Comparing Learning Object Models in Corporations and Higher Education

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Table of Contents

List of Tables and Figures

Glossary of Terms

Term	Definition
AICC	Aviation Industry CBT (Computer-Based Training) Committee (AICC). An international association of technology-based training professionals. The AICC develops guidelines for aviation industry in the development, delivery, and evaluation of CBT and related training technologies.
Asset	The smallest piece of information or instruction that makes sense on its own. Assets make up objects.
CanCore	Canadian Core Learning Resource Metadata Specification. The purpose of the CanCore initiative is to provide guidelines to assist those interested in describing educational objects for sharing, exchanging, and distributing educational resources.
Content objects	See Asset.
Context independent	There is no context (story, thread, situating information) contained within the object. The instruction is free of context.
Enabling objective	An objective that describes a subordinate skill the performer must have mastered in order to complete the terminal objective. (also called subordinate objectives)
Extractable	Can be removed from one learning environment and successfully used in another. Or, in terms of an asset, can be removed from one object and used in another.
Knowledge bit	See Asset.
Learning object or reusable learning object	Context independent, transportable and reusable pieces of instruction that are digitally managed and delivered.
IEEE	Institute of Electrical and Electronics Engineers, Inc. The IEEE is a non-profit, technical professional association of more than 360,000 individual members in approximately 175 countries.

IMS	IMS is a worldwide non-profit organization that includes more than 50 Contributing Members and affiliates. IMS develops and promotes the adoption of open technical specifications for interoperable learning technology. It provides a neutral forum in which members with competing business interests and different decision-making criteria collaborate to satisfy real-world requirements for interoperability and re-use.
Information object	See Asset.
Learning Management System	Learning management systems enable companies to plan and track the learning needs and accomplishments of employees, customers, and partners. An LMS can link learning to jobs and competencies, provide a catalogue of available courses, books, and training events, track classroom activity and launch and track eLearning. These systems also register learners for courses.
Metadata	This is structured data about data. It describes data in a way that is searchable.
Metadata tag	A set of descriptors of a learning object's content and use.
Reusable	Able to be applied, without modification, wherever appropriate given the terminal learning objective to be satisfied.
SCORM	Sharable Courseware Object Reference Model. SCORM is a suite of technical standards that enable web-based learning systems to find, import, share, reuse, and export learning content in a standardized way.
Self-contained	Requiring no links or references to other objects or sources. The object meets the terminal learning objective within itself.
Terminal learning objective	Exactly what the performer will be able to do when the unit of instruction (in this case an RLO) is completed. Terminal objectives describe a discrete task or activity. (also called performance objectives)
Transportable	Able to be transported to, and work on, a variety of operating systems and hardware platforms.
LTSC	The Learning Technology Standards Committee (LTSC) is chartered by the IEEE Computer Society Standards Activity Board to develop accredited technical standards, recommended practices, and guides for learning technology.

Introduction

Reusable learning object designs allow parts of learning to be reused rather than recreated from scratch each time the content is needed. "Learning objects can be re-assembled to create new courses or sequenced to form individual learning paths"(English, 2001, p. 1). This design approach supports the fast, cost-effective development of learning that is consistent in message while reducing learning maintenance costs. Largely because of benefits such as these, reusable learning objects (RLOs) are emerging as the "technology of choice in the next generation of instructional design, development, and delivery, due to its potential for reusability, generativity, adaptability, and scalability" (Wiley, 2000, p. 3). In discussing the likelihood of universities sharing objects, Stephen Downes (2000) makes the point that

> The economies are relentless. It makes no financial sense to spend millions of dollars producing multiple versions of similar learning objects when single versions of the same objects could be shared at a much lower cost per institution. There will be sharing, because no institution producing its own materials on its own could compete with institutions sharing learning materials. (p. 2)

Derived from work in several disciplines, learning objects are a technological construct that has been operationalized and is now being successfully applied in corporations and in higher education institutions. It many ways, this is not a new concept. However,

> The technologies of the 21st century give educators and instructional designers the potential to share, adapt and reuse a wider variety of learning resources to create and enhance learning than ever before. Learning resources are now referred to as learning objects. (Lowerison, Gallant, & Boyd, 2003, p. 1)

