminary sketch or map of course components and the relationships among those components in terms of time and space. There are also some important web design principles to follow.

Practice tells us that there are many different ways to approach online course design. It is easy to be swept away by the plethora of technologies available to designers but an important reminder to conclude this chapter is to keep the focus on learning. Take the time to understand the *why* of your course plan, and how much of the *design* should precede implementation.

# Glossary

**Chat room.** Text-based real-time group communication where multiple users type their questions, answers, viewpoints and ideas for everyone to see.

**Chunking.** The process of organizing learning materials into brief sections to improve learner comprehension and retention.

**Concept map.** When used for course planning, a concept map is a visual representation of the components and elements of the planned course, also referred to as a course map or flow-chart.

**Connectivism.** Described as a learning theory for the digital age, connectivism considers the influence of learning tools in explaining how we learn.

**Constructivist.** The assumption that learners construct their own knowledge on the basis of interaction with their environment.

**E-learning style.** An individual learner's unique approach to learning within the online environment, based on strengths, weaknesses, and preferences. Examples are numerous; well-applied ones include Gardner's Multiple Intelligences and Kolb's Learning Styles Inventory.

**Flexible approach.** An instructional design strategy which is adaptable and learner-centred.

**Interactivity.** A technological feature that supports the learner and teacher to engage in something that helps to maintain learner interest, provide a means of practice and reinforcement. Examples are engaging in dialogue using a forum, journal or **chat room**; providing peer feedback using a form format; verbal discussion using microphone and speaker programs; visual prompts that encourage student clicking and choosing sections of a screen.

**Module.** An integrated "theme" of content. Typically, one component of a course or a curriculum.

**Multimedia.** The integration of various media, including text, graphics, audio, video and animation, in one e-learning application.

**Readiness. T**he level of willingness and motivation in a learner in regards to selecting e-learning as a mode of education. This includes computer skill level and experiential knowledge with online learning.

**Real-time.** Instantaneous response or experience with learning event. Examples include real-time simulation or chats that follow the pace of events in reality.

**Storyboard.** A visual scripting tool made up of a collection of frames created by a multimedia, graphic, video, or instructional developer that details the sequence of scenes or module components that will be represented to the users (instructors and learners).

**Systems approach.** An instructional design strategy that follows a linear model similar to project management. A decision to use a systems approach is usually influenced by the size of the project.

# Quotes to ponder

- "The most powerful designs are always the result of a continuous process of simplification and refinement". – Kevin Mullet and Darrel Sano (1995)
- "There is no such thing as a boring project. There are only boring executions". – Irene Etzkorn, axiom (n.d.)
- "Technical skill is mastery of complexity, while creativity is mastery of simplicity". – E. Christopher Zeeman, Catastrophe Theory (1977)
- "Creativity involves breaking out of established patterns in order to look at things in a different way". – Edward de Bono, 2005, debonoblog.com
- "Quality isn't something you lay on top of subjects and objects like tinsel on a Christmas tree". – Robert Pirsig, *Zen and the Art of Motorcycle Maintenance: An Inquiry into Values* (1974)
- "Absolute certainty about the fail-proofness of a design can never be attained, for we can never be certain that we have been exhaustive in asking questions about its future". – Henry Petroski, *Design Paradigms: case histories of error and judgment in engineering*, New York, NY: Cambridge University Press. (1992)
- "A specification, design, procedure, or test plan that will not fit on one page of 8.5-by-11 inch paper can-

not be understood". – Mark Ardis Comparison of algebraic and state-machine specification methods. In Proceedings of ISPW, 1985. pp. 101–105 (1985)

- "Everyone designs who devises courses of action aimed at changing existing situations into preferred ones". – Herbert Simon, The Sciences of the Artificial (3rd ed.). Cambridge, MA: MIT Press. (1996)
- "Tell me, and I'll forget. Show me, and I may remember. Involve me, and I'll understand". – Chinese proverb
- "Someday, in the distant future, our grandchildren's grandchildren will develop a new equivalent of our classrooms. They will spend many hours in front of boxes with fires glowing within. May they have the wisdom to know the difference between light and knowledge". – Plato
- "X-Generations demand X-cellent training in an X-celerated speed". – Angel Rampy (2006) http://www.coachangel.com/
- "The 'e' in e-learning stands for experience". – Elliott Masie, Masie Center (n.d.) http://www.masieweb.com/
- "Communications is human nature. Knowledge sharing is human nurture". – Alison Tucker, Buckman Laboratories (n.d.)
- "Online learning is not the next big thing, it is the now big thing". – Donna J Abernathy, Distance Learning: Reach Out And Teach Someone, Training and Development Magazine, 52(4), 49–50 (1998).

# References


Advantogy (2003). Memletics Accelerated Learning Styles Inventory. Grayslake, IL: Advantogy. http://www.memletics.com/

Anderson, T. & Elloumi, F. (2004). *Theory and practice of online learning*. Athabasca: Athabasca University.

Bates, A. W. & Poole, G. (2003). *Effective teaching with technology in higher education: Foundations for success*. San Francisco: Jossey-Bass.

Bates, A. (2000), *Managing technological change: Strategies for college and university leaders.* San Francisco: Jossey-Bass.

Bates, A. (2001). *National strategies for e-learning in post-secondary education and training.* UNESCO: International Institute for Educational Planning. Paris: United Nations.

Canas, A., Leake, D. & Wilson, D. (1999). Managing, mapping, and manipulating conceptual knowledge. Institute for Human and Machine Cognition. *Exploring synergies of knowledge management and case-based reasoning.* Tech. Report WS-99-10, Menlo Park, CA: AAAI Press, p. 10–113.

Colon, B., Taylor, K. & Willis, J. (2000). Constructivist instructional design: Creating a multimedia package for teaching critical qualitative research. *The Qualitative Report, 5*(1 & 2). http://www.nova.edu/ssss/QR/QR5-1/colon.html

Colwell, B. (2002). Near misses: Murphy's law is wrong. *Computer, 35*(4), 9–12.

Dede, C. (2007). *Emerging educational technologies and neomillennial learning styles.* 2007 ELI Annual Meeting Podcast, May, 1, 2007. http://connect.educause.edu/display/16662

DeSantis, C. (2002). *eLearners Advisor,* University of Guelph http://www.elearnersadvisor.com

Erlbaum, B., McIntyre, C. & Smith, E. (2002). *Essential elements: Prepare, design, and teach your online courses*. Madison, WI: Atwood Publishing.

Fleming, N. (2001). *VARK—a guide to learning styles.* http://www.vark-learn.com/

Francis, S., Aistrip, J., Winsryg, M. (2003). *Color is the essence of it all.* Santa Monica, CA: Martin Sosin.

Gagnon, Jr., G. & Cooley, M. (2001). *Constructivist learning design.* http://www.prainbow.com/cld/cldp.html

Gardner, H. (1983, 1993). *Frames of Mind: The theory of multiple intelligences.* Tenth Anniversary Edition. New York: Basic Books.

Grasha, A.. (2002). *Teaching with style: A practical guide to enhancing learning by understanding teaching and learning styles.* San Bernadino: Alliance Publishers.

Honey, P. & Mumford, A. (1992). *The manual of learning styles* (3rd ed.). Berkshire, UK: Peter Honey Publications.

Jung, C. (1971). *Psychological Types (Collected Works of C.G. Jung, Volume 6).* Princeton University Press

Kolb, D. A. (1984). *Experiential Learning: Experience as the Source of Learning and Development.* Prentice-Hall, Inc., Englewood Cliffs, N.J.

Le Blanc, D. (2003). *Instructional design for distributed collaborative learning environments based on sociocultural constructivist theories* (Unpublished manuscript): Simon Fraser University.

Mannheim, K. (1936). *Ideology and utopia.* London, UK: Routledge & Kegan Paul.

Mullet, K. & Sano, D. (1995). *Designing visual interfaces: Communication oriented techniques.* New York, NY: Prentice Hall.

Nelson, T. (1999). *Ted Nelson's Computer Paradigm, expressed as one-liners.* http://xanadu.com.au/ted/TN/WRITINGS/TCOMPARADIGM/tedCompOneLiners.html

Novak, J. (1977). *A theory of education.* Ithaca, NY: Cornell University Press.

Novosel, S. (2000). *Readiness Index for Learning Online (RILO).* Indiana University School of Nursing http://nursing.iupui.edu/About/default.asp?/About/CTLL/Online/RILO.htm

Raines, C. (2003). *Connecting generations: The sourcebook for a new generation*. Menlo Park, CA: Crisp Publications.

Rhodes, D. & Azbell, J. (1985). Designing interactive video instruction professionally. *Training and Development Journal, 39*(12), 31 – 33.

Schrum, L. (2001). *SORT: Student Online Readiness Tool.* University of Georgia. http://www.alt.usg.edu/sort/

Siemens, G. (2002, September 30, 2002). *Instructional Design in Elearning*. Retrieved July 2, 2004, from http://www.elearnspace.org/Articles/InstructionalDesign.htm

Sims, R. (1997). Interactivity: A forgotten art?. *Computers in Human Behavior, 13*(2), 157–180.

Sims, R. (2006). Beyond instructional design: Making learning design a reality. *Journal of Learning Design, 1*(2), 1–7. http://www.jld.qut.edu.au

Sims, R., Dobbs, G. & Hand, T. (2001). Proactive evaluation: New perspectives for ensuring quality in online learning applications. In Conference Proceedings of the 18th Annual Conference of the Australasian Society for Computers in Learning in Tertiary Education (ASCILITE), *Meeting at the Crossroads*. p. 509– 517.

Statistics Canada. (2004) Study: The Sandwich Generation. *The Daily,* September 28, 20013. http://www.statcan.ca/Daily/English/040928/d040928b.htm

Struthers, J. (2002). *Working models for designing online courses and materials.* The Higher Education Academy. http://www.heacademy.ac.uk/resources.asp?process=full_record&section=generic&id=197

Veenema, S. & Gardner, H. (1996). Multimedia and Multiple Intelligences. *The American Prospect, 7*(29). http://www.prospect.org/print/V7/29/veenema-s.html

Vella, J. (2001). *Taking learning to task: Creative strategies for teaching adults*. San Francisco: Jossey-Bass.

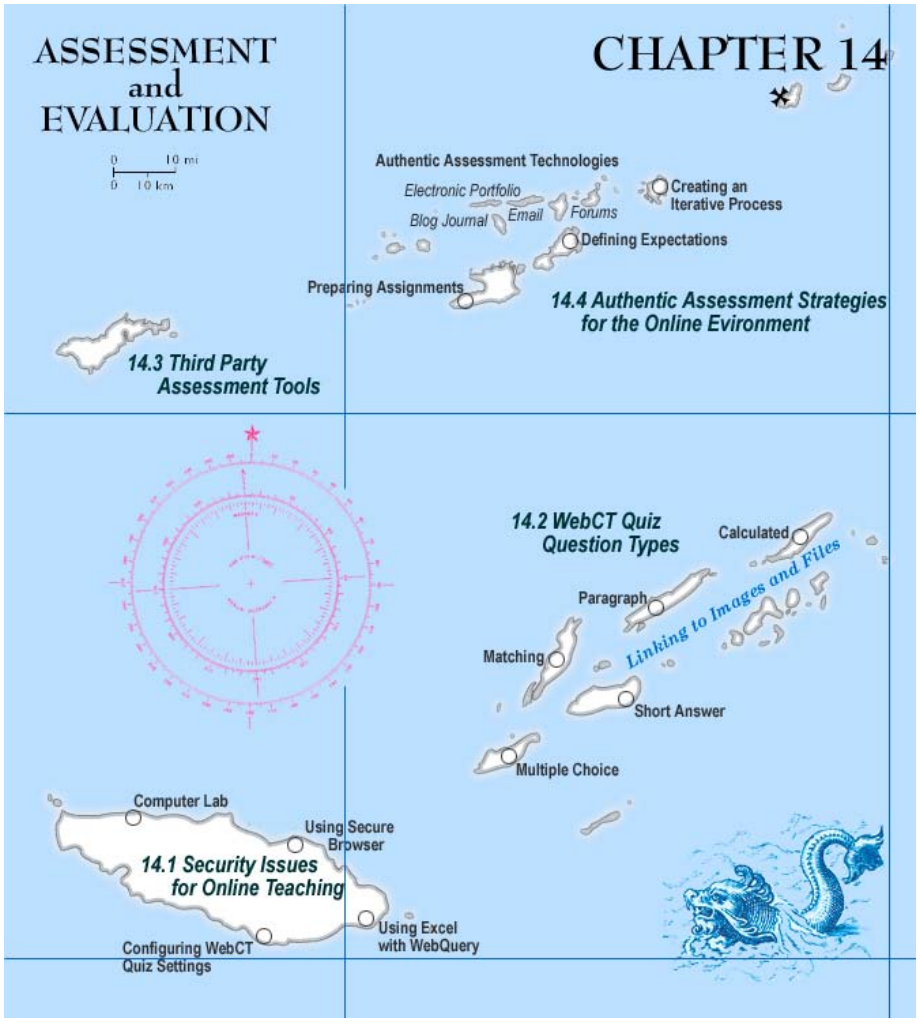
Vella, J. (2006). *Dialogue Education: What are the basics?* Retrieved July, 2006, 2006, from http://www.lidc.sfu.ca/css/JaneVella-QT4x3.mov

Wilson, B. G. (1995). Metaphors for instruction: Why we talk about learning environments. *Educational Technology*, pp. 25–30.

# 14
# Assessment and Evaluation

Dan O'Reilly and Kevin Kelly

To improve learning and promote learning communities, we must recognize that successful assessment is not primarily a question of technical skill but rather you of human will. – Angelo (1999)



# Learning outcomes

After completing this chapter, you will be aware of:

- issues relevant to setting up a computer lab for online testing.
- software configuration issues relevant to online testing.
- security issues relevant to online testing.
- various types of software available to manage quizzes in a lab setting.
- the various types of quizzes that can be delivered online.
- some advanced features available for use in WebCT quizzes: JavaScript, Excel WebQuery, RegularExpression, etc.
- student assessment strategies for the online environment.

# Introduction

This chapter reviews some of the basic issues of evaluation and assessment relevant to online testing. The chapter primarily uses as example WebCT version 4.1; nonetheless, the examples are such that they can be applied to most online platforms used in a lab setting.

The chapter begins by detailing some of the more important security issues for online testing, ones that generally are not covered in most reference material. It looks in detail at some third-party software, namely, NetSupport and Excel, for managing computer labs. NetSupport provides a means of monitoring every computer in a lab from you workstation; Excel, through its web query function, provides a means of collecting data from any page in WebCT in order to monitor activity on that page. Detailed examples are provided for both packages. The quiz settings relevant to monitoring a WebCT quiz in a computer lab are discussed in detail. Here, the discussion focuses on WebCT 4.1 and a computer lab environment.

The chapter next gives a detail examination of the WebCT quiz environment and the different types of WebCT quizzes: multiple choice, matching, short answer, paragraph and calculated. It assumes that the reader has basic knowledge to create a quiz, and rather than providing such information it discusses some advanced features available both within the WebCT settings for quizzes and also features available externally to modify the quiz environment. Such things as using JavaScript pop-up windows for creating links to external information within a quiz; using and creating Regular Expression scripts to edit input at the quiz interface; using HTML tables to control the display in a WebCT calculated type of question; etc. Detail examples are provided for each, with suggestions for using an HTML editor such as Dreamweaver.

