



THE DEVELOPMENT OF ONLINE COURSES

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INTRODUCTION

In an ideal world, instructional media developers – those who will actually create the planned instructional materials with which the student will interact – are included in the course development process from the beginning, to consult with and advise course team members on development-related topics as they arise. Then, on receiving a detailed design document from the subject matter expert or instructor, developers will set to work, assured that

- the instructional designs of the learning materials are stable because they have been based firmly on sound, proven learning theories
- these instructional designs will meet the institution's identified and articulated internal and external standards for quality, usability, and interoperability
- appropriate media have been selected to meet these standards

- the technologies selected for course delivery are not superfluous – rather, the course design will exploit the unique characteristics of the selected media to engage and support both learners and teachers (such characteristics may include accessibility of content, multimedia, hyperlinking, multiple or global perspectives, ease of revision, and accommodation of many forms of interaction)
- the designs are practical and can be developed in a cost-effective and timely way.

Of course, most of us do not have the luxury of working in an ideal world. There is a good chance that a very thick file has just landed on your desk (top), and you are not sure where to start! The first part of this chapter discusses the infrastructures that must be in place to support the development of course materials. The second part considers the key roles on a course production team, a few instructional development models, and some technical issues in the process of developing an online course.

WHAT MUST BE IN PLACE BEFORE DEVELOPMENT CAN OCCUR

Computer-mediated distance education is becoming ubiquitous, and is now being demanded more and more by students. Despite what some might believe, however, Internet-based instruction is by no means the magic bullet that automatically guarantees a rich learning environment. Although research continues to confirm that there is no significant difference among student outcomes based on mode of course delivery (Russell, 1999), we must keep in mind that web-based distance education technology and pedagogy is still very much in its infancy. Hence, those of us working in Internet-based instruction are blazing new trails to develop the essential elements and processes that will lead to high quality, active, online learning environments.

It is generally agreed that the World Wide Web is a compelling, resource-rich, multimedia environment with great potential to serve large numbers of widely dispersed students at relatively low cost. Although many educational institutions have undertaken strategic planning for the systematic implementation of web-based distance education, not all have succeeded. The fundamental requirement to gain support for web-based instruction from faculty, administrators, and students is an institutional model that is distinct from the traditional instructional-planning model and supports the design, development, and implementation of high-quality instruction on the Internet. Each of these stakeholder groups

– faculty, administrators, and students – must be assured that web-based instruction is a viable means of delivering courses and programs, and of accommodating student needs. To create those assurances, the web-based instructional model that is to be implemented must deal with some fundamental issues that may have never been addressed before.

Definition of an Online Course

What does it mean for a course to be considered *online*? Since the web-based delivery option is new to many institutions, there is no standard or accepted definition of what constitutes an online course. An examination of Internet-based courses currently offered reveals two basic categories, with a large middle ground: courses that are primarily text-based (the text being delivered either online or by mailed hard copy), with computer-mediated enhancements; and courses that are designed specifically for the distributed Internet setting, and that merge several smaller educational components into a single course of study.

In the early days of online learning, from the mid 1990s to the early 2000s, the majority of distance-education courses found on the Web were of the former type, involving text that had merely been converted to electronic form and placed on a web site for students to read, or, more likely, to print and then read. The advantages of this method of delivery included circumventing postal delays and getting the materials to the student almost immediately; facilitating easy searching and manipulation of the text by the student; cutting the costs of publishing and shipping; and increasing the ease of development (often using a course template), updating, and revision. In addition, the communication capacity of the Internet allows for a variety of forms of student-student, student-content, and student-teacher interactions, which could be used to augment the students' independent interaction with the printed course contents.

The loudest criticisms of this type of course are that it does not make any use of the multi-modal, computer-mediated instructional means that are available, and that the printing costs are off-loaded onto the student. Also, these text-based online courses are often supplemented by electronic interactive tools, such as discussion forums and chats, which are typically implemented as “extras” or afterthoughts to the course, and thus their pedagogical value is often artificial and suspect.