Defining Reusable Learning Objects

Reusable learning objects (RLOs) are context independent, transportable and reusable pieces of instruction that are digitally managed and delivered. As such, they provide untold opportunities for easy access to tailored learning and are slowly being implemented in corporations and universities. Hodgins (2000) states that learning objects:

> represent a completely new conceptual model for the mass of content used in the context of learning. They are destined to forever change the shape and form of learning, and in so doing, it is anticipated that they will also usher in an unprecedented efficiency of learning content design, development, and delivery. (p. 1)

Definitions related to learning objects abound. For some learning objects are "small chunks or granules of information that can be accessed individually or mixed, matched, and glued together to form a variety of instructional courses or minicourses" (Zielinski, 2000, p. 134). To others a reusable learning object is a collection of chunks organized into a whole that covers a topic or logical sequence of instruction. In this new field, terms and definitions are still being developed. The models of the early adopters are being carefully considered by both universities and corporations and are being modified to meet specific needs. There is no one perfect way to design, create, and manage learning objects. One must consider the goal, the audience, the technology (infrastructure), the financial and non-financial resources, and the educational or corporate culture. As Griff Richards (2002) points out,

> Learning objects is really about sharing our gifts, and there is simply no standard gift. While some may be content to buy dolls for girls or cars for boys, others search to create or finding the most imaginative gift possible, the gifts that will be remembered for expanding horizons and making every learning event memorable. (pp. 3-4)

David Wiley (2000) outlines the basic idea behind learning objects: "Instructional designers can build small (relative to the size of an entire course) instructional components that can be reused a number of times in different learning contexts" (p. 3). Wiley defines reusable learning objects as being "digital entities deliverable over the internet" (2000, p.3). This definition is widely accepted in the field, with one notable exception. The Learning Technology Standards Committee (LTSC) of the Institute of Electrical and Electronic Engineers (IEEE) defines learning objects as "any entity, digital or non-digital which can be used, reused or referenced during technology supported learning" (Wiley, 2000, p. 3). The difference between these two definitions being that the LTSC allows for non-digital items to be considered objects.

For the purpose of this paper, reusable learning objects are defined as "self-contained learning components… that are stored and accessed independently" (English, 2001,

p. 1). They are further defined as a collection of learning pieces covering a topic or complex task and satisfying one terminal learning objective.

Learning objects are made up of smaller reusable pieces called many things such as assets, small objects, reusable information objects, content objects, or knowledge bits. These are the smallest piece of the instruction that makes sense on its own, for example: a step-by-step procedure, a concept, or a short clip of a video showing a process. On their own, these pieces are often informational. Combined together they can become learning. These pieces are also reusable and transportable. They can be reused between learning objects in different courses and they can be reused in performance support systems. An example provided by The Reusability, Collaboration, and Learning Troupe clarifies this concept. In this example an asset is called a small object and an RLO is called a large object.

> As an example, we will consider a webpage containing an art history lesson composed of an image of Da Vinci, text describing the history of Da Vinci and the Mona Lisa, and an animation of Da Vinci's face being overlade on the Mona Lisa. The webpage, complete with graphics, is an example of a large object. An individual picture, such as the image of the Mona Lisa, is an example of a small object. (2002, pp. 2-3)

A common metaphor used to explain objects is Lego blocks. Content pieces can be snapped together with a practice piece and some assessment pieces to create a learning object. Learning objects can be snapped together to create lessons and modules. The problem with this metaphor is the "implicit assumption…that any learning object should be combinable with any other learning object" (The Reusability, Collaboration, and Learning Troupe, 2002, p. 1). A better metaphor for learning objects is described by David Wiley in "*The Instructional Use of Learning Objects"*. Wiley describes learning objects as being comparable to atoms. Atoms are small, self-contained units made up of protons, neutrons, and electrons. They can be combined to make molecules. However, like learning objects, not every atom can be combined at random with every other atom; or at least not if a viable molecule is desired. Learning objects, like atoms, can only be combined within a closed set of objects if you want viable learning.

Learning Object Characteristics

Longmire (2000) describes the ideal RLO content as being: modular, free-standing, and transportable among applications and environments; nonsequential; able to satisfy a single learning objective; accessible to broad audiences; coherent and unitary; and not embedded in formatting (p. 2). From this description three broad characteristics have been selected based on which each of the models presented will be considered: self-contained and context independent; reusable and transportable; and, satisfying one learning objective.