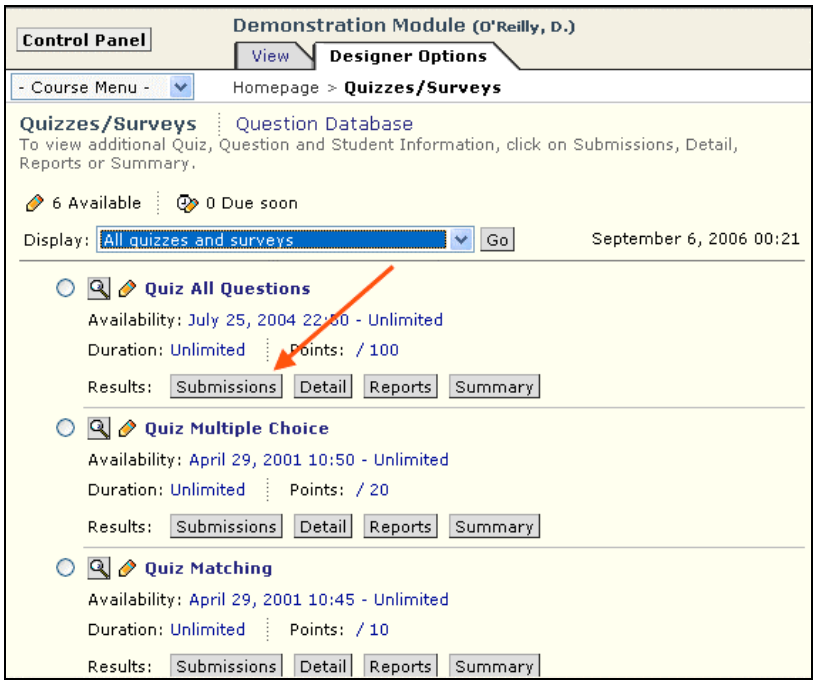
# Security issues for online testing

*by Dan O'Reilly*

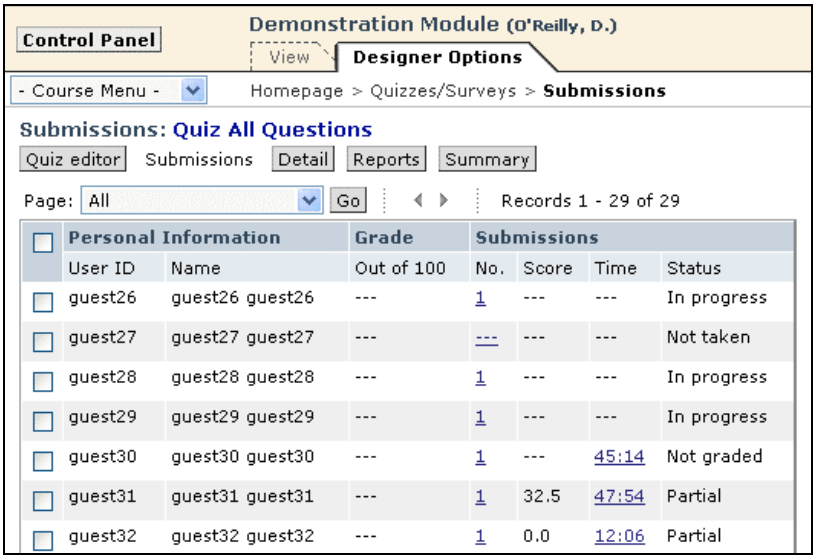
## SECURITY ISSUES IN A COMPUTER LAB SETTING

In this section, I focus on the WebCT CE 4.x Quiz Tool and on issues related to administering a closed-book quiz/exam in a computer lab. I do not cover all issues of setting-up and running a WebCT quiz in a computer lab, I only consider certain security issues not covered in most reference material on WebCT. As well, even though you may use a different platform than WebCT, many of the issues discussed here are similar for most of the learning management systems (LMSs). In the following discussion it is assumed that the person monitoring the quiz/exam has access to a computer workstation in the lab.

You can identify those who have signed into a WebCT quiz through the Submissions page. To open the submissions page, go to the Quizzes/Surveys page and click Submissions.




The link to Submissions displays all student accounts in the course, as well as identifying those who have started or completed the quiz.



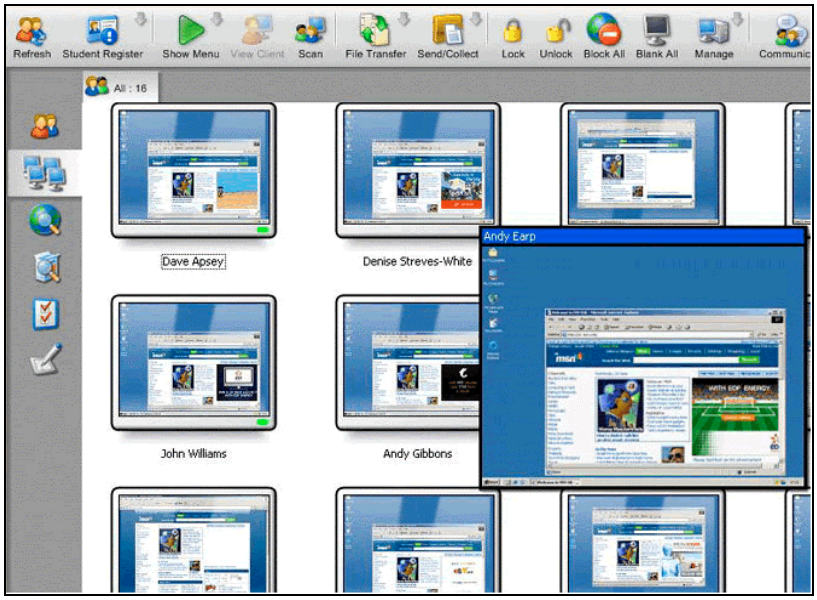

| Personal Information | | Grade | Submissions | | | |
|---|---|---|---|---|---|---|
| User ID | Name | Out of 100 | No. | Score | Time | Status |
| guest26 | guest26 guest26 | --- | 1 | --- | --- | In progress |
| guest27 | guest27 guest27 | --- | --- | --- | --- | Not taken |
| guest28 | guest28 guest28 | --- | 1 | --- | --- | In progress |
| guest29 | guest29 guest29 | --- | 1 | --- | --- | In progress |
| guest30 | guest30 guest30 | --- | 1 | --- | 45:14 | Not graded |
| guest31 | guest31 guest31 | --- | 1 | 32.5 | 47:54 | Partial |
| guest32 | guest32 guest32 | --- | 1 | 0.0 | 12:06 | Partial |

The Submissions page provides a wealth of information about a quiz. The page informs the instructor if the quiz is "In progress", "Not taken", "Not graded", or "Partial". The first two labels are self-explanatory. The last label means that some of the questions in the quiz are not marked. This happens when there are machine gradable questions mixed with short answer or paragraph type questions. The latter question types must be manually marked by a human. The "Not graded" label means that the student either quit the quiz without properly submitting the quiz for grading or the designer configured the quiz so that it either must be manually graded or it must be manually submitted for grading. Clicking a Submissions no. opens the quiz of any student, whether submitted or not. In WebCT, you can view the quiz while it is being completed by the student, before it is even submitted. In fact, the designer can force the quiz to be submitted while it is still being completed, so be careful when accessing live quizzes.

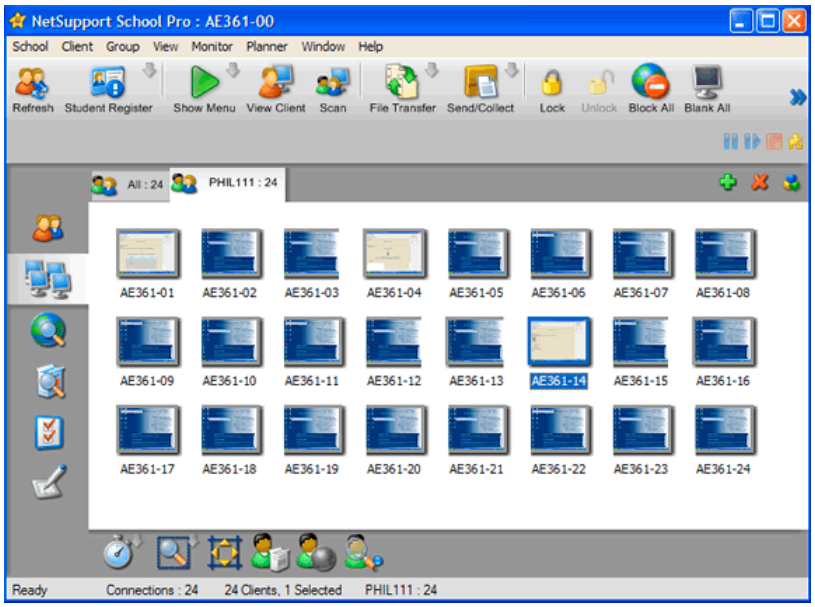
Though the Submissions view does provide information about a quiz, and allows some monitoring of the quiz environment, computer labs should also be equipped

with either a secure browser or computer monitoring software such as NetSupport to protect the security of the quiz environment. Preferably a lab would have both features; neither by itself ensures absolute security. Together, these tools give a high level of security. Nevertheless, even if both these security tools are implemented, you should still consider restricting the IP address of work stations (more on this below in the Quiz Settings).

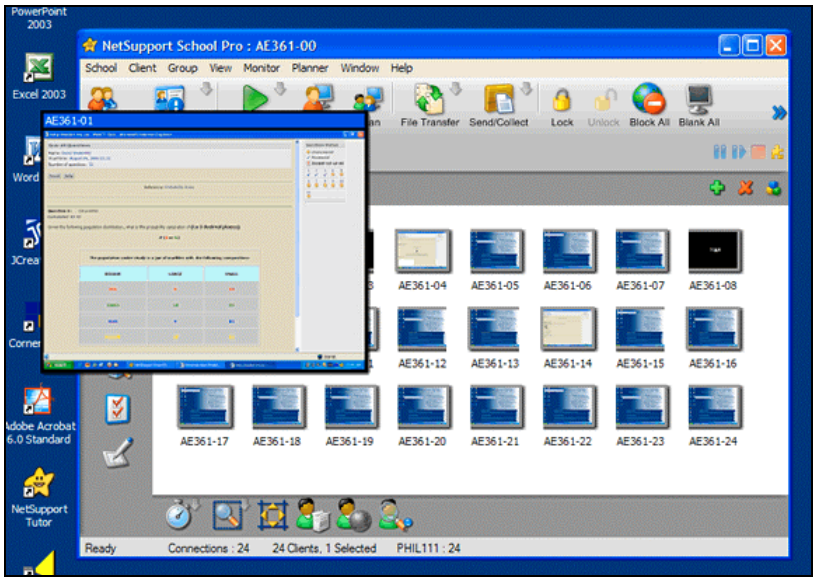
A program like NetSupport (the following is a screen shot from the NetSupport website http://www.netsupportschool.com/quality.htm) allows an instructor to visually monitor all computer screens during a quiz, and this can assist in identifying if a student is viewing a practice set of questions (with answers) during the closed book quiz or even emailing a friend for assistance.



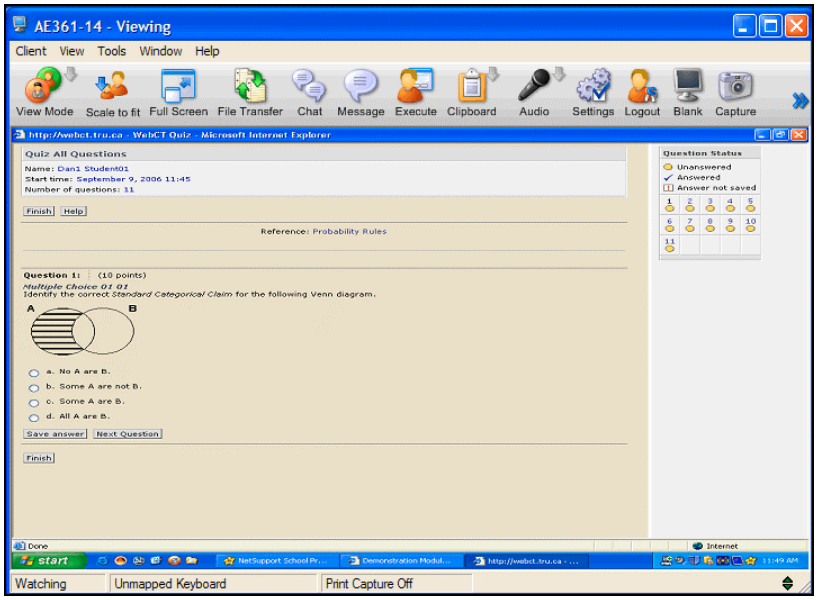

When using NetSupport with WebCT you would see something like the screen shown here.



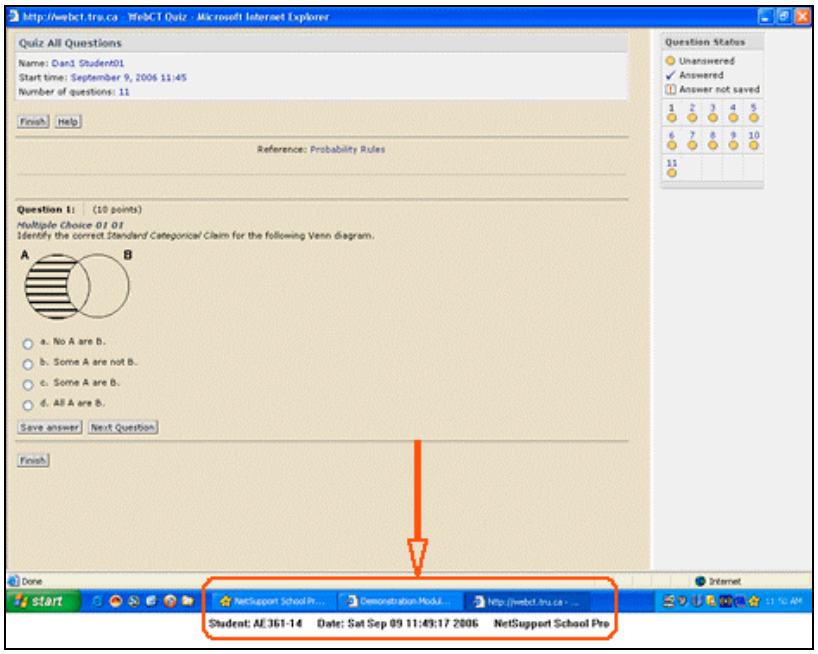
NetSupport provides a view of all of the computers in the lab. It also allows you to mouse-over a station icon, which pops-up a magnified window of a student workstation (this is a view in a Thompson Rivers University lab).




If the NetSupport view raises suspicion of wrongdoing, you can force the suspicious workstation to expand to the full size of the monitoring workstation.

