Planning for the Digital Classroom and Distributed Learning

Policies and Planning for Online Instructional Resources

Subhead to come.

by Patricia McGee and Veronica Diaz

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Introduction

Over the past decade, the use of technology to deliver courses in higher education has expanded rapidly. This reflects two major factors: First, equipment and software have improved so that more sophisticated technology, such as the Internet, can better support the growth of distributed or asynchronous learning (Moore 1990). Second, financial pressures have encouraged the development of more cost-effective methods of delivering education to multiple constituencies (Meyer 2002). In response, postsecondary institutions have become increasingly entrepreneurial in pursuing and developing technological solutions. Nearly one-half of all higher education institutions in the United States participate in some form of asynchronous learning activity ranging from online degree programs to the use of digital learning resources to supplement both face-to-face and online instruction (Kobulnicky and Rudy 2002). Further, over one-quarter of all university courses use *learning content management systems* (L/CMSs) to support traditional learning environments. The increased use of L/CMSs such as ANGEL™, Blackboard™, and WebCT™ has resulted in a

need for clear policies about ownership, use, management, distribution, and sustainability of digital resources (DiRamio and Kops 2004).

In response to the growth of L/CMSs and other distributed learning activities, many institutions have created departments or centers to support the faculty-initiated development of digital instructional resources known as "learning objects." The substantial employment of institutional resources to develop and support learning objects creates many challenges for the management of these new digital products. These challenges are further exacerbated by the absence of institutional policies that address surrounding ownership, control, and maintenance issues. As recent studies confirm, it is not unusual for institutions to have nonexistent or outdated intellectual property copyright policies addressing learning objects specifically or other distributed learning activities in general (Berg 2002; Diaz 2004).

This article was written to provide guidance for planners at all levels responsible for learning technologies, broadly defined. Our intent is to provide an overview of the policy and planning issues that must be addressed to create a clear policy framework to manage the instructional resources developed and used for distributed learning. We begin by reviewing the role of learning objects in the digital classroom. We next focus on issues related to intellectual property rights, ownership, and copyright and present recommendations for framing policy development. In addition, we review the challenges of developing, managing, and distributing learning objects and provide planning recommendations. Finally, we discuss several emerging distributed learning policy issues.

Learning Objects

A learning object is any digital resource that is designed to achieve a specific learning objective and that may be reused in different educational contexts (traditional or informal) for different purposes. Examples include data sets, text such as worksheets or handouts, images or image collections such as photographs or diagrams, audio or video materials, executable programs, or nearly any other item that can be delivered electronically. These digital resources are typically housed in a database known as a digital repository, which contains either the objects or information describing the objects (metadata) so that students and educators can easily locate and use them (Metros and Bennett 2002). Learning objects are particularly relevant when campuses are planning to or are already participating in distributed learning. A distributed learning model allows instructors, students, and content to be located in geographically dispersed locations so that instruction and learning can occur independently of time and place. Distributed learning is one solution that has been used to address the financial challenges created by shrinking higher education budgets, changing and growing student populations (including adult and global populations), corporate education demands, competency-based programs, and the service of geographically remote, underserved areas (Meyer 2002). Distributed learning can also help campuses manage classroom space though courses offered partially or completely online. Turning to distributed learning as a solution, however, requires new ways of dealing with teaching and learning. In particular, the use of learning objects is one strategy well suited to any distributed learning initiative because these objects are capable of generating multiple benefits.

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Learning objects have four key attributes that differentiate them from other digital resources: reusability, adaptability, interoperability, and accessibility (Robson 2001). Unlike most materials that are developed for use with a specific course, learning objects are created with the expectation that they will be *reused* in different ways and in many applications. Reuse means that a learning object may be used by different people in different situations. For example, a learning object such as an image of the light spectrum can be reused in art, physics, computer science, and math courses. When a learning object is intentionally designed to be used by different disciplines for their specific purposes, it is more likely to be reused. Designing an object that is independent of any discipline means that designers must pay careful attention to corresponding language that may be jargon, to images that may include details that would be distracting to different audiences, or to presentation that is discipline-specific. In these ways, learning objects are vastly different from other types of learning materials such as books, audio recordings, videos, Web sites, or computer programs, which also are designed for reusability in a variety of contexts. Furthermore, unlike other digital resources

such as videotapes or CD-ROMs, learning objects may exist in multiple course delivery systems (for example, L/CMSs or course Web sites), making them more versatile and adaptable.