As the nature of Internet users evolves, so do their demands and expectations from e-learning. Since the beginning of the twenty-first century, there has been a marked shift in online course development

toward the second type of course mentioned above, which attempts to take advantage of the strengths of the Internet as a teaching and learning environment: its open, distributed, dynamic, globally accessible, filtered, interactive, and archival nature (McGreal & Elliot, 2008). In the first generation of this type of online course, where all course materials and activities are Internet-based, text can still play a part in instruction, although it generally appears in short, concise “chunks.” The instruction is also distributed among other multimedia components, commonly known as *learning objects*; ideally, learning objects are designed to be shareable, reusable, and repurposed so that they can work in multiple contexts (McGreal & Elliott).

The first-generation, learning-object-based online course is often delivered through a learning management system (LMS), a software application suite that organizes and standardizes learning content, dividing the course into modules and lessons, supported with quizzes, tests and discussions (Downes, 2005). Today, most LMSs afford developers the use of text; email; asynchronous discussion boards; synchronous utilities such as voice over Internet protocol (VoIP); instant-messaging chat features; desktop and application sharing; on-demand video clips and demonstrative animations; interactive activities, simulations, and games; self-grading exercises, quizzes, and examinations; and secure assignment “drop boxes” where students and instructors exchange assignments and feedback one-on-one.

Some well-known examples of Learning Management Systems are *Blackboard®*, *Moodle*, and *Desire2Learn®*. The eduSource Canada Network of Learning Object Repositories brings together several online collections of learning objects, which can be searched and contributed to by developers free of charge.

While debate and research continues about the value of the first generation online courses, the ground is shifting beneath our feet. As we approach the halfway mark of the new millennium’s first decade, the nature of the Internet, and just as importantly, the people using the Internet, have begun to change. These changes are sweeping across entire industries as a whole, and are not unique to education; indeed, in many ways education has lagged behind some of these trends and is just beginning to feel their wake. One trend that has captured the attention of numerous pundits is the changing nature of Internet users themselves. Sometimes called ‘digital natives’ and sometimes called ‘n-gen,’

these new users approach work, learning and play in new ways.
(Tapscott,1997, in Downes, 2005)

In learning, these trends are manifest in what is sometimes called *learner-centred* or *student-centred* design. This is more than just adapting for different learning styles or allowing users to change the font size and background colour; it is the placing of the control of learning itself into the hands of the learner (Marzano, 1992).

What is emerging from the learner-centred approach to online learning is “E-learning 2.0,” the next generation of online learning that is characterized primarily by a shared domain of interest where members interact and learn together, and develop a shared repertoire of resources (Wenger, 1998). In other words, the shift in learning is moving from the didactic teacher-to-learner model to a networked, community-based model of learner-to-learner. This evolution, of course, has significant implications for instructional design and development, the scope of which is not the intent of this chapter. As instructional developers, however, we are being called upon to become familiar with a new set of tools that will facilitate those engaged in e-learning 2.0.

The type of online learning you are planning to develop might fall into one of the two categories above, or it might fit somewhere in between, and it might contain any combination of learning objects. Regardless of how you define your online instructional materials, your course should contain certain administrative documents to help instructors organize, prepare, and orient students, especially if they are new to online learning. These documents could include

- a personalized letter of welcome for each new student
- general information about online learning, technology requirements, and the resources available to students for technical help, and for obtaining the proper software and Internet services required for the course
- information on how to access the course on the Web, and how to navigate it successfully
- student log-in and password information for course web site
- rules, procedures, and help for use of the interactive tools
- a course syllabus (preferably on public pages so that prospective students can browse in advance of registration); course overview; course schedule; list of required text and materials (if applicable); clearly defined pre-requisite academic and computer skills; course expectations; instructions on activities, assignments, and deadlines;

faculty and tutor contact information and office hours; and student support information