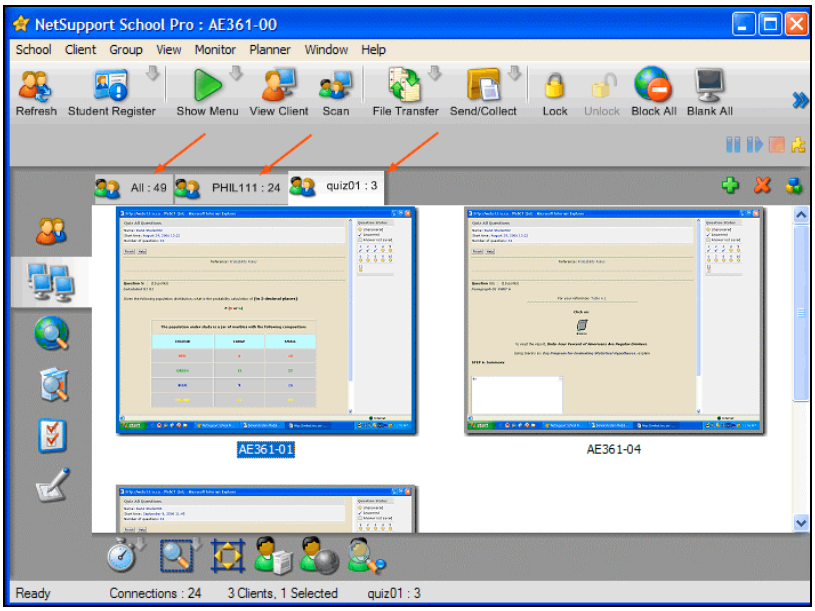


And you can identify all programs the student has activated in the background by viewing the task bar of that workstation.




As well, by setting your quizzes a certain colour it is easy to spot workstations that are accessing material that is not part of the quiz. You can do a screen capture of any suspicious workstation, to act as evidence of violation of the rules of the exam setting.

You can also increase the magnification of the collective class screen. The following demonstrates that it is possible to create other views of the workstations in the lab, which are easy to tab between. You can create a tabbed view of all workstations, of the workstations for only the class, or of the workstations that are only doing the quiz (I frequently allow other students in the lab who are not completing the quiz). The fewer the number of stations monitored the greater the magnification possible to view all stations at once.



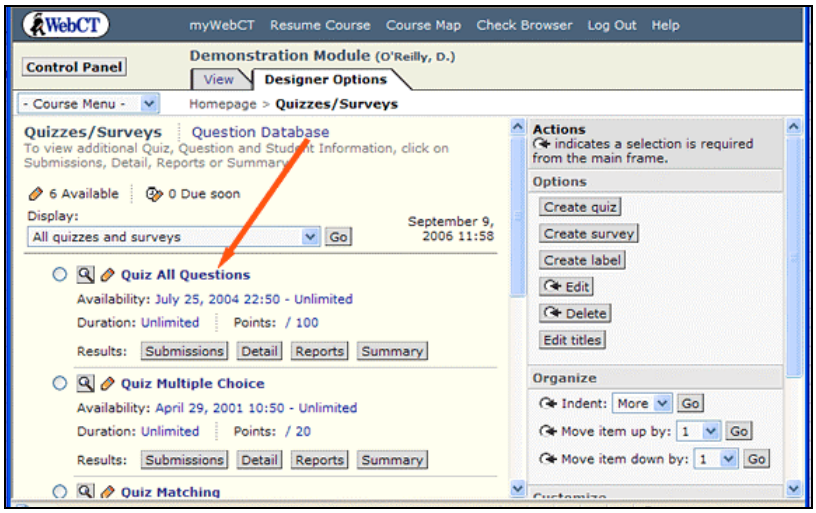
## USING A SECURE BROWSER

A secure browser can be configured to only allow authorized programs during the quiz. For example, Respondus LockDown Browser (http://www.respondus.com/) is a custom browser that locks down the testing environment within WebCT. Students then are unable to print, copy, go to another URL, or access other applications during the quiz. When an assessment is started, students are locked into it until they submit it for grading. Though secure browsers provide a significant degree of security, it is still worthwhile viewing each individual station with a program like NetSupport. NetSupport also provides similar features to the Respondus LockDown Browser. Check out their respective Websites for further details. As well, if possible, restrict IP addresses (more on this below).

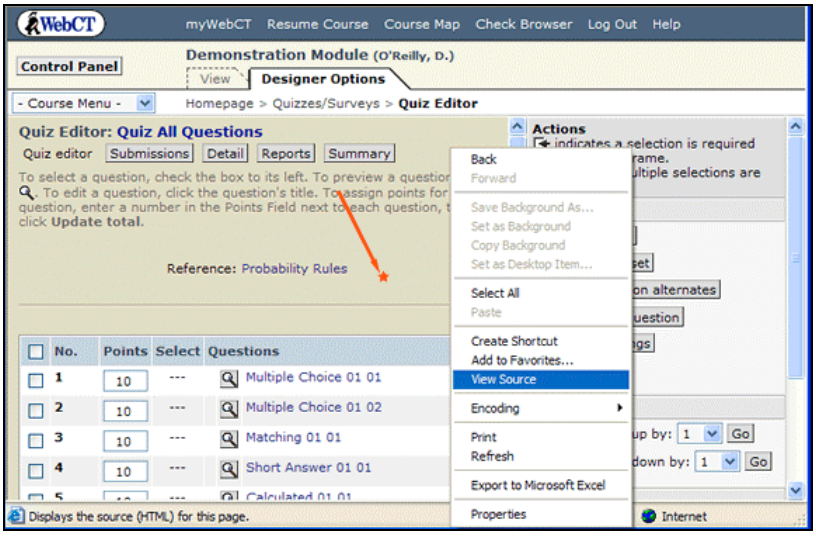
## USING EXCEL WITH WEBQUERY

I have up to 200 students registered in a WebCT course. Even though the class breaks down into 24 students per lab/quiz, which is quite manageable, the Submissions screen does not provide an easy way to isolate the specific 24 students taking a quiz; you must view all 200 student accounts at once. It is very difficult to monitor the 24 students taking a quiz when the Submissions screen lists 200, and the 24 are scattered throughout the 200. This is especially a problem if students are assigned to the labs non-alphabetically (the Submissions screen sorts students alphabetically by Last Name only). However, you can use the WebQuery feature of an Excel spreadsheet to assist in the monitoring. All data on any WebCT page can be grabbed by an Excel WebQuery.

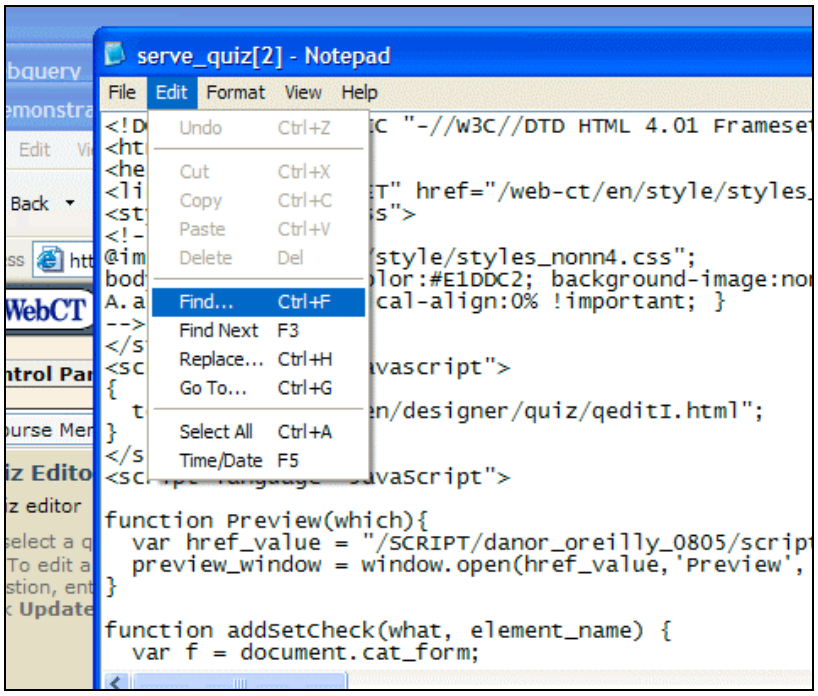
To prepare for using WebQuery, you must enter the WebCT URL of your Submissions page. To identify that address, open your WebCT Quizzes/Survey page from the designer account. Then click on the link to the quiz.



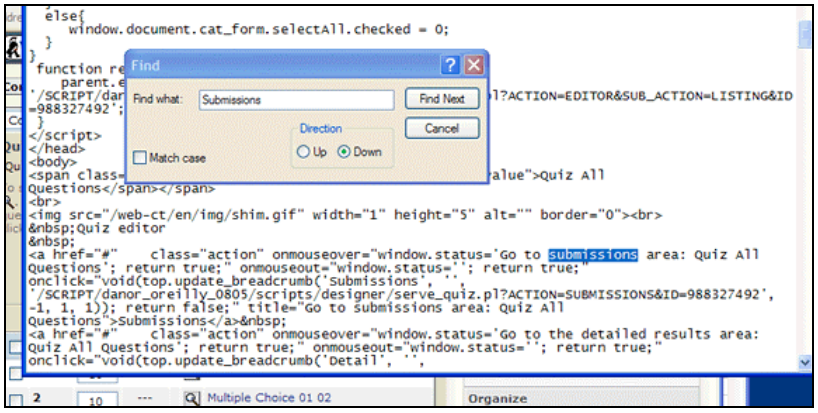

This opens the Quiz Editor for that quiz. Pull your mouse over the background of the quiz page (anywhere but a hypertext link), and right click (this assumes you are using a PC). In IE, a pop-up window appears. Select, View Source.



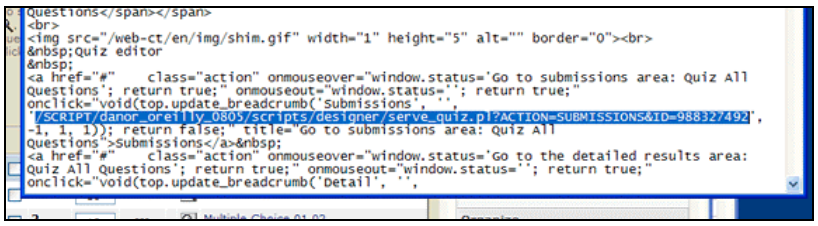
This opens a Notepad window of the source HTML code for that page. Make sure your Notepad is in Word Wrap mode. Click on Edit > Find.



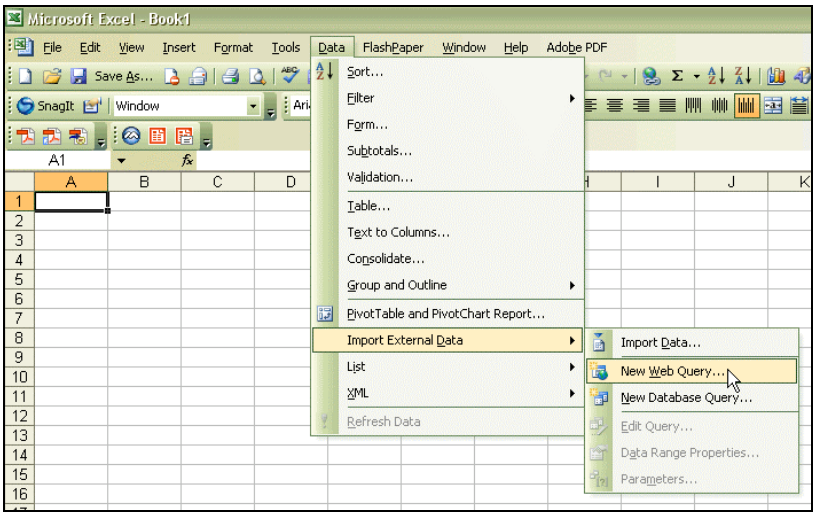

Type “Submissions” into the find field and click “Find Next” until you find the anchor link for ‘Submissions’ (code with a “<a href” included).



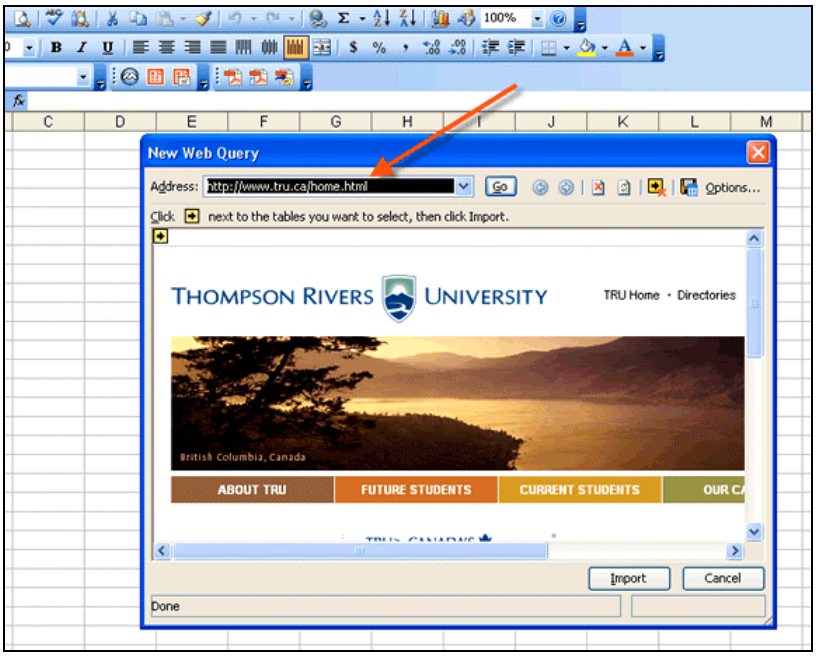

Just ahead of this location is the required URL. Copy and save that address, it is the Submission Page URL. You require this address for the WebQuery which follows.



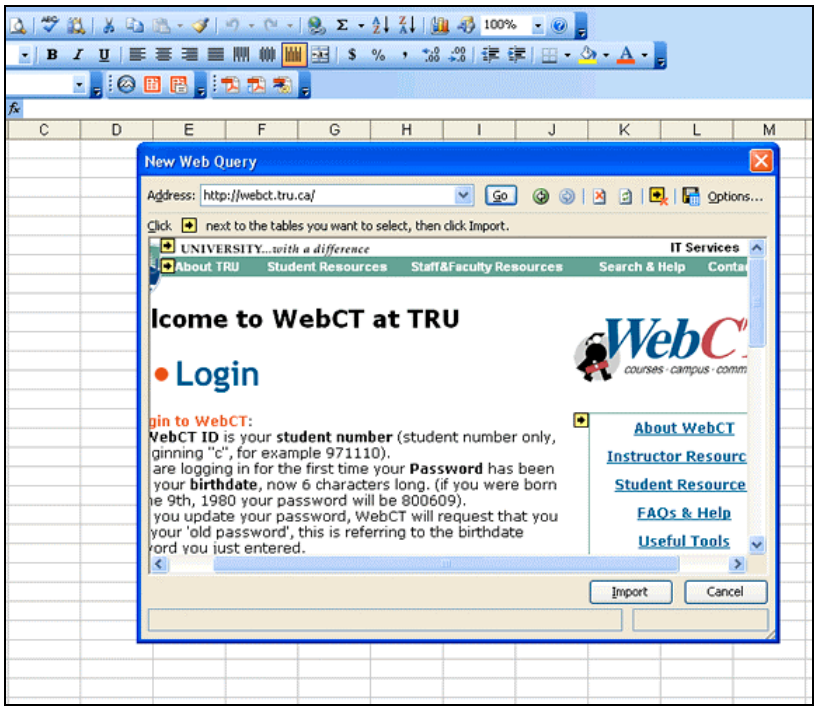
To execute a WebQuery, open an Excel spreadsheet, click Data > Import External Data > New Web Query (I assume some working knowledge of Excel and I am only sketching out the process here because specifics can vary from system to system).