Second, some learning objects will be used as developed, but more frequently they will be *adapted* to fit the needs of the instructional context. Adaptability is an important, but little understood, feature. Creators of learning objects can either design them so that content will respond to the user or they can allow the content to be customized by instructional designers who alter language or symbols depending on the purpose or learning environment. For example, using Extensible Markup Language (XML) in a learning object allows text or images to be interchanged within the object depending on the learner's actions. In a learning object about growth seasons, XML could allow the learner to select information that may be appended to the learning object, such as a geographic location and crop preference, thereby customizing the content. Such adaptability enhances the content's relevance to the learner and potentially increases reusability.

Third, learning objects are designed to be *interoperable* across various computer platforms and software applications so that they may be used on any platform, for example, on either Microsoft™ or Apple™ operating systems. Interoperability increases reusability and supports adaptation by allowing learning objects to be integrated into traditional classroom or online environments or offered as parallel learning supports outside of regular class meetings. This means that a learning object can potentially be used in a university course offered for credit or in a non-credit corporate training seminar. This also means that learning objects can be used with different delivery models, such as a supplement to face-to-face instruction, in remote delivery via satellite, or as an online course delivered asynchronously. However, interoperability can only support adaptation if the object is created using technological standards that are consistent within and across universities.

Finally, learning objects can be located and *accessed* through search queries when standardized descriptors known as "metadata" are attached to each object. Metadata describe a learning object by providing information about ownership, content, rights of use by others, and authorship. This information can be used by a search tool to readily locate the learning object that best matches the searcher's needs and also facilitates the successful storage and retrieval of learning objects in repositories. For example, when someone searches for the topic "small business research" on Google™, a variety of resources are identified, most of which are not research reports. However, when the searcher attaches the appropriate metadata that identify a report about small business research, Google can locate documents that more closely match the request. Many institutions and organizations have created templates for entering metadata as part of the development process to ensure that metadata accurately describe the object and to allow the object to be retrieved easily. Curtin University of Technology in western Australia offers such a template that allows faculty and instructional designers to enter metadata descriptors into appropriate categories (see www.metadata.curtin.edu.au/template.html).

Before learning objects can be stored, they must conform to an identified technical system (such as an L/CMS, Internet portal, or digital library) that determines how they may be accessed and used. Technical standards for accessibility allow a learning object to be located, distributed, and used in different software systems. For example, HyperText Markup Language (HTML) is considered a standard for the Internet since any browser can "read" HTML. The IMS Global Learning Consortium (IMS) project (see www.imsproject.org/) is an international partnership of institutions working to develop specifications for online systems that will support interoperability between systems and provide tracking services that will streamline administrative functions and tasks associated with the online delivery of instruction. However, at present there is no *consistent* use of technical standards for all learning objects.

Learning objects can benefit institutions of higher education and their students in several ways.

The use of learning objects can benefit institutions of higher education and their students in several ways. First, they can have positive fiscal effects by reducing costs and generating revenues (Mortimer 2002). Curriculum cost savings result from the reuse of materials and from the ease of storing and sharing these materials within and across universities. For example, if departments share the development costs for the light spectrum object, content development time and resources are also shared and therefore costs are lowered. Similarly, an institution may reduce its costs by purchasing content modules already

developed by other universities or commercial providers instead of developing its own materials. Furthermore, learning objects can be easily updated and reused, thereby reducing development costs and potentially improving instructional design. Learning objects can be migrated to another system or updated intact, unlike most L/CMSs, which are designed so that content becomes a part of the system and thus segments into separate files, making transportation to another system timely and unwieldy. Also, learning object modules can be sold either separately or together in a package, thereby generating revenue for an institution.

Second, learning objects have the potential to provide customized learning paths for students with different learning styles and learning needs through the use of competency-based, rather than course-based, learning experiences. For example, in the United States approximately 20 percent of the population has a hearing, sight, or mobility impairment (U.S. Census Bureau 2003). Similarly, cultural adaptations also are key aspects of accessible design that extend the shelf life of an object and increase usability. For example, if a nursing department creates an object that allows the user to test various fever-reducing strategies on Hispanic patients of different ages, the usefulness of that object in other contexts such as a non-Hispanic population may be limited. The ability to customize learning objects can enhance the learning experience for individuals in either of these situations.