Self-contained and context independent

From a design point of view self-contained and context independent means that there can be nothing in an object that requires it to reside in a sequence. Learning objects must be "extractable or 'stand-alone'. They really should possess the ability to be plucked from one learning environment and placed into another" (Mills, 2002, p. 2). Self-contained and context-independent objects are modular and free standing with no backwards and forward referencing. There can be nothing in an object that refers to another object. Learning objects facilitate "a new model for digital learning – one in which learning content is free from proprietary "containers", can flow among different systems and be mixed, reused, and updated continuously…" (Barron, 2000, p.1).

While a learning object must be able to stand on its own, there is no reason the learning designer cannot sequence objects into learning elements. The key is that each learning object must also be viable on its own, outside any sequence. The power of this can be demonstrated by how one of the author's clients has been able to use RLOs. Learning was developed for Air Canada ramp employees using an RLO design approach. The objects are used four ways as follows. At some locations the objects are sequenced and presented as modules of eLearning. At other locations, facilitators use some of the objects during leader-led instruction and have learners access some on-line. At still other locations the objects are used for purely leader-led instruction. At all locations the objects are available at the job-site through a performance support system using a search function.

Providing a pre-set object structure may make sense from a learning perspective. With some audiences, presenting learning objects in a traditional module/lesson/topic format may facilitate initial adoption. If the same objects are also easily available independently then multiple learning styles and requirements can be simultaneously met.

> Fast paced, ever changing organizations often have at least a subset of the work force who have neither the time nor the patience to attend a training class…In circumstances like this, the best approach is to provide well defined descriptions of bits available and effective search tools, so that learners can find what they need when they need it. (Schatz, 2000, p. 6)

In many universities providing students with a pre-set course or learning element is more in line with existing curriculum, grading, revenue, and other administrative functions. Of the universities using objects, many are either sequencing objects and presenting them as courses or only using objects as supplements to existing courses.

Reusable and transportable

Learning objects must be reusable and transportable: Transportable among applications and environments and repurposable to different delivery structures. "If an item is able to stand alone, then it has a much greater chance of being reusable. In order for learning objects to be reusable, they must be shared across learning environments and accessed on demand by instructors and learners"(Mills, 2002, p. 2). To be reusable and transportable an object needs to meet some technical coding standards and it must be instructionally designed for reuse.

In addition each object must be labeled to make identification of content, topic, purpose, etc. readily apparent and to make it easily retrievable. There are "two requisite components of a learning object: the object content and its metadata tag" (Longmire, 2000, p. 2). Metadata tagging means linking or tagging objects and assets with specific metadata. "Metadata, literally 'data about data', is descriptive information about a resource… metadata allow you to locate an item very quickly without investigating all the individual items through which you are searching" (Wiley, 2000, p. 10). Because they are stored in a database structure and managed through a Learning Content Management System via metadata tagging, learning objects make it easy to find and access content anywhere and anytime. This makes them easy to maintain and display.

Satisfies one learning objective

The size of a learning object is often defined as a meaningful division of learning that can be accomplished in one sitting. Mills maintains that "the acceptable size of a learning object is determined by the amount of information that can be digested by a learner at the time the learning is occurring" (2002, p. 2). In practical terms, a learning object should satisfy one terminal objective (sometimes called a performance objective) that has been stated objectively and measurably. Each asset should satisfy all or part of an enabling objective related to a terminal objective.

Benefits of using Learning Objects

For universities and corporations to be willing to change their current learning design and delivery processes, approaches, models, and, in some cases, technology, there must be tangible benefits. The benefits of learning objects are numerous: reduced costs, personalized learning, interoperability, standardization, and customization (Siemens, 2003, p.1). In addition, a critical element of sustained success in any organization or institution is the intellectual capital. As Davenport and Prusack state "A knowledge advantage is a sustainable advantage" (1998, p. 17). Capturing knowledge, developing training, and maintaining content costs money.

Universities and corporations are looking for ways to safeguard and make multiple uses of their intellectual assets and investment as well as increase consistency and accuracy in learning. Learning objects represent a key point of intersection between knowledge management and eLearning initiatives facilitating improved capture and use of knowledge through flexibility, ease of updates, customization, interoperability, and increased value of content and cost avoidance. Each of these five benefits is explored in more detail below.