- administrative regulations, including guidelines on plagiarism, privacy, academic appeal procedures, library facilities, and access to counselling and advisory services

Faculty Buy-in

While the World Wide Web has been with us for well over a decade now, only in the past few years has it begun to be accepted as a workable vehicle for the delivery of instruction. Consequently, many faculty members working in post-secondary educational institutions were not hired with the expectation that they would use educational technologies in their teaching. This new mode of learning is also redefining teaching. Access to new cohorts of students and new media makes it possible, sometimes necessary, to teach in new and innovative ways.

Some faculty take to these new methods immediately, while others are unsure if they have, or even want, the technical abilities to develop an online course. Do not underestimate the importance of the degree to which faculty feel they are receiving encouragement and support in all areas of online development. Administrators can initiate certain policies designed to encourage and support faculty acceptance of online teaching. Faculty should be reassured that they are not about to lose their jobs to technology, but that they can expand the ways they do their jobs by employing technology. Finally, it is crucial to adequately reward all who undertake the considerable personal effort and risk to develop courses and teach online, especially within the merit award and promotion processes associated with performance reviews.

Focus on Sound Pedagogy

Any instructional strategy can be supported by a number of contrasting technologies – old and new – just as any given technology might support different instructional strategies. For any given instructional strategy, however, some technologies are better than others: “Better to turn a screw with a screwdriver than a hammer – a dime may also do the trick, but a screwdriver is usually better” (Chickering & Ehrmann, 1996, para. 4).

Faculty concerns about using new teaching methods and media often centre on pedagogy. Unfortunately, many examples of poor pedagogical application in web-based instruction can be found, often in the form of the text-based online courses described above. The prevalence of such examples is largely due to the novelty of online instruction, or

the fact that critical mass has yet to be achieved in design or practice, to prove the value of online learning. One way to address concerns about inferior pedagogy online is to dictate that the same educational standards must apply to the development of instruction for the Internet as to any other delivery medium, such as the classroom.

The American Association of Higher Education's *Seven Principles for Good Practice in Undergraduate Education* is one such set of standards (Chickering & Gamson, 1987). Originally written for classroom instruction, it was later revised to include online educational practice, and is now widely accepted by post-secondary institutions. Good practice in undergraduate education

1. encourages contacts between students and faculty
2. develops reciprocity and cooperation among students
3. uses active learning techniques
4. gives prompt feedback
5. emphasizes time on task
6. communicates high expectations
7. respects diverse talents and ways of learning (p. 3)

Arthur Chickering and Steve Erhmann have recently updated these practice guidelines to illustrate how communications technologies, and especially the Internet, can be used to support these seven "good practices" (see <http://www.tltgroup.org/programs/seven.html>).

Another set of standards is presented in the Western Interstate Commission for Higher Education's (WICHE) *Balancing Quality and Access: Principles of Good Practice for Electronically Offered Academic Degree and Certificate Programs*. (n.d.). Some of these principles are paraphrased as follows:

- Programs provide for timely and appropriate interaction between students and faculty, and among students.
- The institution's faculty assumes responsibility for and exercises oversight over distance education, ensuring both the rigour of programs and the quality of instruction.
- The institution provides appropriate faculty support services specifically related to distance education.
- The institution provides appropriate training for faculty who teach in distance education programs.
- The institution ensures that students have access to and can effectively use appropriate library resources.
- The institution provides adequate access to the range of student services appropriate to support the programs, including admissions,

financial aid, academic advising, delivery of course materials, and placement and counselling.

Your institution may have its own set of standards. The point, however, is that all instructional endeavours, regardless of their medium of delivery, should be measured equally against an explicitly stated set of criteria.