Competency-based learning experiences support individual learning styles by providing content and support at the time and in the amount needed. A learning object's dynamic features allow the user to make just-in-time (i.e., information or supports delivered at pre-designated moments in a learning experience) and just-in-need (i.e., information or supports accessible when a learner requires them) decisions about how to interact with content, interface, and other learners. For example, a learner may want to hear instead of read a narrative, manipulate an image, or reorder the content of a learning object. The ability to "disaggregate" course content into content modules may also improve student performance. Some students may have enough prior knowledge to skip sections of a course, while others may need remediation. Disaggregation can allow a more customized approach to course design rather than the lock-step and one-size-fits-all method that is currently used. This, in turn, improves course completion and graduation rates and also reduces an institution's cost per student (Diaz 2004). When learning objects are designed to achieve specific instructional objectives, they support best practices in the assessment of learning, which results in improved course and program design (Kolitsky and Marlino 2003).

Learning objects and corresponding repositories are a means of publicly sharing "intellectual capital," i.e., products that are developed within higher education institutions, such as instructional products, publications, and inventions (Crow 2002b). They are also potentially becoming part of a larger system of interoperable repositories that serve as a "foundation for a new disaggregation of scholarship" (Crow 2002a, p. 6). Tracking, capturing, and controlling the development and use of learning objects in distributed learning environments where faculty members may create part of an online learning experience has created the need for institutional policies and guidelines.

Intellectual Property: Ownership and Copyright

Over the last 20 years the increased use of technology in higher education and the resulting digitization of knowledge, especially as it relates to distributed learning activities, has made intellectual property one of the most contentious issues in higher education (DiRamio and Kops 2004; Olivas 1992). A recent statement by the American Association of University Professors (AAUP) highlights the review and revision of intellectual property policies underway across the United States and pays particular attention to copyrighted materials, including software, instructional technologies, and, specifically, learning objects (Euben 2000; Lape 1992; McMillen 2001).[1] Rapid technological changes have prompted institutions to address issues of ownership and copyright, including software and other distributed learning tools, such as online courses and learning objects (Diaz 2004; McMillen 2001).

Ownership. The first issue that institutions must address is who owns the intellectual property embedded in a learning object. This is a basic, but often difficult, step in assigning copyright. Chew (1992) notes that until the passing of the Digital Millennium Copyright Act of 1998 (DMCA), long-established legal principles granted to employees, such as faculty members, the inherent right of ownership to their inventions. This right is abrogated only by an explicit agreement. However, intellectual property policy language can sometimes be ambiguous, especially in the area of copyright and digital works, so the informal principles of university practice may guide decisions in two

ways (McMillen 2001). First, if there is ambiguity in a faculty member's contract or other written document that expressly assigns copyright ownership, courts may look at custom and usage to determine intent regarding ownership. In other words, courts may decide to consider an institution's established practices in deciding who should retain property rights. Second, if no contract, policy, or written document regarding copyright ownership exists, courts are permitted to use the academic custom and usage within or outside the institution to determine what the parties would have agreed to had they explicitly addressed copyright ownership. In practice, a majority of institutions provide for faculty ownership; in fact, the institution does not always claim ownership, even when it is a "work for hire" (Rhoades 1998).

Although institutions paid relatively little attention to these matters in the past, they are now asserting ownership where they previously did not for several reasons. First, learning objects present a potential source of revenue from which the institution may benefit by eliminating licensing fees for commercial products and reducing contract fees for vendor development of materials. Second, objects designed for specific student populations can improve learning, which increases the potential value of those objects to other institutions (Twigg 2000). A well-designed object can be traded or sold to other institutions, thereby increasing revenue or building trading capital. Third, although many learning object initiatives begin as the projects of individual faculty members, increasingly institutions are creating a centralized approach to the design, development, and management of objects. Over the last five years, learning objects are more commonly created by a team that includes various information technology support staff and faculty members who provide consistency, coherence, and, most importantly, technical expertise to departmental or programmatic initiatives. Consequently, a faculty member is no longer the sole creator of the educational product. This team approach and the often-significant expenditure of institutional resources involved are the bases for the argument for ownership by the employer and the determination of who is assigned the copyright to the work.

Finally, the institutional appropriation of digital instructional materials may also be a preemptive move on behalf of colleges and universities that fear faculty members will package their courses and make them available to multiple markets either while still employed or after they have left, perhaps in competition with the college or university that employs them.

Copyright. Historically, technology has had a profound impact on copyright law from the printing press to electronic reserves. While technology continues to present challenges to controlling copyright infringement, it has also paradoxically aided in measuring copyright violations. For example, while it is nearly impossible to assess how many patrons walk into a library and copy a particular journal article, it is much easier to log in to a department's course Web site (after acquiring the necessary permissions) and look over the electronically available required reading list devoid of copyright permissions.