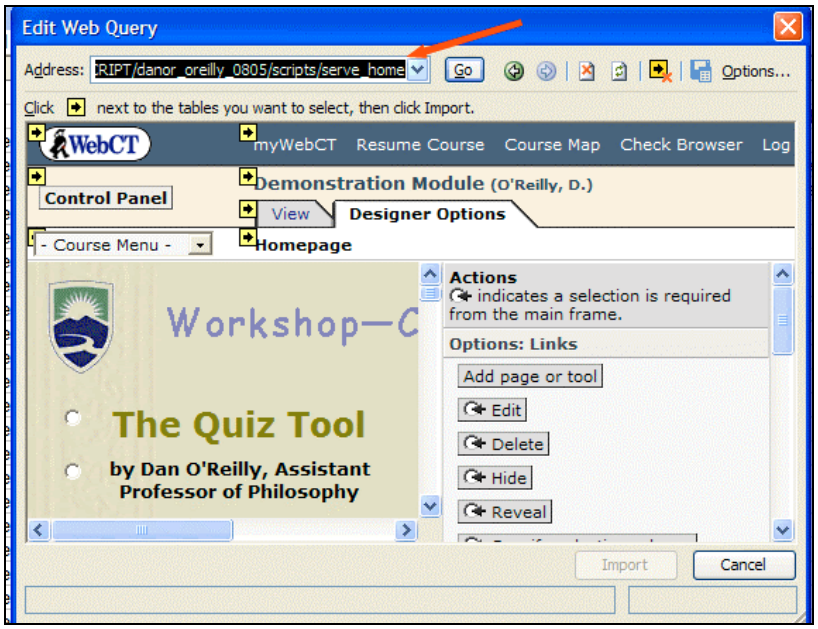

This opens a window in your spreadsheet, which initially displays your default browser Homepage. Enter the location of your WebCT server in the address field.



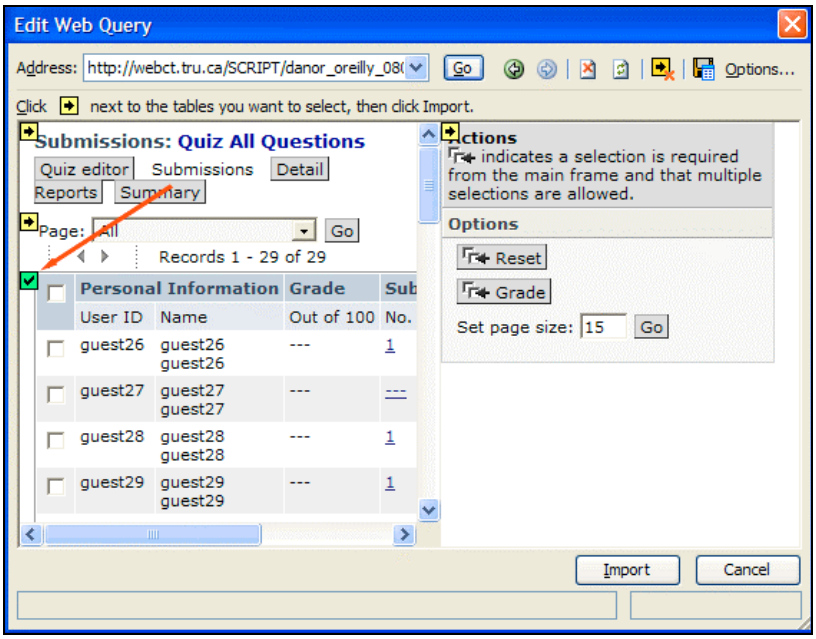
This should bring you to the WebCT server and Login screen (again this varies according to WebCT setup). Login to your designer account. All this is happening in the small window opened in the spreadsheet.




Locate the course module, and enter the Submission Page URL (discussed above) beginning at the slash just before SCRIPT, e.g., "/SCRIPT/danor_oreilly_0805/scripts/designer/serve_quiz.pl?ACTION=SUBMISSIONS&ID=988327492" overwrites the "/" before SCRIPT in "http://webct.tru.ca/SCRIPT/danor_oreilly_0805/scripts/serve_home".

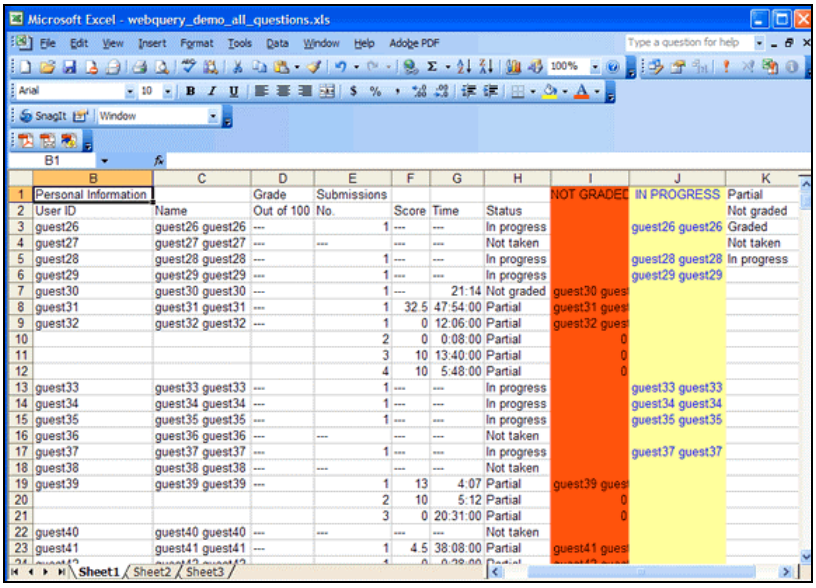


Once the URL is pasted, click GO. This then takes you to the Submissions page, listing all the students in the course. Click the yellow which turns to a green . This identifies the data that you want to import from WebCT into Excel.



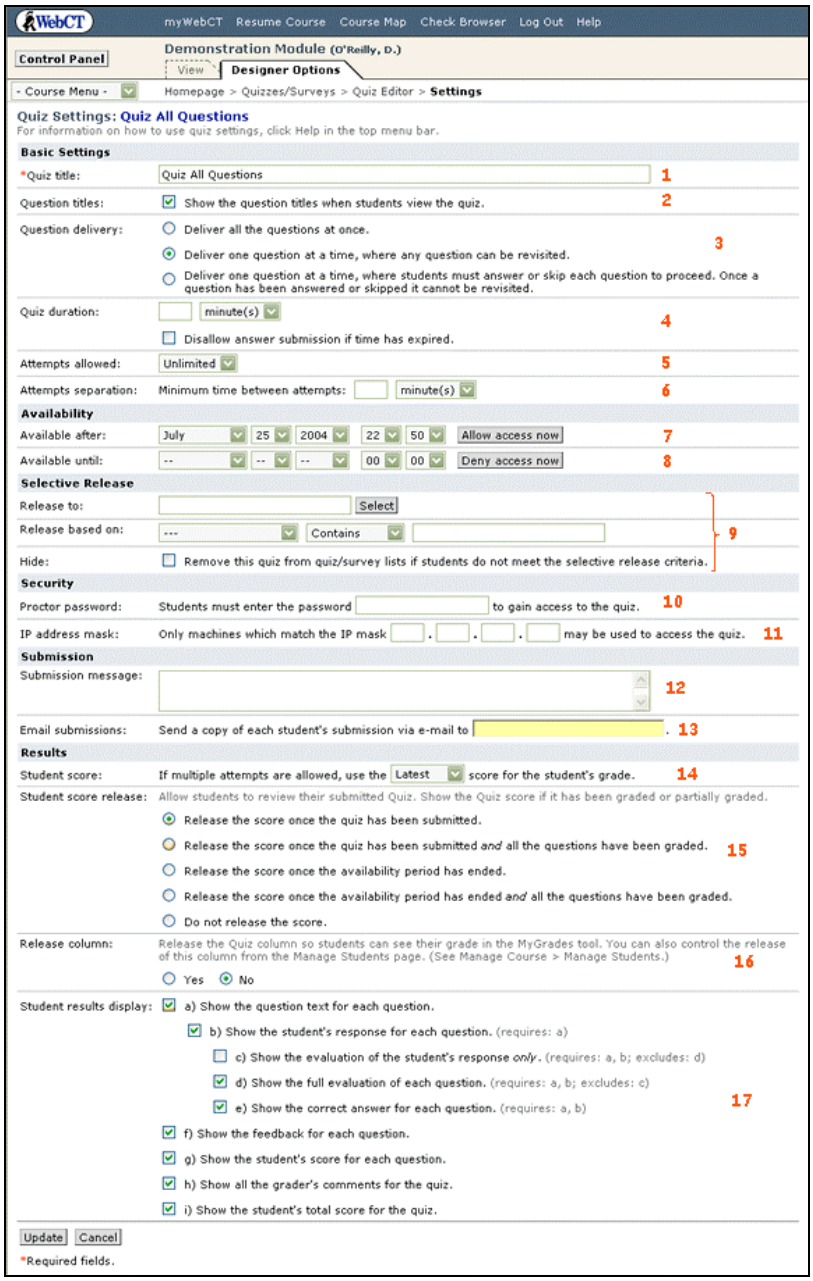

Click Import, importing the data from the Submissions page into your Excel spreadsheet.

This screen capture displays an Excel spreadsheet, in which I wrote macros and formulas to analyze the data pulled from the Submissions page. Excel has tools that allow you to continuously update the data being generated from WebCT. With WebQuery you are basically creating a real-time Excel window into the Submissions page of your WebCT Quiz. Excel WebQuerys can be used to mine data for a variety of different purposes in WebCT; they are exceptionally useful.



## CONFIGURING THE WEBCT QUIZ SETTINGS

To open the Quiz Settings page: From Control Panel > Quizzes/Surveys > [Name of Quiz] > Edit Quiz Settings. Seventeen different areas can be identified in the Quiz settings.




In the following I only discuss a few of the 17 areas numbered above, many of these areas are covered in other sources about WebCT CE 4.x. I only cover those that are directly relevant to monitoring a quiz in a lab.

### Controlled release of quizzes

**Controlled release to specific students [9]**

- You can release quizzes to the whole class or to only a subsection of the class, even to just one person.
- Even though you can control release to one account, more than one person can sign into an account (all using the same student/WebCT ID). So, a student could sign into a quiz, and have their bright friend in Timbuktu sign in at exactly the same time and complete the quiz for them, while the student sits in front of the workstation appearing to do the work. The best way to stop this is by controlling the IP Address, and setting and changing the password.

**Controlled release to an IP address [11]**
To reduce the risk that more than one person signs into the same account/quiz, you can release quizzes to a single IP address or to a range of IP address. This at least prevents the person in Timbuktu from accessing the quiz.

**Controlled release by quiz password [10]**
You can set a password to allow entry into a quiz. With this setting, the quiz cannot be started without the password. Not only does this assist to control unauthorized access to the quiz, it also gives you the power to force everyone to start the quiz at approximately the same time. This option combined with the release by User ID and the release by IP address can significantly reduce the possibility of unauthorized access.

**Change the password during the quiz and deny access [10]**
During the quiz, I usually reset the password as soon as everyone is into the quiz, which effectively prevents anyone new from signing in. This helps to prevent someone signing-on from a remote site (if you didn't restrict access by the IP address and they were emailed the current password by someone taking the quiz), especially someone who was authorized to do the quiz but did not show up.

### Security Issues for totally online courses

Obviously, the security issues for totally online courses are quite different than for face-to-face courses. There is a fair amount of literature on this topic. Most universities and colleges have testing centres, and for a fee you can have students invigilated during an exam. I have done this with students taking my online logic course. These students arranged with a testing centre to use an Internet-enabled computer for completing their exams. An invigilator was also present. However, you still need to create an exam that is more demanding and that could not be easily completed by cheating. In testing centres, you seldom have the ability to check out the computer system the student uses for the exam, or to specify that there must be a secure browser.

# WebCT types of quiz questions

*by Dan O'Reilly*

## WEBCT (4.X)

In contrast to some of the other WebCT tools, such as the calendar or email, the WebCT Quiz Tool is more an environment than a single application. The WebCT Quiz Tool environment has four important parts, one is the question database, another is the quiz index, a third is the quiz editor and the fourth is the actual WebCT quiz (see Figure 14.1).

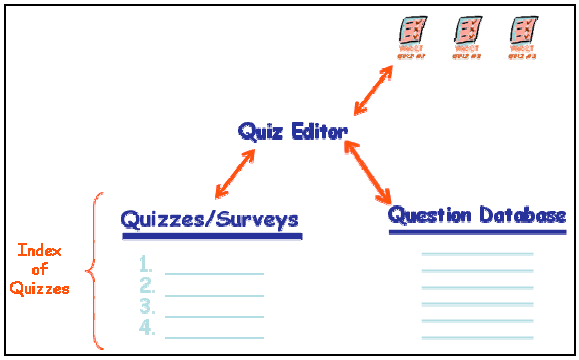



*Figure 14.1*

The question database contains the questions used in a quiz, the quiz editor organizes the questions from the database into a WebCT quiz, and the quiz index (technically referred to as the Quizzes/Surveys page) provides a quick index/link to all the quizzes and their results/statistics contained in the course module. This logical structuring allows the same question database to be used in a variety of different quizzes. You can even export questions from the question database to self-tests.

You access the Quiz Tool through the Control Panel. From the Control Panel you click on Quizzes/Surveys and that takes you to the Quizzes/Surveys page. Here you can create a new quiz or survey, edit an old quiz or survey, and modify the look of the Quizzes/Surveys homepage. From the Quizzes/Surveys page you can link to the question database. The Quizzes/Surveys page is the central hub of the Quiz Tool.

As part of the content of a quiz, you can link to external sources, such as images or other file types (HTML, audio, video, PowerPoint, XLS, etc.). Though the student would not be aware, the code causing this linking can be contained either in the individual questions (in the question database) or in the quiz module (entered through quiz editor). I will discuss linking from individual questions to other files first, and then I will discuss

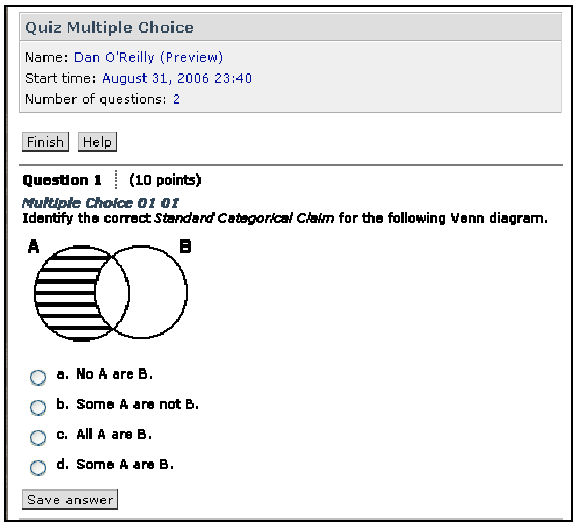
linking from the quiz module to other files. JavaScript can be used in this linking process to significantly enhance quiz presentation.

There are five different types of quizzes in WebCT, and one type, the short answer quiz, allows the student to enter either a single word or a more complex longer phrase as answer. The answers for these quizzes can be parsed using RegularExpression coding. This means that immaterial or trivial typing mistakes on the part of a student, such as an extra space between words, can be identified and will not be penalized. This reduces some of the anxiety often experienced with online testing. After discussing linking to files, I examine RegularExpression coding in some detail.