NEW TEACHING PARADIGM

The unique possibilities inherent in web-based instruction originate not from the Web itself, but from the instructionally innovative ways in which it may be used. It is helpful to consider the Web not simply as a new medium for distance education delivery, but also as a partnership offering a new teaching paradigm and new technology, creating the potential for fundamental changes in how we undertake teaching and learning. Instructors and other members of the online course development team should strive to create learning environments that exploit the features inherent in computers and the Web, to promote active learning that resides in the control of the student, and that can effectively lead to the development of high-order and critical thinking skills. In addition to the AAHE's seven principles cited above, Fox and Helford (1999) list several more suggestions specific to effective teaching online. They are paraphrased below:

- Develop tolerance for ambiguity (recognize that there may be no “right” answer to a given question, and emphasize cognitive flexibility).
- Use scaffolding principles (create material that is slightly too difficult for the student, to encourage cognitive “stretch”).
- Use problems that require students to understand and manipulate course content.
- Create opportunities for high levels of interaction, both student-student and instructor-student.
- Integrate formative assessment throughout the course.

TEACHER EDUCATION IS CRITICAL

One of the WICHE principles of good practice recommends appropriate training for faculty who use technology to teach by distance education.

Many of the skills that faculty had honed in face-to-face settings no longer apply online; indeed, some teachers must unlearn certain teaching methods as much as they need to learn new ones. For the sake of both teacher and learner, faculty should undergo some training before beginning to teach online.

One way for faculty to become familiar with the skills and resources needed to be successful online teachers is to become online learners themselves. Many institutions advocate that their online teaching faculty initially enrol in an online course that teaches them how to develop online instruction. This strategy often proves valuable, as teachers experience the same challenges that their students typically will face: problems with inadequate computer abilities, learning about the variety of interactive tools, and underestimating the amount of time needed to complete the online readings and homework. To be successful in the online course, faculty must not only develop new pedagogical skills; like their students, they must also gain new administrative and technical skills. The lists below summarize the most crucial of these new skills.

Pedagogical Proficiencies

- Think of the online environment as just a different kind of classroom for interacting with students.
- Look at other online courses, take some yourself, and ask colleagues if you can access theirs.
- Be prepared to invest the time and effort necessary to deliver a course online. Exploit technology to respond to students' questions and requests for assistance, as well as to provide timely feedback on assignments and grades.
- Always remember to weigh how important something is against how much time it will take to transmit and receive it. And remember to ask yourself whether or not users can see and hear exactly what you intended to communicate.
- Be creative in planning how to use technology to teach more effectively. To inform your planning, invest time and effort in gaining a basic understanding of how the technology works (see *Technical Skills* below).

Administrative Skills

- Teaching online often requires more anticipatory effort than the teaching effort which is typical of a face-to-face classroom setting. Lay out your ground rules right away. Unless you explicitly tell

students otherwise, they will want to interact with you at the moment they need you. Create a course syllabus. This syllabus should include the class rules, and you must make sure that your students read it, so that they are aware of the rules. Then stick to those rules.

- Find out where your help is, and know when use it. As mentioned in the WICHE principles paraphrased above, your institution should have people whose job it is to support you (e.g., computing help-desk staff or media development departments). Find out who those people are before you need them, and do not wait to call on them, when you first discover you need them.

Technical Skills

- Determine whether you possess basic PC skills (at minimum, a familiarity with file structure, with opening, copying, saving, and moving files, with creating and managing backup files, with keyboard and mouse functions, with screen and windows features, and with web browser functions.
- Determine whether you need to learn new software applications for teaching online, and if so, whether you are willing to learn them, and to use support systems outside of your institution.
- Determine whether your institution supplies regular training in new software applications.
- Make certain that you are very comfortable with using email. It may be the most common means of communication with students.
- Make certain that you understand basic Internet functionality, bandwidth, and connections speed issues. Your computer and computing environment is probably not like the ones that your students are using (i.e., some students will be dealing with low bandwidth situations). At work, you are likely to be using a local area network (LAN), but when you log on using a modem and an older computer, you will get a better sense of what your some of your students will see and experience.
- Make certain that you have a basic understanding of how web browsers on different types of machines affect the appearance and functionality of your material.