It is generally expected that copyright ownership will rest with the "author or authors" of a work, as stated in Title 17 U.S.C.A. §201(a), unless the "works made for hire doctrine" provides an exception (U.S. Copyright Office n.d.). The doctrine of works made for hire is included in the Copyright Act of 1909. The determination of whether a work is for hire is based on the facts of the employment relationship and the circumstances surrounding the creation of the work[2], including the "resources expended" argument: whether the employer paid for materials, equipment, and other labor used in creating the work. The involvement of information technology departments and technical support (server time, use of institutionally licensed software), staff support (instructional designers, HTML programmers, text editors, graphic artists, research assistants), and administrative support (copyright clearance of third-party materials) all support a university's claim of ownership. Substantial university resources are expended when integrating or converting content into a digital medium, thus increasing the stake in ownership and blurring the lines between creators. Policies reflect this change by mimicking the shift in ownership conditions away from those required in a traditional setting to those required in a high-technology setting (Chew 1992; Lape 1992; Packard 2002; Slaughter and Rhoades 2004).

Diaz (2004) finds that institutional intellectual property copyright policies often include detailed scenarios describing the participation of various constituencies in the production of instructional materials and ownership determinations. Some policies are particularly unique in addressing issues of content to include credibility and relevance and in assigning responsibility for such tasks beyond the original creator(s). In his survey of institutional policies addressing intellectual copyright in distance learning courses, Berg

(2002) finds that only 16 percent of policies clearly give intellectual property interests exclusively to the faculty member, while 46 percent of policies view the courses as the property of the institution. Perhaps more significantly, his interviews show a great deal of confusion and lack of clear policy regarding intellectual copyright. Similarly, DiRamio and Kops (2004) find low levels of faculty involvement in creating distance education policies (11 percent), with 35 percent of those surveyed indicating that no such policies existed.

Recommendations for policy development. The rapid growth of new forms of distributed learning will continue to change the relationship between property and policy. Institutions may use this changing relationship as an opportunity to develop new models of ownership and control that may not have been considered previously. The following planning recommendations are provided for institutions developing or revising intellectual property copyright policies to address learning objects and related distributed learning activities.

- *Identify and focus on the goals to be achieved.* It is important to maintain a clear focus on the institution, college, or departmental vision and the goals for distributed learning. Policy language may invoke the "work-for-hire" doctrine and/or "resources expended" language, thereby strengthening the institution's ownership claims, or it may assign ownership and control to faculty members or other developers.
- *Use a collaborative policy development process that includes all contributors.* Most of the currently existing policies were written to deal with the work of an individual faculty member. However, this traditional focus ignores the contributions of specialists when teams are used and fails to address new development models. Also, it does not reflect the variety of motivations for developing digital resources within an institution. For example, digital repositories may be useful to an academic department intent on sharing resources, such as a repository of art images to teach a variety of art history courses. Conversely, some university administrators might prefer an L/CMS, which is typically available only through a centrally controlled learning technologies center. An academic department may have collaboration and knowledge building as its goal, while the institution's administration may be more interested in revenue generation. Faculty members may have in mind a cooperative/sharing model, especially within and outside of their department, while administrators may be inclined to protect their often-costly investment. Consequently, these differences must be considered as new policies or policy models are created. To address these issues, all levels of employees, and perhaps even students, should be included in the policy development process.
- *Retain the ability to be flexible.* It is important for institutions to develop policies that can address changing models of learning object development and future technological innovation. One approach may not be appropriate for all situations, so institutions should offer a "menu" of options that may include contracts, policy, or individually written agreements.
- *Build "maintenance" language into policies.* A critical, but often unaddressed, learning object issue is maintenance of the subject content's quality and currency. Policies should prevent the potential erosion of quality that may occur in the process of divorcing the educational product from the producer; for example, the responsibility for keeping the information up-to-date must be clearly assigned. As more instructional products are transformed into digital objects (for instance, a classroom overhead projector presentation transformed into a Microsoft PowerPoint™ presentation) and removed from the larger course or subject learning environment, policy language must address issues related to maintenance of quality and relevance to the academic field.
- *Develop clear policies or agreements.* The development of clear policies, contracts, and agreements creates an environment in which all involved parties clearly understand their rights to ownership and control. This helps to prevent disputes and encourages innovation and participation over time.
- *Periodically reexamine and revise policies.* Overall, current institutional policies address distributed learning products that are about five to seven years old (Berg 2002; Diaz 2004). Specifically, intellectual property policies cover basic technology used for instructional purposes, instructional labs, and, in some cases, online courses (both faculty-produced and -hosted and institutionally-hosted). However, most policies do not address the more evolved forms of distributed learning, such as L/CMSs and learning objects, and emerging

distributed learning issues are not addressed at all. For instance, a more detailed examination of how distributed learning products such as digital repositories and learning objects fit in with existing policy language, if at all, would be useful.