Flexibility

As mentioned earlier, learning objects are self-contained and context independent. Flexibility relates to designing content so that it can be used in multiple contexts. Content designed with multiple uses and contexts in mind can be reused much more easily than content that has to be rewritten for each new use. Having a library of learning objects to draw on shortens course and curriculum development time allowing for faster deployment of learning.

> If material is designed to be used in multiple contexts, it can be reused much more easily than material that has to be rewritten for each new context. It's much harder to uncouple an object from the context of its parent course and then recontextualize it than it is to conceptualize as part of the development. (Longmire, 2000, p. 1)

Ease of updates, searches, and management

Content management and content maintenance are costly activities for both corporations and universities. The digital nature and storage of learning objects makes them easy to manage. The labels or tags mentioned earlier facilitate updates, searches, and content modification by making each object easy to identify and locate. Once located a piece of content is changed once. All places linked to that content are updated instantly ensuring consistency of message while greatly lowering maintenance costs. As Warren Longmire explains, "Metadata tags facilitate rapid updating, searching, and management of content by filtering and selecting only the relevant content for a given purpose" (2000, p. 1).

Customizability

Customizability refers to the ability to recombine pieces into any number of objects adapting them to meet individual knowledge, skill and attitude gaps. Universities and corporate learning departments can now create “prescriptive, dynamic learning for customers within their time frame for learning” (Influential Trends, 2001, p. 1).

Interoperability

By adhering to one of the recognized sets of technical standards for tagging and coding (such as IMS) universities and corporations can set specifications regarding the design, development and presentation of objects based on their individual needs while retaining interoperability with learning systems at other organizations or institutions. “The object approach allows organizations to set specifications regarding the design, development, and presentation of learning objects based on organizational needs, while retaining interoperability with other learning systems and contexts” (Longmire, 2000, p. 2).

Increased value of content

Increased value of content and cost avoidance is realized through content reuse. The value of a piece of content increases every time the content is reused. Reuse also results in cost avoidance since there is far less new design and development required. In addition content can now, realistically, be sold.

According to Warren Longmire ”The object approach can satisfy both immediate learning needs – such as knowledge-based or skills-based course – and current and future learning needs that are not course-based” (2000, p. 1). According to Ruth Colvin Clark “learning objects can be used to capture, disseminate, and improve knowledge capital in an organization” (Clark, 1998, p. 1). The knowledge drain out of universities and organizations as people leave due to retirement, reengineering, or career changes calls for a better way to define, store, and use institutional knowledge. Learning objects can be used to categorize, contextualize, and tag this knowledge and then display it in a variety of training, documentation, reference, and support venues.

Two Learning Object Models

While corporations and universities both hope to garner the same types of benefits from learning objects they are implementing very different learning object models. The differences in the models reflect differences in the goals and the perceived constraints and opportunities. The following is a description of a model used by several corporations and a description of a model used by several Canadian universities.

Cisco Systems (A corporate model)

Cisco Systems Inc. is an American company that has become a worldwide leader in networking for the Internet. Cisco is also one of the forerunners in learning object design, creation, and deployment (Cisco Systems, Inc. 2004). The Cisco learning object model is used by many Canadian and American corporations and so is the corporate learning object model chosen for consideration in this paper.