TIME AND RESOURCE MANAGEMENT

During the semester in which the course is implemented, the instructor's time is frequently taken up with responding to student emails, marking assignments, and dealing with other interactive components of the class, such as discussion forums and chats. Due to the inherent nature of web courses, student interaction will likely be sporadic, and will at times produce a surge of email messages for the instructor to respond to. For example, an instructor should expect to receive many email messages at the beginning of the course (students will initially have many questions about online learning), if technical problems make course material inaccessible or students experience difficulty in submitting their assignments. To deal with the influx of email messages, instructors can

- solicit help from a technical assistant (graduate student, teaching assistant) to respond to course emails,
- create a frequently asked questions (FAQ) page, where students can find the information typically needed throughout the course,
- create a protocol in which students must ask questions over the course forum (bulletin board), prior to emailing the instructor,

or

- refer students to a help-desk contact to handle the inevitable technological obstacles that are inherent in accessing a web-based course.

In short, it is important that you get your course online, but it is equally important that you plan and design your course completely before it is opened to students. Indeed, positive first impressions in this new medium are vital for the success of teachers and learners. And remember, trying to develop course materials while teaching the course can be overwhelming. Many instructors typically underestimate the time and assets required to develop, maintain, and offer an online course. Efficient planning and time management are fundamental to its success. Faculty are therefore strongly advised to become familiar with their institution's web development unit, technical training unit, information technology unit, and other support units, and to build a strong working relationship with those support units.

REWARDING FACULTY

A final strategic building block in the success of online course offerings is the institutional development of a process that encourages and inspires faculty to be creative in a web-based environment. Faculty can often be suspicious about technology-based instruction, and many will be hesitant to experiment with it. Establishing the supportive systems described above will go a long way toward gaining faculty “buy-in.” It is often more meaningful, however, for faculty members to know that they will receive recognition for their willingness to engage in innovative online education activities, and that their efforts will reward them with tenure, promotion, salary merit increases, and other tangible benefits.

ONLINE COURSE DEVELOPMENT

Online course development is a complex endeavour, and it is not reasonable to believe that a high calibre online course of instruction can be created by just one or two people. Quality courseware production requires a highly organized, concerted effort from many players.

Centralizing the Online Development Unit

Centralizing web development roles into one departmental unit has proved beneficial to ensure that courses are of high quality and meet institutional guidelines. Members of this department may be described as *para-academics*, a role comparable to that of paramedic in medicine. Para-academics are the “first on the scene” of course development; they liaise with the course author or subject matter expert (SME) throughout the authoring process to prevent or remove any instructional barriers that might arise. They also look after the interests of the institution (e.g., obtaining copyright permissions for images used in the course) and undertake other routine tasks that must be dealt with before a course can be published. Roles in this group include project manager, copy editor, information technology expert, HTML and XML coder, media developer, instructional designer, graphic designer, administrative assistant and, sometimes, copyright officer.

Reusable Learning Objects

There has been some development in recent years toward creating repositories of reusable learning objects, where educators can submit, use, or

exchange learning objects. Some examples of successful repositories are Merlot (see <http://www.merlot.org>), EDNA (see <http://www.edna.edu.au/edna/go>), and SMETE (see <http://www.smete.org/smete/>). When these and other repositories first appeared, the vision was to build a large infrastructure of networked repositories, to provide the education community with reusable, interoperable, searchable learning objects, and to some extent they have achieved this goal. However, there are still issues around interoperability that limit the usefulness of these objects. It remains difficult to build an object specific enough to meet the requirements at hand, yet generic enough to be adapted to other unknown requirements.