Management, Distribution, and Sustainability

A recent survey of institutions with learning object initiatives found that most used homegrown, nonstandard approaches that employ a variety of instructional design models and technical standards (McGee, forthcoming). Also, a variety of L/CMSs are used to store and access learning objects. However, nonstandard technical design elements and specific L/CMSs limit the reuse of objects outside a given system. Consequently, planning for an institutional learning object initiative aimed at reuse must address management, distribution, and sustainability issues.

Planning for an institutional learning object initiative must address management, distribution, and sustainability issues.

Management. A managed system for storage and access is required for learning objects, as is the appropriate staffing to support such a system. Two options are available for managing the system, one of which is used by institutions using L/CMSs, which limits access to learning objects developed for courses to those registered for a course. However, once the semester has ended, the course is deactivated and the course content cannot be accessed unless it is made available through archived materials. The second system employs a method of learning object management based on a framework for managing *content* rather than *courses*, an approach that increases access and the opportunities linked to access.

There are four key characteristics of content management: concept, process, function, and strategy (Siemens 2003). *Concept* includes how content is designed, what format it takes, and how and when an intended population may access it. For example, a learning object about the Muller-Lyer Illusion used in psychology (see epsych.msstate.edu /descriptive/Vision/muller_ly/) is stored in an open repository and is easily accessible by anyone through an Internet search engine. This is in contrast to learning objects that are stored in closed repositories such as CANARIE (see www.canarie.ca/). *Process* is a predetermined set of standards for design, format, roles, and procedures that control how the object is designed and formatted, as well as who is involved in making decisions about the use and sharing of the learning object, including copyright restrictions, dissemination, and venue. For example, since the Muller-Lyer Illusion was funded by the National Science Foundation (NSF), it is available to all users through the Internet, the most accessible venue for mass distribution. *Function* requires a screen design (interface) that allows those users who are not technologically savvy to interact with the content. Function also requires control points to make sure that users are getting all the information they need (through help functions, quizzes, etc.) and that the object's content is separate from its technical presentation so that the content remains understandable even if the technology does not perform consistently. In our example of the Muller-Lyer Illusion, the interface is part of a larger presentation through which users can explore different functions of the human brain. Because the site is organized around a space exploration metaphor, users with a variety of backgrounds can relate to the content, as well as the context. *Strategy* reflects planning decisions: how to organize information within an institution, identify what learning object content is owned by that institution, and ensure that institutional information remains a part of the object and is kept up to date. Institutions must clearly articulate how objects will be organized for access and ensure that metadata are current and accurate.

Content management concerns extend beyond the limits of one institution when learning objects are shared through consortia. There are limited consortia in the United States, and these are primarily organized by level of education (such as the K–12 Apple Learning Interchange [see www.ali.apple.com/]) or discipline (such as the National Science Digital Library [see www.nsdl.org/]). However, Canada, Australia, and the European Union have established national, multi-disciplinary consortia with shared responsibility. All of these consortia agree upon metadata standards, have rules about interoperability of software, and have search conventions that are consistent and easy for users to access.

Peer or expert reviews can also increase reusability, particularly if a review panel or process includes multidisciplinary perspectives. For objects placed in

consortia L/CMSs or repositories, expert reviews are essential. MERLOT (Multimedia Educational Resource for Learning and Online Teaching) is one such repository (see www.merlot.org/home/PeerReview.po) that uses a validated peer review process by 13 editorial boards for every object stored. Each board has established criteria for excellence; some use rubrics, while others use checklists of attributes deemed to exemplify a high-quality learning object. This process is designed to test the reliability of objects across software systems and to validate the integrity and usefulness of the content and design.

Proper staffing of this system is critical. It is difficult if not impossible for an individual faculty or staff member to produce learning objects that can be replicated on a larger scale. Development that is not organized and standardized through policy jeopardizes quality, reusability, marketability, ownership rights, and tracking. A team approach not only streamlines production and ensures that standards regarding copyright, digital rights management (DRM), accessibility, effective learning design, and technical issues are met, but also increases the quality and durability of a learning object (Wikipedia 2004; overview of DRM).