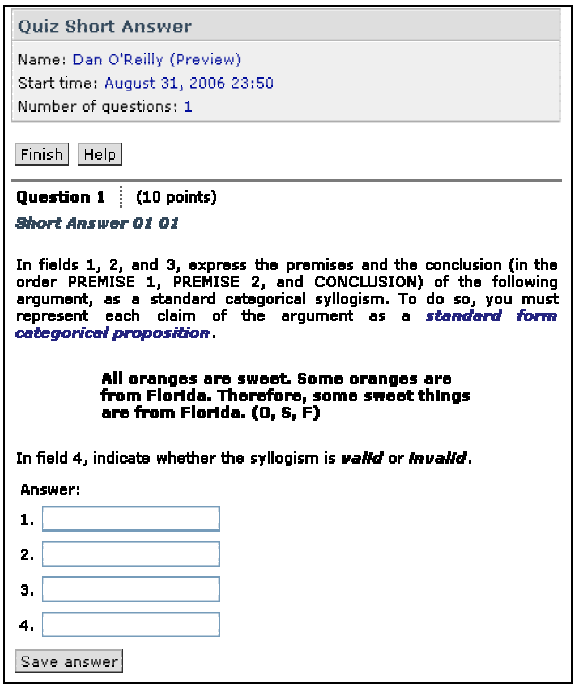
## THE WEBCT QUESTION DATABASE

There are five different types of WebCT questions:

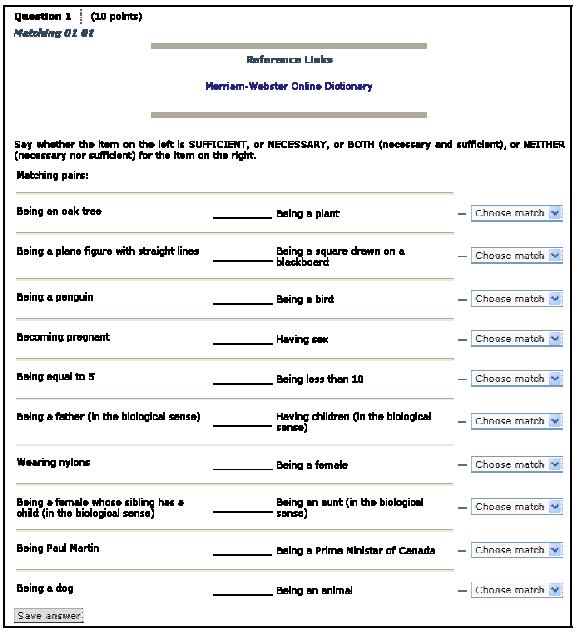
- **Multiple Choice**: MC questions are of two types, students are allowed to select either you or multiple answers to a question. The following example only demonstrates the one answer type.



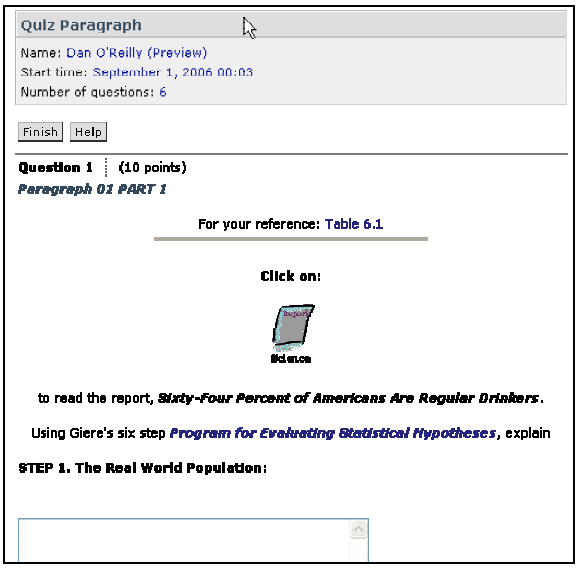

- **Short Answer**: Students enter a word, phrase or short sentence, which is then matched against possible answers. Short answer types of questions can use the RegularExpression feature for evaluating answers (more on this feature later).



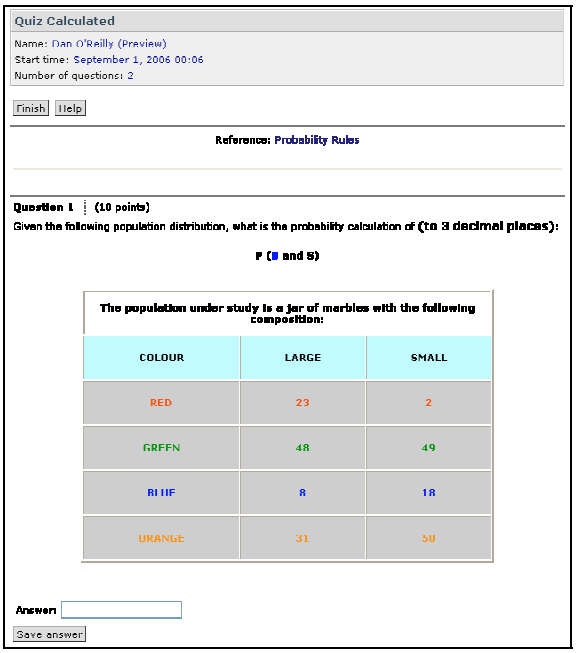

- **Matching**: Students match items in relation to two columns. This type of question uses a pull-down menu.




- **Paragraph**: Students answer the question using a longer essay-type format. The instructor or the teaching assistant must grade this type of question manually.



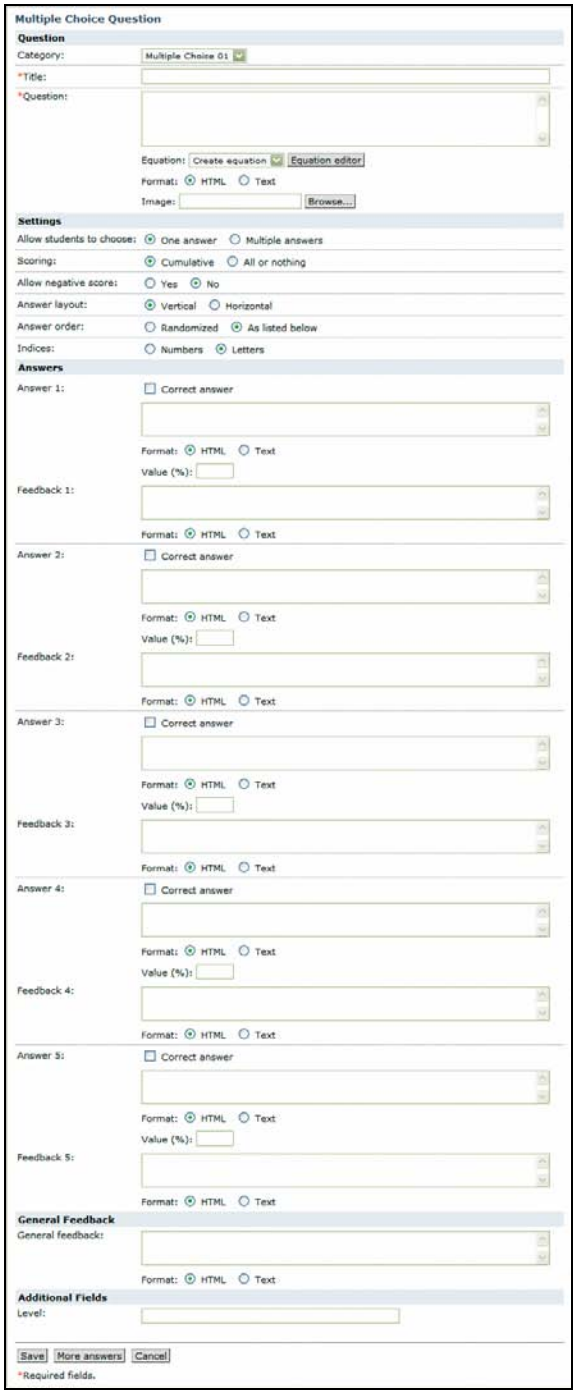

- **Calculated**: Students answer a mathematical question, which requires the use of a formula. In creating the question, the designer specifies the mathematical formula and the set of variables it uses, along with a range of values for each variable. Up to 100 different sets of answers are generated from the set of variables specified (each value in the table below is a variable, which in principle varies from one student to the next).



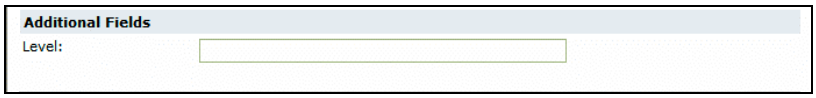

In each type of question shown above, you can link either to content contained within a WebCT directory or to content external to the WebCT course module.

## LINKING TO IMAGES FROM A WEBCT QUIZ QUESTION

Though it does vary slightly from question type to question type, the entry screen to create or edit a quiz question usually has seven sections: category, title, question, settings, answers, and general feedback.

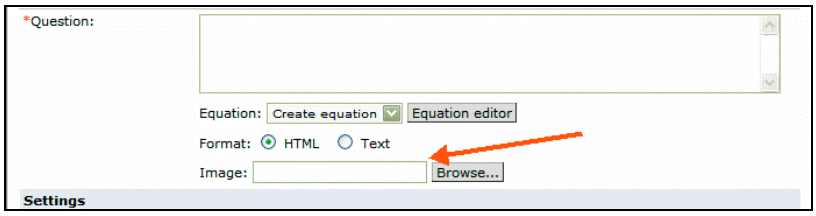


As well, you can also add other sections, for example, I always add a section for the level of difficulty of a question.



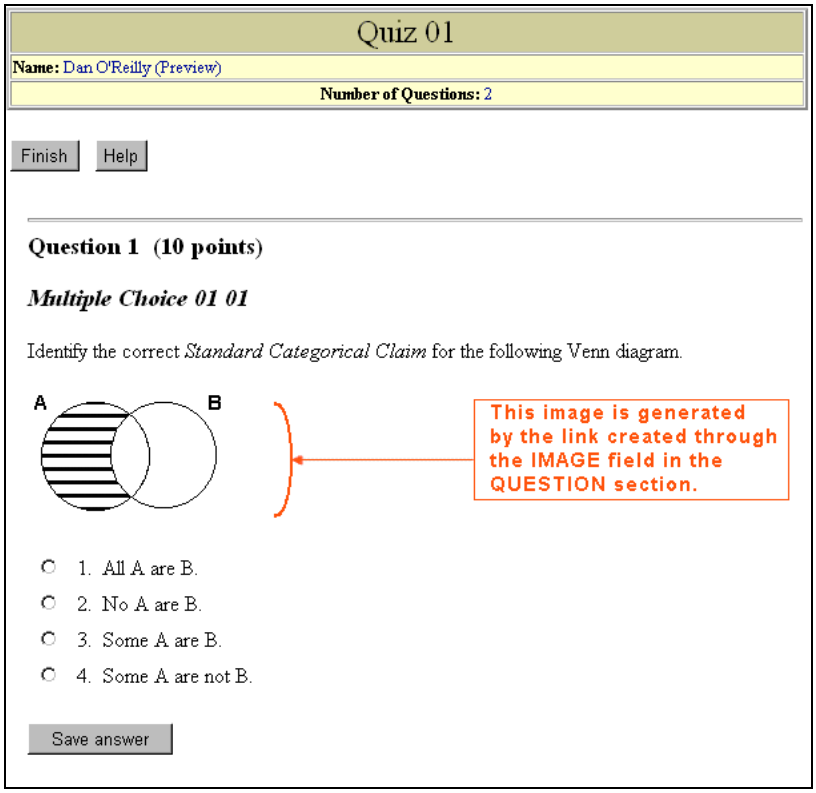

## Two easy methods of linking to images

- **IMAGE FIELD**: In the question database section accessed with the question editor, WebCT provides a field to link to images.

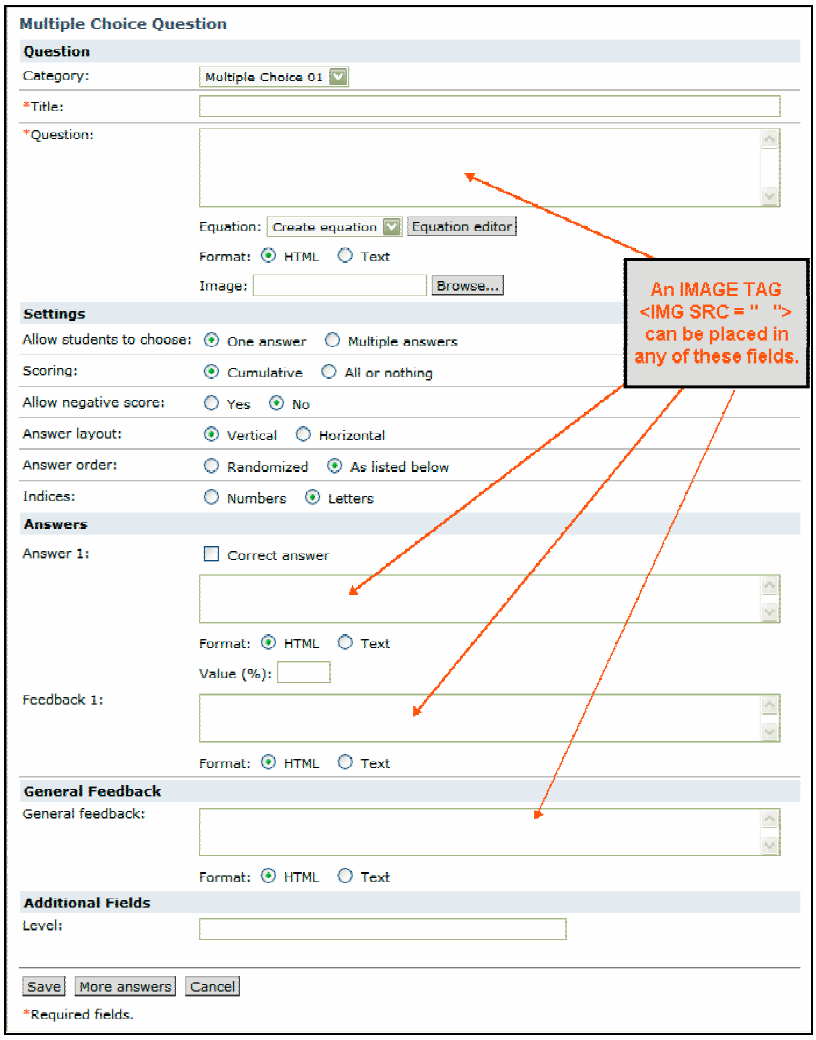



This field is primarily useful when a common image is used to provide information for each possible answer in the question, as in this example.