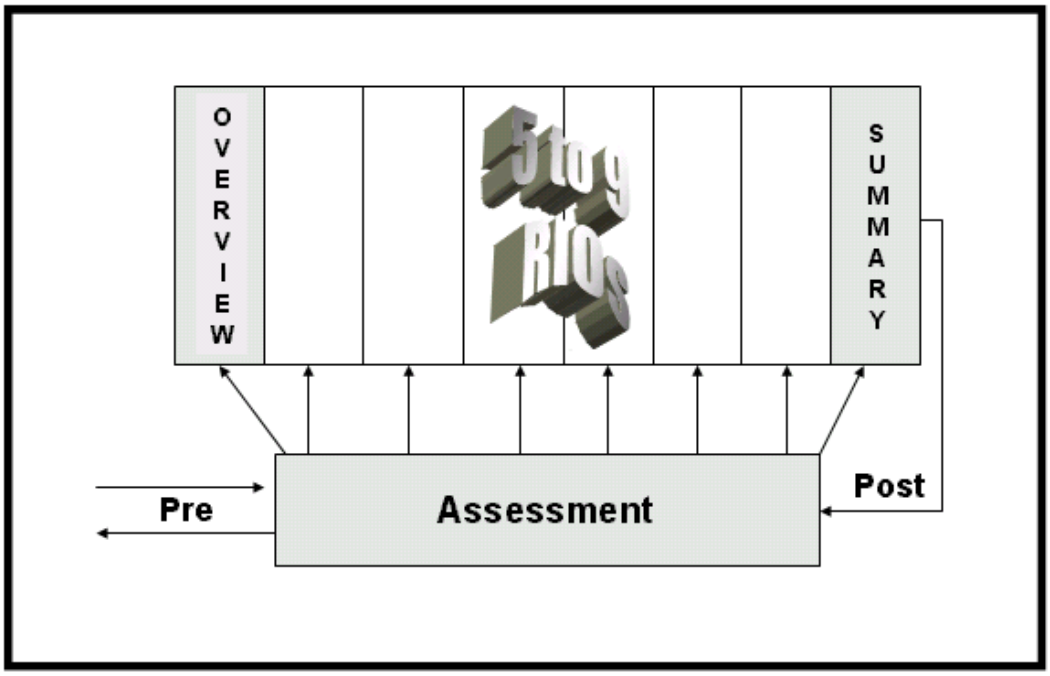
As shown in Figure 1, a learning object designed based on the Cisco model contains an overview, a summary, and between five and nine reusable information objects (RIOs). Each learning object is based on a single terminal objective, derived from a specific job task (Barron, 2000, p. 2). Cisco learning objects are tagged based on the IMS metadata tagging schema.

Each information object, within a learning object, is based on an enabling objective that supports the learning object objective. As shown in Figure 2, information objects are made up of content, practice related to the content, and assessment related to the content (CISCO Systems, 2002, p. 4). Every RIO is a self contained unit.

> Cisco's information objects are classified to provide information for reuse and to allow for templated development of each classification. The classifications used are: concept, fact, process, principle, and procedure. Templates have been created for each so every concept information object, for example, will be structured in the same way. This allows for consistency when a large number of people are creating the information objects. Several information objects, as few as five and as many as nine, are combined together to create a reusable learning object (RLO). If a RIO can be equated with an individual component of a learning objective, an RLO is the sum of RIOs needed to fulfill that objective. (Barron, 2000, p. 2)

In the Cisco model both information and learning objects are self-contained, reusable, and transportable with no referencing of other objects that would cause dependencies.

Figure 1: Learning Object



(Adapted from Cisco Systems, 2002, p.4)

Figure 2: Information Objects within a Learning Object

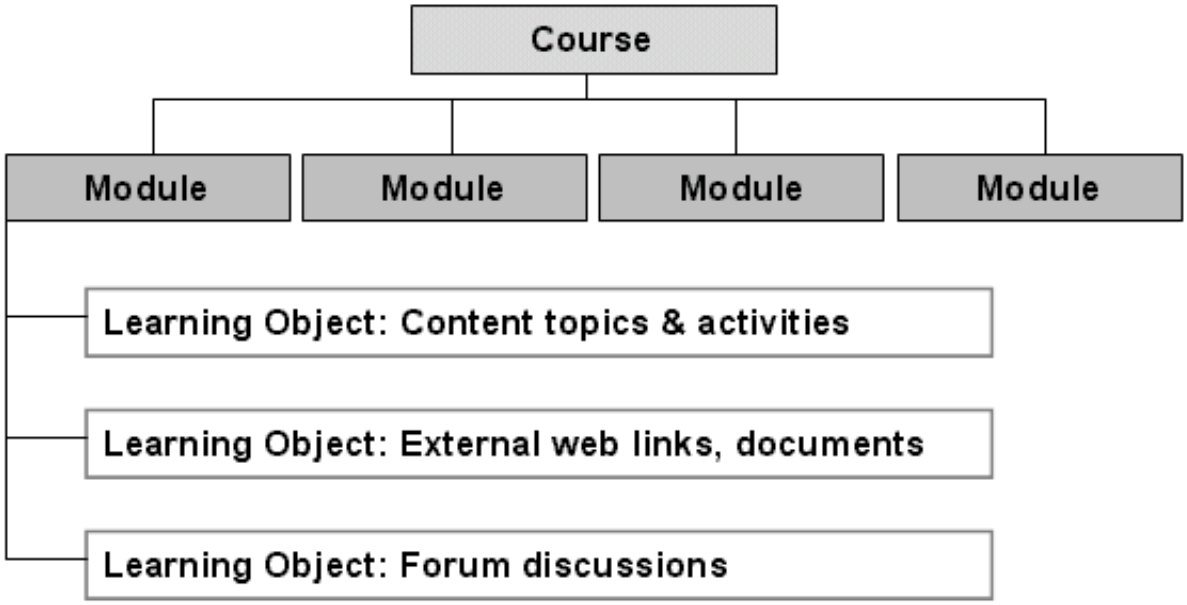
OVERVIEW						SUMMARY
	Content	Content	Content	Content	Content	
	Practice	Practice	Practice	Practice	Practice	
	Assess	Assess	Assess	Assess	Assess	