Distribution. Institutions developing learning objects quickly realized that they must devise a system for storage and retrieval to support both internal and external distribution, and to ensure the proper use of their intellectual property. Typically this recognition results in a homegrown repository that is designed as an extensive database accessed through the Internet or campus network. However, campus-based repositories generally are not satisfactory since they often result in unique and incompatible learning object "silos" designed for use by specific people with different software systems. These silos are also inefficient when they duplicate the efforts of peer institutions (Mattson 2003). To address this problem, institutions increasingly are working collaboratively within consortia to leverage resources and to establish a unified system for housing and distributing learning objects (McElroy and Beckerman 2002). Consortia provide for content and evaluation standardization that increases a learning object's market value.

Distribution also requires tracking to document that the object is being used in the way it was intended. One strategy for tracking that is proving effective is use of the Digital Object Identifier (DOI®) system (see www.doi.org/) designed to identify and track the use of digital objects and to protect and document the use of intellectual property. DOI also provides a way for an institution to collect data about an object's use. The right to use a copyrighted piece is embedded in metadata attached to the object. For example, to ensure that ownership rights are being honored, IMS identifies areas of consideration for DRM,[3] which allows the consortium member who owns the digital content to control its usage in ways that are predetermined and clearly specified, and uses DOI to administer the DRM process. The first area of consideration is *accretion of knowledge* through which the original owner of a learning object allows subsequent users to add or modify content. As learning objects are increasingly accessed among and across systems, the original source can become more difficult to identify. Strategies such as the use of DOI can reduce this problem and ensure all contributors are acknowledged. Second is the *layers of rights*. As noted earlier, learning objects may have different levels of ownership depending on where they are stored and accessed. Once an object is utilized outside of an institution, its marketability increases and its demand may require distribution outside of the original repository. This distribution may be articulated and controlled by the individual owner of the learning object (most likely a faculty member), his or her institution, or through negotiation of ownership rights between the institution and the faculty member.

Sustainability. This refers to the ability of an institution to support the development of learning objects as well as its commitment to providing and maintaining a repository that can be used with other instructional tools, particularly with L/CMSs. For most institutions in the United States, there are two key components of sustainability: a commitment to funding support and the need to reconsider the organizational support, personnel, and technical resources provided for learning objects. In addition to funding provided by institutions themselves, external funding agencies also have relatively recently made the development of learning objects a priority. For example, the New Media Consortium and other consortia report an expansion of funding support that is both international and extensive (see www.newmediacenters.org/projects/lo/fanddl.shtml). Funding is targeted at the micro level as incentive for design and development (by individuals, departments, or programs) and at the macro level as incentive for institutions.

Recommendations for planning. The following recommendations are targeted at institutions considering or planning a learning object initiative:

- *Address policy issues related to management as part of planning before learning objects are developed.* This means addressing issues early before initiatives have begun and considering whether organizational changes of existing services and supports are needed, including the addition of new support staff.
- *Create teams that assign clear roles to members.* A team approach not only streamlines production and ensures that copyright, DRM, accessibility, effective learning design, and technical standards are met, but also increases the quality and durability of a learning object. A team approach employs several common roles and responsibilities: manager, instructional designer, programmer, graphic artist, editor, subject matter expert, and trainer (Higgs, Meredith, and Hand 2003). Someone must serve as *manager* of the collection, development, and access of learning objects. This person must not only be in charge of organization but also stay abreast of current developments and partnership opportunities, particularly if objects are to be exchanged in the marketplace. *Instructional designers* are responsible for creating designs that support interactive learning within a multimedia environment. *Programmers* and *graphic artists* must work with *instructional designers, editors*, and *subject matter experts* (notably faculty members) to make sure that embedded pedagogy and media support learning outcomes. Additionally, *trainers* must work with faculty and students to make sure that learning experiences with and around learning objects are effective and coherent, and that they produce the intended learning outcomes.
- *Adopt widely used technical standards and implement them consistently.* Standards for interoperability, accessibility, and learning design should be adopted. Priority should be given to adopting standards already in use by consortia members or other repositories to which a particular institution will want access. Once the standard is chosen, an institution should consistently use it, as supported by IMS (see www.imsproject.org /collaboration. cfm).
- *Plan for tracking and documentation.* It is critical that institutions or consortia determine the degree of access that users can have. This includes development of policies establishing the rights of the object's owner prior to its release to control replication or revision that would reduce the value of the object. Policies regarding DRM must be specified during the development phase. One widely used and free tool for DRM is the Creative Commons project (see www.creativecommons .org/) that provides no-cost licenses so that copyright holders can inform potential users about copyright restrictions. When building access levels into objects, Mclean and Iannella (2002) recommend considering the following four approaches in managing access to and reuse of learning objects: (1) objects can be viewed but not printed or saved, (2) either part or all of an object can be downloaded for a fee, (3) either part or all of an object can be downloaded for inclusion in another work, and (4) either part or all of an object can be downloaded for reuse for a set period of time.
- *Plan for the requirements of special needs and diverse populations.* The Center for Applied Special Technology (CAST) (see www.cast.org/udl/) offers design guidelines that address both United States legislative mandates for digital equity and research-based designs that support a large variety of learning needs and preferences. (For more information on Section 508, which requires that Federal agencies' electronic and information technology be accessible to people with disabilities, see www.section508. gov/.) IMS has issued both best practices for accessibility (see www.imsglobal.org/ accessibility/index.html) as well as technical standards for implementation that support learning design (see www.imsglobal.org/learningdesign/index.html.) Protocols for accessibility must be developed institutionally to include an identified scope of learning needs for a target population as well as a process for integrating accommodations for disabilities in the design process. Such accommodations require alternative metadata tags known as "ALT tags" that give a text description of an image so that the image can be described in narrative form, in an audio version of written text, as an alternative for forms, or as another type of text entry that provides access for populations with physical disabilities.
- *Develop evaluation systems and processes that document the quality of learning objects.* Part of the initial development must include a process of review and field-testing before objects are released for use. Review by a subject matter expert or panel ensures the credibility and validity of an object and will increase