Web 2.0

Web 2.0 is not an update to the Web, but a phrase that refers to a different way we use the Web, based more on social networking and virtual communities running on hosted services. This new use includes blogs, wikis, podcasts, RSS feeds, multi-user domains, and so forth. The potential benefits of Web 2.0 for education are especially apparent when considering the opportunities for social networking now available. From simple discussions to more complex social software, it becomes easier and more effective for learners to engage with one another as well as with the content.

The Course Development Team

The core of an online course development team might comprise as few as five key roles: SME or author, graphic designer, web developer, programmer, and instructional designer. In larger commercial organizations, it is not uncommon for development teams to be much larger, as the expertise in each of these five roles is typically further subdivided and specialists are employed. In non-profit education circles, however, where budgets are tight, it is more likely that a few people will fulfill hyphenated roles, such as *web developer-programmer*, for example.

There are both advantages and disadvantages to these hyphenates. Although one person who performs multiple roles can often exercise more creative control, their workload can, in essence, double. Hyphenates can also see their capabilities and their output become “watered down” as they end up working in areas in which they may not have expertise. The reality is that, in online educational development today, those who already possess strong skills in at least one of the areas described above are considered even more valuable if they also possess the ability and desire to learn new skills in other areas.

It is worth noting that, as the popularity of the Internet continues to increase, software applications and other development tools that combine and automate several development tasks into a single package are being introduced. Macromedia's *Flash*® application is one such example: it allows its users to create script-based interactions without actually writing any programming code, and to automatically export the results in a web-based format, without having any in-depth knowledge of web development. Although the team roles are described and discussed linearly here, each member works with other team members, often in different combinations and at different stages within the development process.

Subject Matter Expert

Subject Matter Experts (SMEs) ensure that the content of the online course is an appropriate alternative to the lecture content normally given in a traditional course. In addition, the SME must write the exercises, activities, and examinations needed to reinforce the new learning. It is also essential that SMEs commit to working as an integral part of the team throughout the development process, ensuring that the online course content is easy to access and interesting for students. Other tasks that SMEs perform include

- identifying or creating textbooks, readings, and resources
- ensuring a pedagogical match among the course objectives, content, exercises, examinations, and assignments
- identifying materials that require copyright clearance, and providing the instructional designer with the necessary information
- providing other team members with a legible copy of any written material

Instructional Designer

While there are hundreds of instructional design models, certain generic processes emerge from their common features (Seels & Glasgow, 1998). These processes are described as follows.

- Analysis – the process of defining what is to be learned
- Design – the process of specifying how learning will occur
- Development – the process of authoring and producing the materials
- Implementation – the process of installing the instruction in the real world

- Evaluation – the process of determining the impact of instruction (Seels & Glasgow, p. 7)

In practical terms, the instructional designer

- helps to make the SME aware of appropriate pedagogical strategies and options
- helps to determine, create, and adapt instructional resources
- provides advice on how best to present information
- writes statements of learning outcomes
- sequences learning outcomes
- sequences activities
- evaluates instruction
- arranges technical production and services
- usually acts as project manager
- acts as editor
- acts as web developer

Web Developer

One of the challenges that web course designers face is to create an atmosphere of confidence in the process during the early stages of development. Web developers should show faculty examples of online materials which illustrate various kinds of content and interactive options that are available to them. They should then describe to faculty how their courses can be produced using a consistent organizational template that provides students with knowledge of the learning objectives, an outline of the content, assignments, evaluation information, resources, links, a list of requirements, and FAQs.

Other roles of the web developer include

- helping the SME or instructor to use tools to create the course web pages, and to maintain the course when complete
- helping the instructor or tutor to use the tools needed, such as email and chat utilities, to make the course interactive
- working with the graphic designer to conceptualize the screens, backgrounds, buttons, window frames, and text elements in the program
- creating interactivity, and determining the look and feel of the interface
- creating design storyboards

In a small production group, the web developer may also act as the graphic designer, photographer, and director, and as the editor of

video, audio, and animations. In a larger group, the web developer would typically consult with other team members for the additional aspects of the program; for example, collaborating with the sound designer on the music, or working with the programmer on functionality issues.