Adapted from CISCO Systems, 2002, p. 4)

British Columbia Open University (A higher education model)

British Columbia Open University (BCOU) is a public institution that has been offering students flexible access to post-secondary distance education for the past twenty-five years. As a member of the Association of Universities and Colleges of Canada (AUCC) this university partners with other educational institutions, professional bodies, industry, and business, and is a founding member of the Canadian Virtual University (British Columbia Open University, 2004).

Figure 3: Structured Content Model



(Adapted from Open Learning Agency, 2001, p. 3)

The learning object model (called the structured content model) used by BCOU was developed by the Open Learning Agency, of which BCOU is a division. The Open Learning Agency is internationally recognized for delivering high quality distance learning and represents Canada on international eLearning standards and specifications committees. Through the AUCC and the Canadian Virtual University the structured content model is now used by many Canadian universities. Metadata tags for this model are taken from the Canadian Core Learning Resource Metadata Application Profile (CanCore) which was designed to help educators and learners access objects from educational repositories world-wide (Bartz, 2002, p. 2).

As shown in Figure 3, in the structured content model learning objects nestle inside modules that are in turn grouped into courses. "Tying these pieces together is the instructional narrative, which is developed at the course level, the module level, and in the introductory sections of the learning objects" (Open Learning Agency, 2001, p. 3). Rationales and organizers are threaded through the course module and objects informing the learners of what is coming up in future topics and linking them to past topics.

In this model learning objects are seen as providing flexibility in a course. The entire course may not be comprised of learning objects. The objects, in some courses, may simply be additional resources that support the course goals and allow for flexible learning paths. The model allows for three types of learning objects: content objects that are one topic with the associated activities. Content model objects are structured as shown in Table 1.

Table 1: Structure of Structured Content Model Objects

Object Component	Details
Topic Title	Required component.
Topic Organizer	Required component. A brief paragraph of instructional narrative that provides guidance to the learner; must include a brief topic rationale that will help guide development of metadata.
Topic Content	Required component. Lecture materials, commentary, vignettes, directions to read external source, etc.
Activity	To reinforce the topic and learning outcomes, activities have these forms: Activity.essay: An activity that requires writing. Activity.general: General activity. Activity.lab: A lab-based activity. Activity.tta: A reflective activity; the title "Things to Think About" will appear on the output Web or print page.

(Adapted from Open Learning Agency, 2001, p. 5)

The second type of object in the structured content model is a document object. These objects are links to web sites, a reference to a book, video, or other media. The third type of object is a forum object. Forum objects link the learner to online discussion forums.

Comparing and Contrasting the Models

The two models presented are wide-spread within their particular milieus. They are, however, significantly different as can be seen when they are compared based on the learning object characteristics outlined earlier in this paper.

Considering each of the three characteristics in turn it can be seen that Cisco's model requires that all learning and information objects be self-contained and context independent. Nothing in a Cisco object can refer to any other object. There can also be nothing that requires the object to reside in a sequence. As mentioned earlier, the Cisco model requires that objects be extractable and free of dependencies.

BCOU's learning object design model does not possess this characteristic. The BCOU model requires that rationales and organizers be incorporated into the objects linking them to other objects, modules, and even to the course as a whole. This requirement creates dependencies between objects and imbues them with context. In addition, the BCOU model two of the object types in the model, document objects and forum objects, require a relationship and sometimes an internet link between objects. As soon as an object has a relationship or link with another object it is no longer stand-alone and is probably not context free.