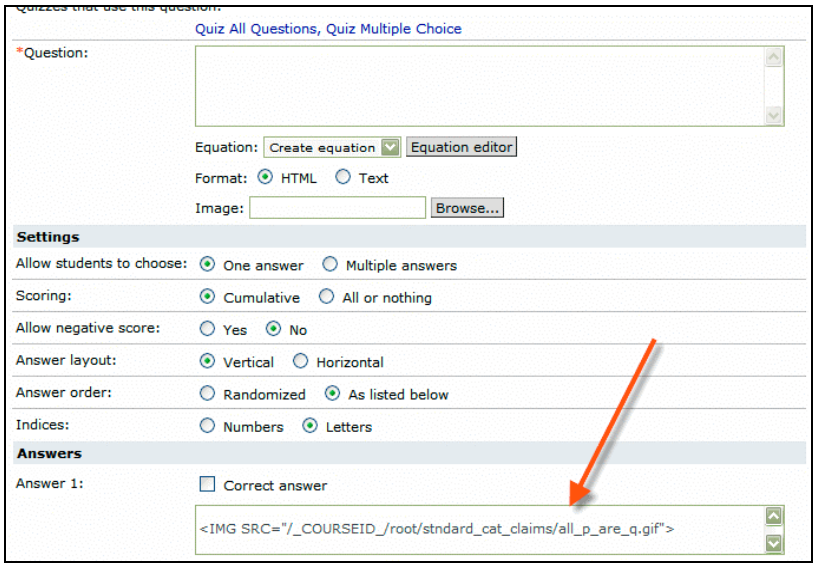
It is a simple matter to create the link to the image, click on the browse button to search the directory structure of WebCT for your graphic; you simply need to know where the image is located in your WebCT file structure.



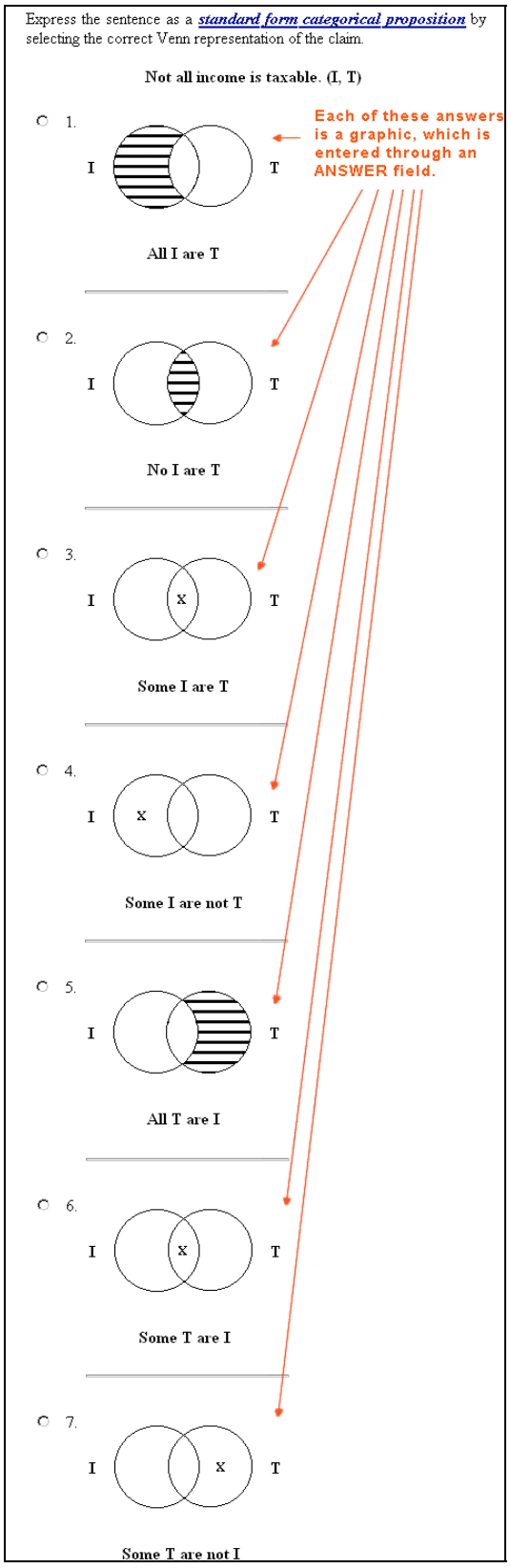
- **<IMG SRC=“ ”>**: If you want to be a little more creative in the use of images in your questions, each of the question field, the answer # field, the feedback # field, and the general feedback field can contain code to images, such as the HTML image tag, <IMG SRC=“ ”>, which is used to automatically display graphics in a HTML page. (These fields can also contain anchor links <A HREF=“ ”> to other HTML pages or external web pages. More on this later.)



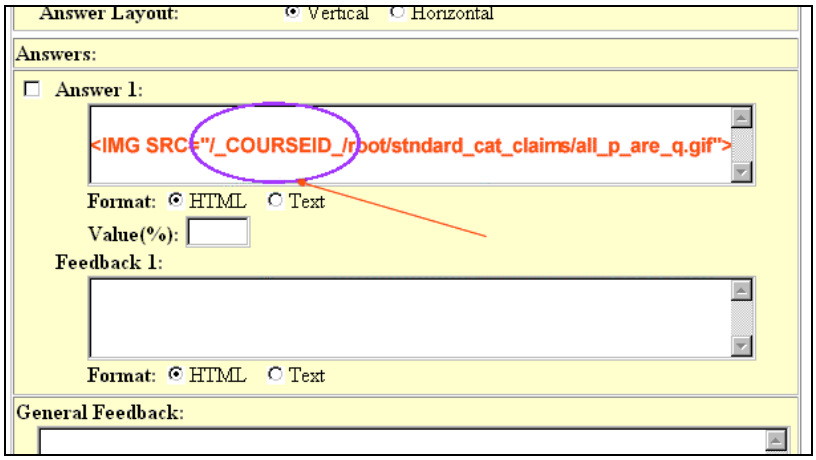

For example, suppose you wanted a graphic associated with each answer in a question. Simply enter the appropriate <IMG SRC=“ ”> tag in the answer field for each possible answer in your question.



I have created quizzes with up to seven possible answers (I do not know the limit).



An undocumented (though discussed on the WebCT listserv) variable in WebCT is the **_COURSEID_** variable. This variable takes on the value of the course root name; you can use it to locate the path to the image.



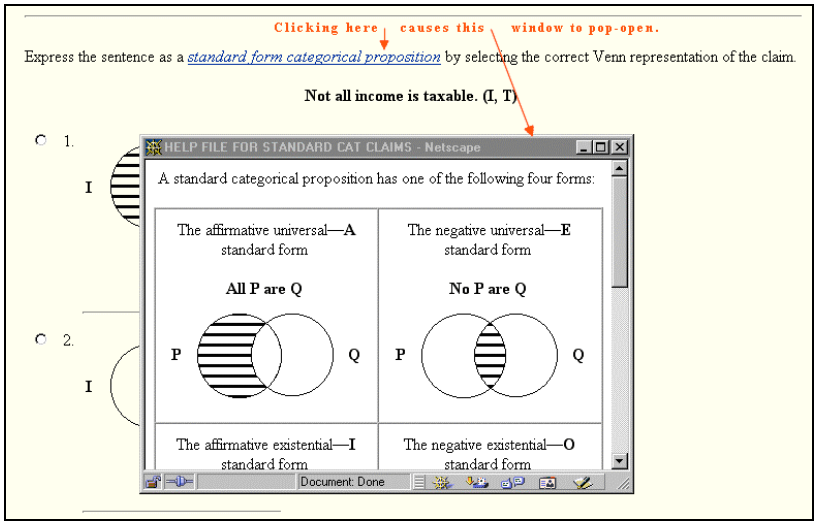

The value of using this variable is that it enables you to easily transfer a database of questions from you WebCT module to another, as long as the directory structure is logically the same. It also allows you to zip your course into a different WebCT root name.

Even though I am using the multiple choice question as an example, these methods of linking to files to provide content for a quiz apply to all the question types. The WebCT quiz environment is quite versatile and rich. Beyond the scope of this article, there are many other options that can be set at the individual question level, such as randomization of the index, multiple choice questions can be configured to accept only one answer or a number of possible answers each with a different value, etc. In addition, the quiz module itself, as distinct from the questions in the quiz, has a variety of different settings, which allows the quiz to be managed in a variety of different ways. In the section on supervising quizzes, I will discuss in some detail the quiz module settings.

In summary then, from within WebCT questions, there are two easy ways to link to images for display during a quiz, you is using the IMAGE FIELD in the question section and another is using the <IMG SRC=“ ”> tag within the question field, the answer # field, the feedback # field, and the general feedback field.

## USING JAVASCRIPT TO LINK TO FILES

Besides using HTML tags in the fields of a question, you can also use JavaScript to link to images, and this gives you the ability to create pop-up windows in your quizzes.

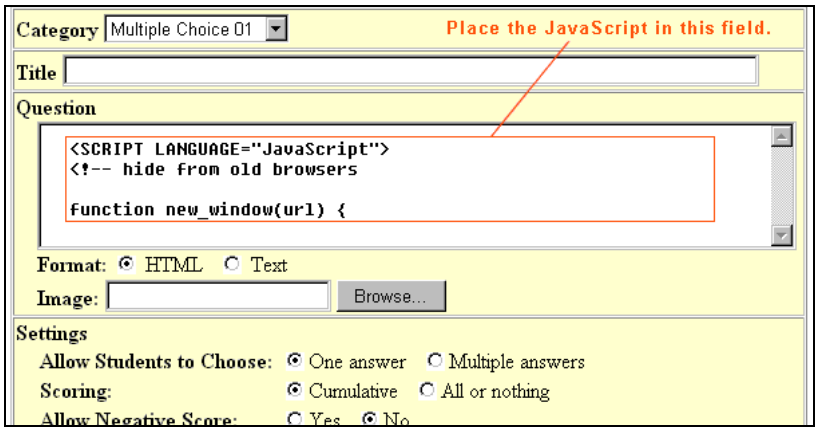


Besides linking to images, you can also link to other types of web documents, everything from standard HTML pages, to audio files, video files, PowerPoint files, etc. These links can be to files within your course or to files external to your course. For example, I frequently provide a link to the ***Merriam-Webster Online Dictionary*** for many of my quizzes.

A simple JavaScript to generate a pop-up window is shown here. [The code in red is not part of the JavaScript required to create the pop-up window link.]

```
<SCRIPT LANGUAGE="JavaScript">
< !-- hide from old browsers
function new_window(url) {
link =
window.open(url,"Link","toolbar=0,location=0,directories=0,status=1,menubar=0,scrollbars=yes,resizable=yes,width=550,height=300,left=60,top=100");
link.focus()
}
// end script hiding -->
< /SCRIPT>
< HR WIDTH=50% ALIGN=center SIZE=5 NOSHADE>
< H3 ALIGN=center>Reference Links</H3>
< P ALIGN=center>
< a href="javascript:new_window('http://www.m-w.com/home.htm')">Merriam-Webster Online Dictionary</A>
< P><HR WIDTH=50% ALIGN=center SIZE=5 NOSHADE>
< P ALIGN=justify>Say whether the item on the left is SUFFICIENT, or NECESSARY, or BOTH (necessary and sufficient), or NEITHER (necessary nor sufficient) for the item on the right.
```

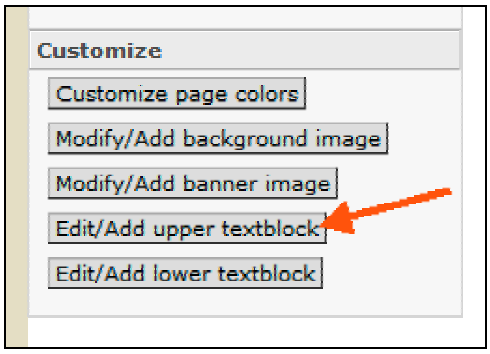
This script can be placed in the question field of a question template (only a portion of the JavaScript is shown in the following field).




## LINKS FROM THE WEBCT QUIZ MODULE

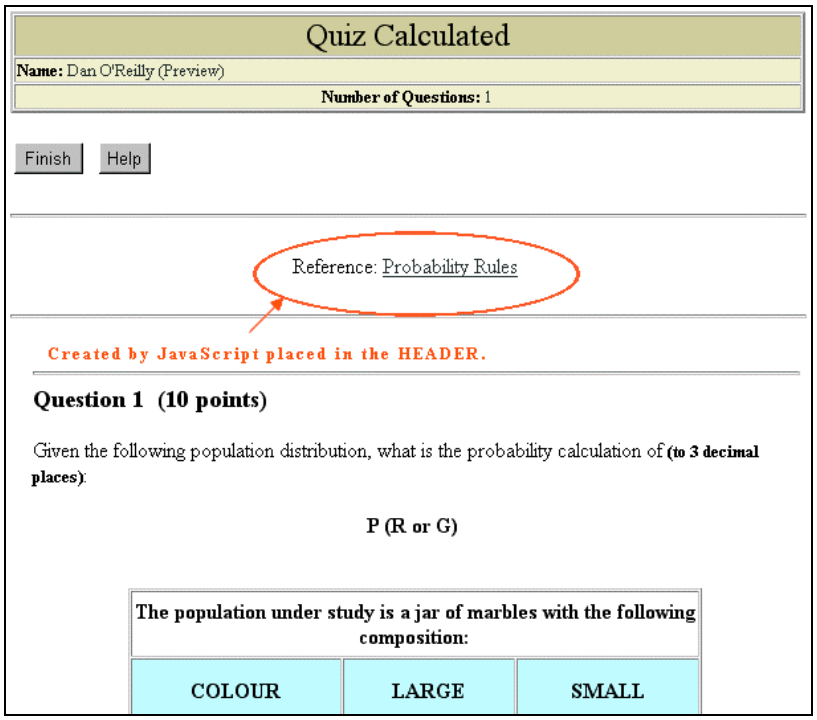
The quiz module is created/edited through the Quizzes/Surveys link. Go to the Quizzes/Surveys page and select the quiz. When you click on the quiz name you are automatically put into the quiz editor. The quiz editor assembles and connects the various parts of a quiz (which I am referring to as the quiz module). Most importantly, through the quiz editor you link the questions from the question database to a quiz. Here you can add questions, delete questions, modify the settings for a quiz, and preview the quiz, to name but a few of its functions. This is where you can program WebCT to randomly generate a set of questions from a database of questions.

The quiz editor allows you to modify the page style of the quiz. One of the modifiable style features is the upper textblock.




In the textblock you can place a variety of JavaScripts. *(Just a note of caution at this juncture: You should always do a backup of your course before you try any JavaScript in textblocks. Some JavaScript can completely disable a page. So, it is handy to have a backup of your course in case your JavaScript crashes your system.)* When I want a link to the same information for every question in a quiz, I place the JavaScript code that creates the pop-up window/link in the upper textblock of the quiz module.


When the JavaScript is placed in the textblock, it operates on every page of the quiz.



The JavaScript code used to generate the pop-up window for the quiz linked to this page is shown here.