Graphic (Visual) Designer

Visual design for Athabasca University courses, whether print-based or electronic, is driven by the needs of students and academics, and by the content of the course itself. Distance education can be enhanced by including technical drawings, illustrations, graphics, and photography to interpret course content. Visual design for electronic courses, or optional electronic enhancements of print-based courses, includes the development and creation of generic or customized templates, navigational icons, icons or images to aid recognition of location within a non-linear presentation of materials, and visuals or graphics to enhance textual content (Athabasca University, 2007).

The World Wide Web has turned the Internet into a compelling visual medium; however, in production terms, good visual design and development can often consume the largest amount of time in a project. As the Web allows educational media to rely more and more on visuals, clear visual design is essential. The visuals that students, especially those new to online learning, encounter in an online course often set the tone for their entire learning experience.

As content is being developed, the graphic designer works with the web developer and the author to create a unique course look, while at the same time integrating the course's functionality into the common institutional template. The use of these common elements provides familiarity for online students and makes it possible for them to take several courses while learning how to learn online only once. The graphic designer ensures continuity for the faculty by designing consistent graphical elements when courses are updated or revised.

For graphic designers, *Adobe Photoshop*® has been the must-have software tool for years. For those developing specifically for online delivery, *Photoshop* has recently incorporated the features of an adjunct application, *ImageReady*®, which formats bitmap images for the Web. Other applications that are becoming more important in the visual designers tool box create vector-based images (as opposed to bitmaps); examples include *Adobe Illustrator*® and *Macromedia Freehand*®.

Programmer and Multimedia Author

The programmer is responsible for program functionality. The programmer uses specialized software tools to enable the interactivity that is suggested and desired in online courses. In the most productive teams, programming is treated as a highly specialized and separate discipline.

Many software applications are available to programmers, who each seem to have a favourite working tool. Programmers should endeavour to provide development team members with a basic understanding of the two classes of programming tools and their capabilities: code-based programming languages and graphical-user-interfaced (GUI) authoring programs. Code-based languages require that programmers use a proprietary computer language to create applications, which can then be delivered over the Internet. For example, these languages enable the processing of information which users supply on web-based forms. GUI authoring programs enable similar processes, but they also offer some automated generation of computer code.

This chapter is not meant to be a comparison of these tools – hundreds of articles cover that – but currently, there does seem to be a clear line between the followers of code-based programming techniques and those who prefer GUI applications. One clear advantage of code-based programming is that these tools are often open source; that is, they are created from freely available, stable code that encourages collaborative development. Commercial GUI software often requires less technical expertise to use than code programming, but such software can be expensive, and the companies who publish these proprietary software programs update them often, rendering earlier versions obsolete and constantly forcing developers who rely on them to purchase new versions.

Below is a partial list of the types of applications that programmers typically work with in a web-based course. Open-source code-based programming languages include

- Hypertext markup language (HTML)
- Java
- Javascript
- Perl
- Extensible markup language (XML)
- PHP
- MySQL

Proprietary GUI web-development software packages include

- Macromedia *Dreamweaver*®, *Flash*®, *Director*®, *Authorware*®
- Microsoft *.NET*®, *Visual Basic*®
- Adobe *GoLive*®, *Photoshop*®, *Illustrator*®

CONCLUSION

Developing effective instructional materials depends on a great deal of planning, collaboration, and concerted efforts from many people skilled at using the right tools. These requirements are even more crucial in online multimedia and course development, which is highly dependent on ever-changing computer technologies. Pedagogical standards must not be compromised, regardless of the instructional medium employed. Employing the principles and guidelines offered in this chapter will help all stakeholders involved in online instructional development to ensure that their efforts are rewarded, ultimately, with satisfied learners.

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