The next characteristic, reusable and transportable, is possessed, to some extent, by both models. Both models are reusable and transportable among applications and environments and repurposable to different delivery structures since both use reliable and consistent metadata tagging schemas (IMS and CanCore) and adhere to the related coding standards.

The reusability of objects designed using the BCOU model is denigrated by the dependencies established between the objects and the context within and between objects. These objects will likely require some modification before they can be reused in a different university, within another course at the same university, or as a pure reference component. This, however, seems to be a constraint that those using the model are willing to tolerate in return for the benefits they believe they garner from the context setting and linkages.

Table 2: Comparing Characteristics

Characteristic	Corporate model (Cisco)	Education Model (BCOU)
Self contained and context independent	This model requires that there is no referencing between objects and that there is no sequential requirement. Objects created are self contained and context independent.	Since this model prescribes links to other objects, imbedded context, and to outside resources objects are not self contained or context independent.
Reusable and transportable	Objects created using this model are both reusable and transportable among applications and environments due to design and metadata tagging scheme.	This model creates objects that are transportable but that may not be reusable. They are transportable because of the metadata tagging schema and coding requirements. Objects designed using this model may require modification before reuse due to context imbedded in objects.
Satisfies one learning objective	Each object satisfies one terminal learning objective.	No: Satisfies one topic, not one learning objective.

(J. Mowat, February 2004)

Of the two models considered in this paper, only the Cisco model has the third characteristic: Satisfies one learning objective. The Cisco model clearly calls for each learning object to satisfy only one terminal learning objective and each information object to satisfy one enabling objective. If a corporation has standards related to what constitutes a terminal objective, this design requirement helps to maintain consistency of size and scope of each object.

The BCOU model does not claim to satisfy a learning objective, rather they indicate that a learning object "focuses on a single topic" (Open Learning Agency, 2001, p. 5). They also refer to clearly stating the learning outcomes for each object (2001, p. 6) that seems to indicate that there may, in fact, be more than one objective for each topic. By having objects designed based on a topic rather than a terminal objective size and scope are undefined. Since objectives within one topic may also be within another, this design model could result in content overlap between objects and a lack of consistency in how a piece of content is covered.

Conclusion

The two design models compared in this paper are significantly different and produce radically different products. Both products are called learning objects and both are accepted as valid within their respected milieus (corporate and higher education). However, the products created would not be transferable across milieus.

The Cisco design model prescribes the creation of objects that are extractable, context free, relatively standard in size and scope, reusable, and transportable. This meets the corporate need to capture, manage, and disseminate knowledge and support in a performance-based environment. Many corporations "are concerned with a smaller universe than the web, mostly organizations that want to share objects internally" (Shatz, 2001, p.2).

Learning objects designed using the BCOU model do not exhibit all the standard characteristics of learning objects. Specifically they do not stand-alone, are not context free, and they satisfy a topic rather than a learning objective. Nor do they recognize the same benefits. Specifically these objects do not provide the same level of flexibility due to contextualization and interdependencies. So why is this model widely used by Canadian universities and accepted by other international institutions? The answer is that this design model satisfies a different object usage model.

In higher education institutions individual objects are often used as additional resources for a course or as alternate ways to express the same information or providing more detail. Also, groups of objects are most often bundled and shared as modules. The module becomes the sharable content object rather than the individual learning object. This allows for relationships between the objects within the sharable content object.

> Objects may interact – or more generally, be related to each other, in many ways...one object may in general contain one or more other objects… a

course may contain units or modules. A unit may contain a test. Each of these items is an object, defined from a prototype, which may interact with other objects in predefined ways (Downes, 2000).

This nesting of objects within each other also allows for the use of document and forum objects that require links to other objects.

Despite the differences both models produce a product (learning object) applicable and sufficient unto the needs of the relevant milieu. Corporations yearning for contextualization, that are not planning to share objects with other corporations, and who are willing to give up a degree of flexibility and customizability should consider models from higher education. Conversely, educational institutions such as community colleges who may be more interested in a flexible, performance-based learning product should explore corporate design models. Both design approaches are valid. Which one to choose depends on the goal, environment, constraints, and opportunities.

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