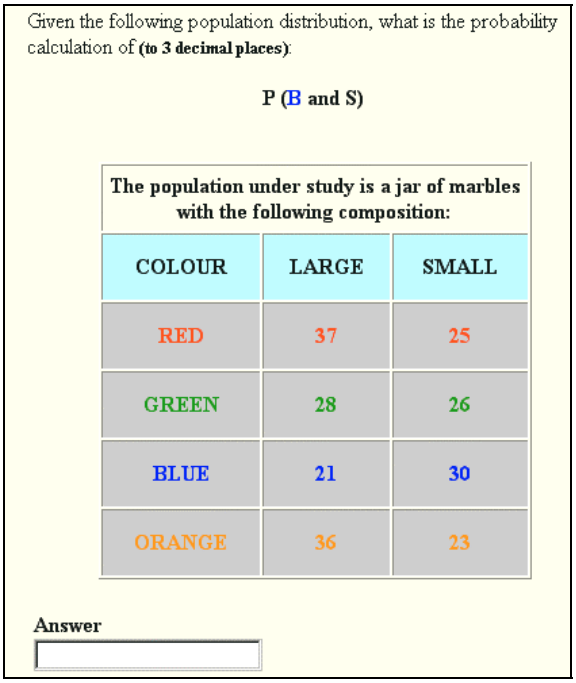
```
<SCRIPT LANGUAGE="JavaScript">
< !-- hide from old browsers
function new_window(url) {
link =
window.open(url,"Link","toolbar=0,location=0,directories=0,status=1,menubar=0,scrollbars=yes,resizable=
yes,width=550,height=300,left=60,top=100");
link.focus()
}
// end script hiding -->
< /SCRIPT>
< P ALIGN=center>Reference: <a
href="javascript:new_window('//root/calculated_question/probability_rules.htm')">Probability
Rules</A>
< P><HR>
```

## ADVANCED FEATURES WITH HTML AND JAVASCRIPT IN WEBCT QUIZZES

In two of the quizzes created for this section on WebCT Quizzes, I used some relatively advanced coding features of HTML and JavaScript.

### Use of HTML in question field

For example, in the calculated question example, I create the table for the quiz using the following HTML code.


Given the following population distribution, what is the probability calculation of **(to 3 decimal places)**:

**P (B and S)**

| The population under study is a jar of marbles with the following composition: | | |
|---|---|---|
| COLOUR | LARGE | SMALL |
| RED | 37 | 25 |
| GREEN | 28 | 26 |
| BLUE | 21 | 30 |
| ORANGE | 36 | 23 |

Answer

Calculated questions allow the use of variables, and if you scan this code you will notice the variables by looking for braces, e.g., { }. Using the variable feature of calculated questions enables you to generate hundreds of examples from one question.

```
<P>
Given the following population distribution, what is the probability calculation of <FONT
SIZE=-1><B>(to 3 decimal places)</B></FONT>:
<P ALIGN=center><B> P (<font color="#0000FF">B</font> and <B>S</B>)
</B>
<P ALIGN=center> 
<table width="75%" border="1" cellspacing="1" cellpadding="1" align=center>
<tr>
<td COLSPAN=3 align="center" height="50" ><b>The population under study is
a jar of marbles with the following composition:</b></td>
</tr>
<tr align="center" bgcolor="#CCFFFF">
<td height="50"><b>COLOUR</b></td>
<td height="50"><b>LARGE</b></td>
<td height="50"><b>SMALL</b></td>
</tr>
<tr align="center" bgcolor="#CCCCCC">
<td height="50"><b><font color="#FF0000">RED</font></b></td>
<td height="50"><b><font color="#FF0000">{r2}</font></b></td>
<td height="50"><b><font color="#FF0000">{r3}</font></b></td>
</tr>
<tr align="center" bgcolor="#CCCCCC">
<td height="50"><b><font color="#339900">GREEN</font></b></td>
<td height="50"><b><font color="#339900">{g2}</font></b></td>
<td height="50"><b><font color="#339900">{g3}</font></b></td>
</tr>
<tr align="center" bgcolor="#CCCCCC">
<td height="50"><b><font color="#0000FF">BLUE</font></b></td>
<td height="50"><b><font color="#0000FF">{b2}</font></b></td>
<td height="50"><b><font color="#0000FF">{b3}</font></b></td>
</tr>
<tr align="center" bgcolor="#CCCCCC">
<td height="50"><b><FONT color="#FF8000">ORANGE</FONT></b></td>
<td height="50"><b><FONT color="#FF8000">{o2}</FONT></b></td>
<td height="50"><b><FONT color="#FF8000">{o3}</FONT></b></td>
</tr>
</table></P>
```

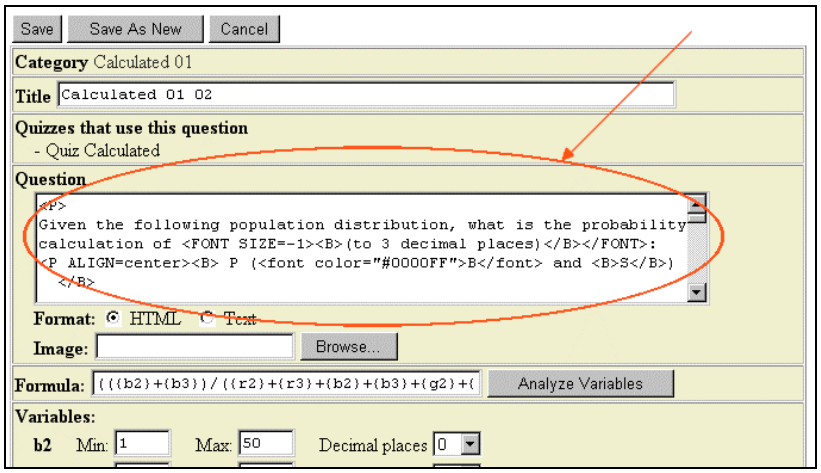
I created this code in the HTML editor Dreamweaver, which gives a WYSIWYG view of the variables.

Given the following population distribution, what is the probability calculation of (to 3 decimal places):

P (B or O)

| The population under study is a jar of marbles with the following composition: | | |
|---|---|---|
| COLOUR | LARGE | SMALL |
| RED | {r2} | {r3} |
| GREEN | {g2} | {g3} |
| BLUE | {b2} | {b3} |
| ORANGE | {o2} | {o3} |

… and then placed the code in the question field of the calculated question template (only the top part of the code is shown here).

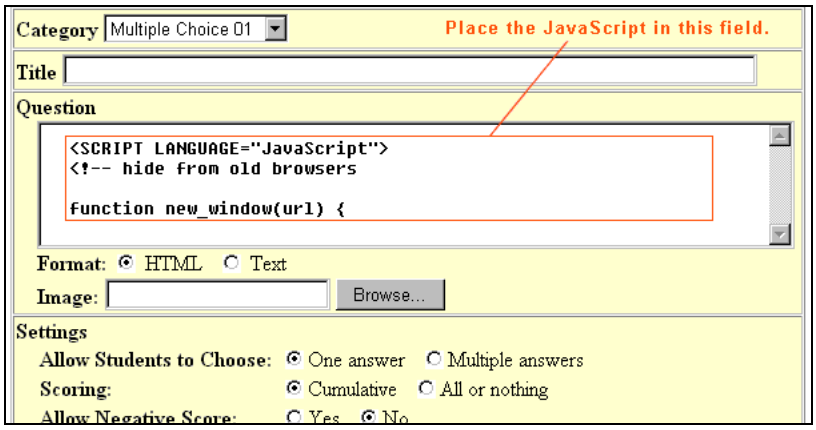



## Use of JavaScript memory variables

In the multiple choice question on page 230 displaying a graphic for each possible answer, I use JavaScript memory variables to supply the category reference labels, as well as the standard form formulas. This enabled me to create one template to generate over 100 exercises; I only had to change the memory variable entry in one location rather than eight locations for each question (which is what I would have to do if I had entered the values as constants). The JavaScript code used to create the memory variables looks like this.

```
<SCRIPT LANGUAGE="JavaScript">
<!-- hide from old browsers

var main_term = "Not all income is taxable. (I, T)"
var p_term = "I"
var q_term = "T"
var all_p_are_q ="All "+ p_term +" are "+ q_term
var no_p_are_q = "No "+ p_term +" are "+ q_term
var some_p_are_q = "Some "+ p_term +" are "+ q_term
var some_p_are_not_q = "Some "+ p_term +" are not "+ q_term
var all_q_are_p = "All "+ q_term +" are "+ p_term
var some_q_are_p = "Some "+ q_term +" are "+ p_term
var some_q_are_not_p = "Some "+ q_term +" are not "+ p_term

function new_window(url) {

link = window.open(url,"Link","toolbar=0,location=0,directories=0,status=1,menubar=0,scrollbars=
yes,resizable=yes,width=450,height=300,left=120,top=180");
link.focus()
}

// end script hiding -->
</SCRIPT>
<P ALIGN=justify>Express the sentence as a <a
href="javascript:new_window('/_COURSEID_/root/stndard_cat_claims/help_stnd_claims.htm')">
<I><B>standard form categorical proposition</B></I></A> by selecting the correct Venn
representation of the claim.
<P ALIGN=center><B>
<SCRIPT LANGUAGE="JavaScript">
<!-- hide from old browsers
document.write(main_term)
// end script hiding -->
</SCRIPT>
</B></P>
```

Similar to the first example, the code is placed in the question field of the multiple choice question (again only the top part of the code displays in this example).

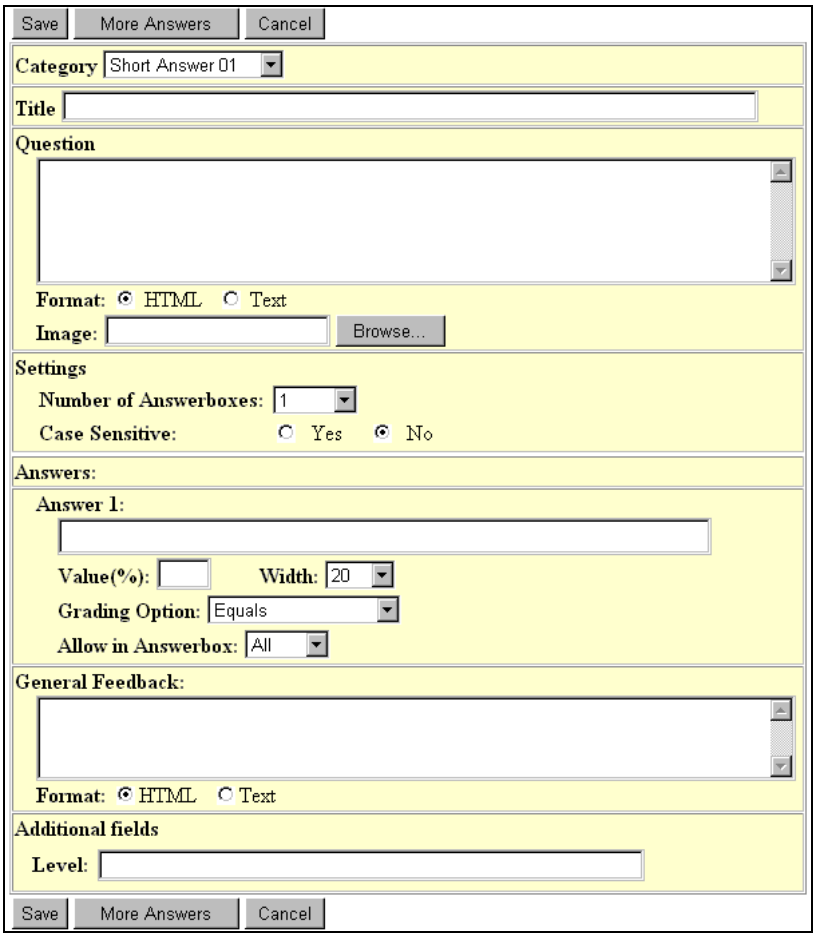



Subsequently, each answer field has code similar to the following which makes use of the variables defined by the JavaScript in the question field.

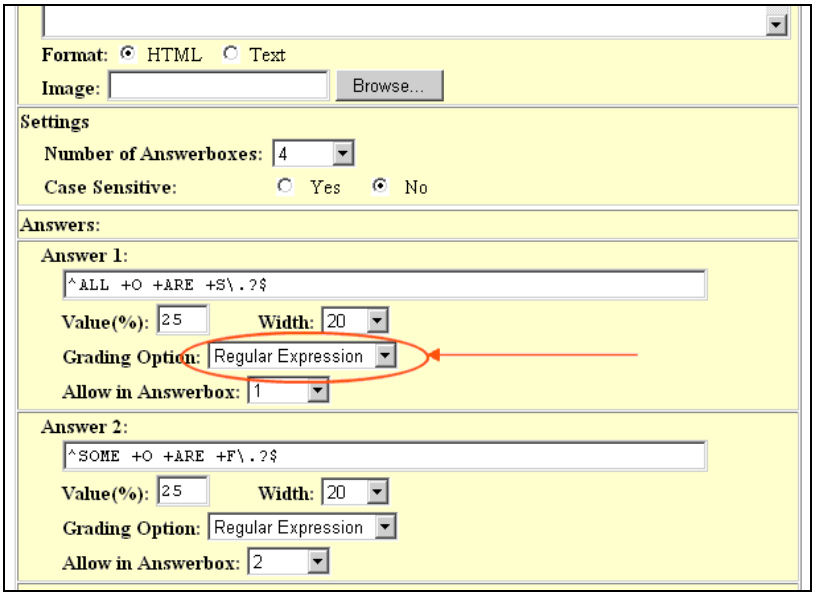
```
<P><TABLE ALIGN=center BORDER=0 WIDTH=100%><TR>
<TD><B>
<SCRIPT LANGUAGE="JavaScript1.2">
<!-- hide from old browsers
document.write(p_term)
// end script hiding -->
</SCRIPT>
</B></TD><TD ALIGN=center>
<IMG SRC="/_COURSEID_/root/stndard_cat_claims/all_p_are_q.gif">
</TD><TD><B>
<SCRIPT LANGUAGE="JavaScript">
<!-- hide from old browsers
document.write(q_term)
// end script hiding -->
</SCRIPT>
</B></TD></TR></TABLE>
<P ALIGN=CENTER><B>
<SCRIPT LANGUAGE="JavaScript">
<!-- hide from old browsers
document.write(all_p_are_q)
// end script hiding -->
</SCRIPT>
</B><P><HR>
```

## SHORT ANSWER WITH REGULAR EXPRESSION

As is the case for the other quiz types, the entry screen for a short answer quiz generally has five sections: category, title, question, answers, and general feedback.




The answer section, however, is a little more complex than on the multiple choice question. In this question type, there is a pull down menu to select the grading option, and one grading option is *Regular Expression*. The regular expression option enables you to parse the input. This assists in reducing the number of simple data entry errors, such as the student entering an extra space between words, in a multiple word answer.



In the example shown above, the ^ tells the parser that the entry has to begin at the beginning of the line; the + tells the parser that it can match one or more occurrences of the character immediately to the left (in this case a space); the \ tells the parser that the character following is a period (not a meta character); the **?** tells the parser that the character to the left (the period) may or may not be there, but if it is there it should only occur once; and the **$** tells the parser this should be the end of the entry. As I do not want my quizzes to be a course about typing, regular expressions can reduce significantly the number of answers marked incorrect due to trivial typing errors. This mean all the following would be treated as correct by the regular expression parser:

Some O are F.

some o are f.

some o ARE F

SOME O ARE F

The following are links to pages about ***Regular Expression***:

- Henk's Test a RegExp
  http://home.wanadoo.nl/h.schotel/testaregex/
- Henk's Quia Page
  http://www.quia.com/pages/regex.html
- The Regex Coach
  http://www.weitz.de/regex-coach/
- Regular Expression HOWTO
  http://www.amk.ca/python/howto/regex/
- Regular-Expressions.info
  http://www.regular-expressions.info/

One of the links is to an applet, which tests your RegularExpression, another is to the Regex Coach, a program which can be downloaded. I have found both these tools invaluable when creating regular expressions. The other links are to online reference material about RegularExpression. Some of these links were created and are maintained by Henk Schotel. For those who have visited the WebCT Home Page and specifically the Dr. C support facility, you will recognize Henk as one of the experts who contributes to Dr. C.