the object's market value. Field-testing learning objects prior to their release can prevent extensive modifications in design, but also may inform instructional designers about how the object can be used in conjunction with other learning experiences. User review can also contribute to the value of an object. If students rate an object highly, then it is more likely to be reused. Most importantly, taking these measures represents a level of quality that garners a reputation for design excellence and enduring usability.

- *Set regular review periods.* It is important to set regular periods to review a learning object's "shelf life" to determine if its content is outdated, its digital format is still viable, and if innovations in instructional design could improve its instructional effectiveness.
- *Form strategic collaborations or communities across universities.* DRM, the Royalty Rights Management (RRM) index, and search functions, as well as supporting technologies, can be collectively addressed and operated through a well-organized consortia initiative such as AEShareNet in Australia (see www.aesharenet.com .au/) and Alexandria in Canada (see careo.ucalgary.ca /cgi-bin/WebObjects/CAREO.woa? theme=Alexandria). Learning object registries can provide standards and access for institutions that may not be interested in partnerships. One example is the Learning Objects Network (LON) (see www.learningobjectsnetwork .com/), a U.S. firm that registers learning objects using DOI as the identifier and collects object metadata and location information that can direct potential users to a source. Rather than storing objects as a repository does, LON points potential users to a learning object's location.

Emerging Issues

The development and management of learning objects will continue to pose policy challenges for planners in higher education. Institutional support and participation in the design, development, management, and distribution processes not only contributes to the quality of the object, but also to the likelihood it will be located, used, and, in some cases, generate revenue. To the extent possible, policy should be developed collaboratively by including the appropriate constituent groups to resolve issues of ownership, maintenance, management, and distribution issues, and to create a clear framework for sustainability for cooperating and competing with other educational organizations.

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These challenges will have to be addressed in a changing environment. In particular, four emerging issues should be monitored. First, the expanded use of learning objects will affect the design of instruction. Ironically, although instructional designers working with faculty to design learning objects are using traditional *instructional design* models, there is little evidence that these models are satisfactory (McGee, forthcoming). This means that faculty members and institutions must strategically rethink and continuously assess how teaching with learning objects affects student learning. Consequently, shifts in pedagogical design should be anticipated as research identifies best practices and suggests new approaches. For example, Collis and Strijker (2003) suggest a pedagogical design model in which students produce learning objects that become part of a course or discipline repository, and are reused by subsequent students. In this model, course instructors guide student construction of course content rather than develop presentation materials and deliver content. There is substantial literature to support this type of active and engaged learning (Carmean 2002), but evidence that such a tactic results in improved retention is lacking. In addition, learning objects are being reconceptualized in ways that differ from current ideas. These new perspectives have the potential to shift how design and development are approached. For example, Wiley (2003) argues that learning objects should not be designed as receptacles for content, but rather as learning process frameworks that present content in an interactive and engaging way. In this way, learning objects are designed to be instructional methods into which different content can be entered. For instance, when learning a new concept, such as deciduous trees, examples of different types of deciduous trees are presented. If an object is designed to present examples of a concept, then examples of other concepts could be easily interchanged.

Furthermore, technological advances are creating innovations that can potentially support the unique and individualized needs of learners in distributed education.