# Third-party tools

There are several free or low-cost third-party assessment tools available over the Internet:

- The Discovery School website "offers teachers of all subjects and array of powerful tools" for assessment (http://school.discovery.com/teachingtools/teachingtools.html). Use Puzzlemaker to generate crossword puzzles, word searches, and math squares. Visit the Quiz Center to create and give quizzes. Try the Worksheet Generator to create custom worksheets for your course materials.
- Higher education and K–12 instructors use Quia ('key- ah) "to create customized educational software online, built around their own course materials and made available to students over the Web" (http://www.quia.com/company/quia_web.html). Quia is a subscription-based service.
- Half Baked Software, Inc., created Hot Potatoes, a set of applications that allow instructors "to create interactive multiple-choice, short-answer, jumbled-sentence, crossword, matching/ ordering and gap-fill exercises for the World Wide Web" (http://hotpot.uvic.ca/). You can also include MP3 audio files and math symbols as part of these assessment activities. Hot Potatoes requires a licensing fee, unless you work for a publicly funded, non-profit educational institution.
- QuizStar is a free web-based tool for K–12 instructors to create and assign quizzes, manage student results, and allow students "to review the results for further learning" (http://quizstar.4teachers.org/).

Some publishers offer assessment tools that accompany textbook activities. For example, Glencoe Online Mathematics provides an Online Study Tools site (http://www.glencoe.com/sec/math/studytools/index.php4).

# Authentic student assessment strategies for the online environment

*by Kevin Kelly*

Often when we talk of assessment in an online environment, we think of automated quizzes and grade books. While useful in many circumstances, automated quizzes do not always accurately reflect a student's abilities, especially when you are asking them to achieve a higher level of difficulty in the cognitive learning domain, to demonstrate a physical skill in the psychomotor learning domain, or to evaluate attitudes in the affective learning domain (see description of learning domains and degrees of

difficulty at http://www.nwlink.com/~donclark/hrd/bloom.html). Authentic assessment—assessing student abilities to apply knowledge, skills, and attitudes to real world problems—is not only possible in an online environment; it is getting more popular.

## PREPARING AN ASSIGNMENT FOR ASSESSMENT

The first step to assessing online work is to prepare each assignment. Since students may not have you around to ask questions, you need to anticipate the types of information that students need. There are some standard items to include in your instructions for all types of online assignments:

- Name of the assignment (This should be the same name as listed in the syllabus).
- Learning objective(s) to which this assignment relates.
- When the assignment is due.
- Any resources that you recommend using to complete the assignment.
- Expectations (length, level of effort, number of citations required, etc.).
- Level of group participation (individual assignments, group or team projects, and entire class projects).
- Process (how students turn in the assignment, if they provide peer review, how peers give feedback, how you give feedback).
- Grading criteria (include rubric if you are using one).

By including these items, you give students a better idea of what you want them to do.

When you consider what types of online assessment strategies to choose, the list will be very similar to the print-based strategies that you know and already use. However, there are a few additional assessment strategies that the online environment makes possible. The list below is not comprehensive by any means. It also does not show which tools could be used to facilitate the different types of assessment strategies. Some of these activities may require students to have access to equipment or software applications to complete.

*Table 14.1. Assessment strategies and disciplines that may commonly use them*

| Type of assessment strategy | Disciplines that might use each assessment strategy |
|---|---|
| text-based | |
| essay | multiple |
| glossary | multiple |
| lab manual | physical sciences |
| computer code | computer science |
| technical writing | technical and professional writing |
| reflection | teacher education, health education, social work |
| observation log | teacher education, nursing, laboratory sciences |
| media | |
| image gallery | art, industrial design |
| web page or website | multiple |
| presentation | business, public administration |
| audio | language acquisition |
| video | theatre arts (monologue), marketing |

Notice that some assessment strategies require participation by someone other than the student. For example, a K–12 master teacher would submit an observation log for a credential student performing his or her student teaching. Similarly, a health clinic supervisor would submit an observation log for a nursing student related to his or her abilities to draw blood for testing. A theatre arts student may need someone to record his or her monologue.

Some assessment strategies allow students to get creative. In Chapter 11, Accessibility and Universal Design, the section on Universal Design for Learning discusses the concept of letting students decide what product or process they will use to demonstrate knowledge, skills, or attitudes. Chapter 11 also covers important aspects of making sure that students have access to, or ability to use the technologies required to complete the tasks. Once you do that, you could ask students to create a video advertisement that demonstrates the application of marketing principles, an audio recording that demonstrates mastery of inflection and tone when speaking Mandarin Chinese, or a PowerPoint slide show with audio clips that demonstrates competency with teacher education standards. The age-old practice of storytelling has been "remastered" as digital storytelling through blogs, wikis, podcasts, and more. Students are taking advantage of these new media formats to illustrate that they have met certain requirements. In some cases, each product becomes an "asset" or "artifact" in a larger electronic portfolio that contains items for a single class, an entire program or department, or all curricular and co-curricular work that a student does. Regardless of what products students provide to show their abilities, you need a way to evaluate their work.

## DEFINING EXPECTATIONS

After determining how students will show how they can meet the learning objectives, it is time to choose an evaluation method. You can use a number of tools, ranging from a simple checklist of criteria to a rubric that contains the same criteria as well as a range of performance and degrees to which students meet the criteria. You can use qualitative or quantitative degrees to evaluate criteria (see Table 14.2 for an example of each). Share the checklist or rubric with students before they begin the assignment, so they know what will be expected of them. In some cases, instructors create the entire rubric, or portions of it, with the students.

*Table 14.2. Portion of a student presentation assessment rubric*

| Criteria | Range | | | |
|---|---|---|---|---|
| | 4 | 3 | 2 | 1 |
| Student supports main presentation points with stories or examples | Student effectively used stories and/or examples to illustrate key points. | Presenter used stories and/or examples somewhat effectively to illustrate some key points. | Presenter used some unrelated stories and/or examples that distracted from key points. | Presenter did not use stories or examples to illustrate key points. |
| | Comments: | | | |
| Cover project completely, including: | Presentation covered all 6 of the areas to the left. | Presentation covered 4 or 5 of the areas to the left. | Presentation covered 2 or 3 of the areas to the left. | Presentation covered 1 or 0 of the areas to the left. |
| 1) Needs Assessment Objectives, 2) Extant Data Analysis, 3) Data Collection Methods, 4) Brief Summary of Data, 5) Collected Data Analysis, 6) Recommendations | Comments: | | | |

Invite students to use the same rubric for peer review assignments. Students benefit from reviewing peers' work, as they get to see different ways of approaching the same objective. These same students benefit from their peers' additional feedback. Let students know that merely giving a numeric score for each criterion is not enough. For peer review to be "constructive criticism," students must help each other construct better answers, better arguments, and better performance. In addition to clarifying expectations about the assignment through the rubric itself, you must clarify expectations about how students use the rubric for peer review.

**Tip**

If you have never created a rubric before, there are online tools that guide you through the process. Rubistar is "a free tool to help teachers create quality rubrics" (http://rubistar.4teachers.org). The site also has example rubrics and information about how to analyze student performance.

## TEACHING AND TECHNOLOGY IN THE ASSESSMENT PROCESS

The next step in the assessment process is to facilitate the student work in the online environment, or to provide avenues for students to submit their work to you. More online tools emerge every day, it seems, and with them come new opportunities for students to perform activities related to the learning objectives and for us to assess student performance. We will cover a range of tools used for assessment delivery, pros and cons related to using each of these tools, and strategies related to the teaching and the technology aspects of using them.

## EMAIL OR LISTSERVS

Email can be used for distributing assignments from student to instructor, from student to small group, or from student to the entire class. It will depend on what role peer feedback plays in the overall assignment. Since almost everyone in an educational setting uses email, it seems like an easy solution for students to submit their

work for evaluation. However, as easy as it is to use, email is not foolproof. Email messages get blocked by spam filters, by overprotective Internet Service Providers, and by inadequate storage capacity, to name a few possibilities. Another issue with email arises when you try to organize all of the files received for a particular assignment. As you create more assignments, it will be harder to separate one from the other. Attachments sometimes get separated from the email message, and large attachments sometimes do not get through due to size limitations. If you have a large class, the volume of email may become overwhelming.

If you do use email as a mechanism to collect student work for evaluation, then require your students to use a specific email subject that will make them easy to sort, such as "Assignment 3—Juan Doe." Keep in mind that even with the most explicit instructions, not every student follows them. To assess each student's work, you will follow the same process as you do for print-based assignments.

## REFLECTIVE JOURNALS VIA WEBLOGS

Instructors in many fields require students to write journal entries or reflective essays. In some cases, these exercises give students a chance to practise writing. In other cases, journal entry assignments force students to reflect on specific experiences and their attitudes about those experiences. While students can write their reflections almost anywhere, a tool called a weblog provides a forum for students to record their thoughts and, in some cases, to control who can access their reflections. You can find more information about weblogs themselves in Chapters 25 and 27. For the purposes of this chapter, we will focus on assessment strategies for students' weblog entries.

As journal entries and reflections are not standard for all students, you will have to adopt different assessment strategies. For instance, rather than evaluate the content of the weblog entries, you can evaluate them based on regularity, length and whether or not the content is appropriate to the topic or theme. You may also want to submit notes or comments and possibly ask students to write weblog responses to those comments. Regardless of your approach, make sure that students know how they will be evaluated before they begin the work.

## DISCUSSION FORUMS WITHOUT ATTACHMENTS

Discussion forums are a useful tool to assess student knowledge and attitudes. They can also be used for higher level thinking assignments such as the One Sentence Summary, which requires students to synthesize a complex process (see example directly below). You can assign points to the students' original work as well as any peer review portion of the assignment.

**Example:**
Based on the chapter you have read about international export and import regulations, identify a topic that you want to summarize.

**PART 1—DUE Friday at 11:59 pm (10 points)**: Click "Add a new discussion topic" below. For the topic you identified, answer the questions below and string into YOU SENTENCE. If your answer is longer than you sentence, then try again.

Who _____
does What_____
to Whom (or What) _____
When _____
Where_____
How _____
and Why? _____

**PART 2—DUE Tuesday at 4:00 pm (10 points)**: Read two or more one-sentence summaries that do not have two replies yet. If it has two replies move to the next one. Select a rating. Click "Reply" and provide feedback:

- If you agree with the summary, say why.
- If you do not agree with the summary, provide evidence and suggestions for improvement.
- If the summary is missing one part ("How", "Why", etc.), then fill in the blank.
- Only the instructor's ratings will count towards the grade. The other students' ratings are to give you ideas about how much work you may have to do to revise your statement.

Sometimes students wait until the last minute to complete assignments. For a discussion forum assignment, this means that students post their ideas and reply to their peers all in the same brief period before the deadline. Unfortunately, the result is that not all students get replies or feedback for their ideas, even if they completed the assignment well ahead of the deadline.

If you want the students to engage in an actual discussion, then you should break up the assignment into parts with separate deadlines. Assign points to each portion of the assignment to encourage students to complete both parts (see example below).

**Example:**
WEEK 04 ONLINE ACTIVITY

**Step 1**: Go to the following online workshop about using existing data: http://www.k12coordinator.org/onlinece/onlineevents/assessment/index.htm

(NOTE: The workshop says it takes one hour for each of the five sections. That is for their purposes. Plan to spend one or two hours at your own pace. Most of this will be discussion, since there is not too much to read.)

**Step 2**: Read through the five sections.

**Step 3**: BY FRIDAY (9/23) AT 11:59 PM, do the following:

- 10 points—Post two original threads (one answering each question in this Forum)
- Use your project name in the title of your reply.

**Step 4**: BY TUESDAY (9/27) AT 5:00 PM, do the following:

- 10 points—Post two reply threads for each question (one from your team and one from a different team that does not have two responses yet).

## DISCUSSION FORUMS WITH ATTACHMENTS

Discussion forums keep track of the date and time that assignments are submitted. This feature helps instructors who may have included a late submission policy in their syllabus, such as "Students will receive half credit for late assignments submitted up to two weeks after the assignment is due."

## MAKING ONLINE AUTHENTIC ASSESSMENT AN ITERATIVE PROCESS

Online work does not require everyone to be in the same room, at the same time, so you can take advantage of the online environment to make assessment an iterative process. As we previously stated, authentic assessment mimics work that students will encounter in the real world, such as creating antiviral drugs in a biopharmaceutical lab, making presentations to potential donors to a non-profit organization, or teaching civics lessons in an inner-city high school. In these work environments, there are benchmarks or milestones that allow people to check their progress. You can use authentic assessment methods like the peer review rubric to replicate this process. For example, you may have the students provide peer feedback first, as a way to improve their work before turning it in for a grade, or you may have them provide it at the same time as your own with the option to rewrite it. By creating additional parts to each assessment strategy, students will learn even when you are evaluating them.

# Summary

This has been an overview in some cases and in others a detailed examination of the types of issues you need to consider when evaluating student performance in the online environment. The issues covered in this chapter include security for online testing, creating quizzes in WebCT, finding third-party assessment tools, and authentic assessment strategies.

If you are going to administer an online exam and students will be on campus, it is important to think about the computer lab environment. Work with lab managers to have students use secure browsers and/or computer monitoring software, like NetSupport. You can also use Excel with WebQuery to monitor large numbers of student test submissions. Quiz Settings in WebCT and in other Learning Management Systems include, but are not limited to, restricting which IP addresses (or ranges) can access the quiz itself and setting a password for the quiz.

This chapter provides valuable information for teachers using WebCT. In addition to showing you how to create the different types of questions (multiple choice, short answer, matching, paragraph, and calculated), it demonstrates how to link to images and files. Linking to images can be done using the WebCT Graphic User Interface (GUI) or with HTML code. Linking to files can be done using the GUI or JavaScript. It concludes by looking at grading options for short answer questions.

For those of you who do not have access to, or do not wish to use, a quiz in a learning management system (LMS), there are other online assessment tools available. These third-party tools provide a variety of options, ranging from quizzes similar to those from an LMS to crossword puzzles that use vocabulary from your course. You can also create customized worksheets or include media like MP3 audio files. Some of these tools are free, while others require a subscription or fee.

The last section of the chapter discusses a different type of assessment, called authentic assessment. Authentic assessment is designed to give students the opportunity to show their abilities in ways that are closer to what they will be asked to do in the field they

are studying. Usually multiple-choice quizzes do not provide the opportunity for students to show physical skills or higher level thinking. Essays, lab manuals, audio or video clips, observation logs completed by experts in the field, and presentations are just a few examples of evidence students can provide to demonstrate competencies. Sometimes these pieces of evidence are collected in an electronic portfolio, while in other cases they are individually submitted.

As an instructor it is your job to choose the appropriate assessment strategies for the knowledge, skills or attitudes that students need to display. Define your expectations, possibly with a rubric and model evidence that students should emulate. Pick a technology pathway that will provide equal opportunities for students to succeed. Finally, be sure to make assessment an iterative process. This can mean giving students a chance to go through a self-assessment quiz or to participate in a peer review exercise. It might also mean that you assign low-stakes quizzes or writing assignments each week. This will help students prepare to complete a high-stakes exam or written work.

# References

There is an online version of the WebCT quiz tool discussed in this chapter. It demonstrates the quizzes discussed here: http://webct.tru.ca/webct/ticket/ticketLogin?action=webform_user&WebCT_ID=oreilly01&Password=qwerty&request_uri=/webct/homearea/homearea

Benjamin Bloom's Learning Domains: http://www.nwlink.com/~donclark/hrd/bloom.html