Open source software[4] may expand the nature of learning objects, how they are shared, and who makes them; if objects are designed using open source code altering them becomes easier since no software has to be purchased to do so. The use of open source mobile devices (e.g., portable digital assistants (PDAs) such as Palm™, mobile phones, and cameras) also has implications for the development and distribution of learning objects, requiring that objects be designed for use with all these different interfaces. While the "digital generation" learner (typically defined as anyone born after 1980 who has grown up with digital toys, information communication tools, television, and technology in the K–12 classroom) may be more receptive and eager to participate in ubiquitous learning,[5] the small PDA, for example, requires different interface design principles than the larger computer screen. Additionally, since learning objects might be used in a variety of locations such as a restaurant, public transportation, or movie theater, some media may work better than others.

Finally, adaptive and intelligent software agents that can provide support for learning (such as the Microsoft Office™ "paperclip man") already are being used in a variety of environments; their integration into learning objects is quickly approaching. Software that can provide just-in-time feedback or coaching as part of a learning object will alter how learning experiences are designed. We are beginning to see the crossover innovative effects of TiVo™, eBay™, and Amazon™ enterprises—all systems that adapt to the customer/user and remember what the customer/user prefers (Hodgins 2004; Rehak 2004). Just as with the use of tools like XML, we are beginning to see learning objects that adapt to the learner who wants to have information presented in certain ways. This customization can be operationalized in functions that allow the user to hear or read in English, Spanish, or French. These potential innovations indicate that learning objects will be able to support learning models that are increasingly ubiquitous and customized. Informed and well-articulated policies and careful planning will help institutions of higher education make a smooth transition into new approaches to distributed learning.

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Notes

1. Traditional notions of ownership, control, and use of educational materials are being challenged by the revolution in communications technology. The authority and responsibilities of faculty members in this digital era with regard to how courses are developed, taught, and revised are in flux, and many existing institutional policies on these issues fail to address important questions raised in this changing environment.
2. Circumstances include whether the work was produced on the employer's time; whether the employer paid for materials, equipment, and other labor used in creating the work; whether the work was produced in the employer's place of business; whether the employee received a salary; whether the employer had the right to supervise the manner in which work was performed; whether the employer did exercise such a right to supervise; whether the contract referred to the employee as an "employee;" and whether the employer instigated creation of the work (Lape 1992).
3. The Content Object Repository Discovery and Registration/ Resolution Architecture (CORDRA) initiative currently under development will resolve the challenges of DRM and DOI. CORDRA "is designed to be an enabling model to bridge the worlds of learning content management and delivery, and content repositories and digital libraries" (Learning Systems Architecture Lab 2004, p. 2).
4. Any "programs whose licenses give users the freedom to run the program for any purpose, to study and modify the program, and to redistribute copies of either the original or modified program (without having to pay royalties to previous developers)" (Wheeler 2005, sec. 1).
5. Ubiquitous learning occurs anytime, anywhere, without the constraints of formal meetings or specific technologies. In this way, learning can occur through a variety of technologies when the learner wants and needs.

Author Biographies Continued:

Her work as an ASEE Research Faculty with the Joint ADL Co-Lab provided a foundation for her work as a 2003 National Learning Infrastructure Fellow in which she produced tools and resources involving pedagogical frameworks associated with learning objects and course management systems. Currently she is leading an open source ePortfolio project, co-authoring a book on next generation course management systems, and conducting research about pedagogy within course management systems and institutional learning object development.

Veronica Diaz holds a doctorate from the Center for the Study of Higher Education from The University of Arizona with an emphasis in Science and Technology Policy. Currently, she is the Learning Technologies Manager for the Eller College of Management and also works with the Learning Technologies Center at The University of Arizona. She studies various areas of distributed learning at both the two- and four-year level of higher education. Her research has focused on higher education intellectual property policy as it relates to faculty members and their instructional products. Other research interests include distributed learning activities and digital products in higher education along with emerging technology to include digital repositories and learning objects.

Noteworthy Quotes

Initiating change, with its inevitable conflicts, represents a grave threat to the Diplomat, and he will avoid it if at all possible, even to the point of self-destruction.

Rooke, D., and W. R. Torbert. 2005. Seven Transformations of Leadership. *Harvard Business Review* 83 (4): 70.

Although technology itself is not strategic, the right technology architecture and the right tools allow the institution to move more adroitly in the face of new challenges.

Voloudakis, J. 2005. Hitting a Moving Target: IT Strategy in a Real-Time World. *EDUCAUSE Review* 40 (2): 53.