



Learning Objects and Instructional Design

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Abstract

Traditional training is too large, expensive, general, and slow to meet the needs of many fast-paced corporations. “The new economy thrives on producing information and passing it at unprecedented rates among partners, employees, and customers.” (Stacey, 2000, p. 2) 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) We are approaching a time when, through the design and deployment of learning objects, we can: reuse parts of training rather than starting from scratch every time; cost-effectively and quickly customize learning to meet the needs of the individual or small group; and, dramatically reduce maintenance costs.

This paper provides a working definition of learning objects as they are being considered and implemented in corporations to meet performance-based training and support requirements. This paper also explores some of the business benefits, and proposes two instructional design methodologies for use by corporate instructional designers. One methodology relates to creating new instruction using a learning object approach. The other relates to revising existing learning using a learning object approach.

Introduction

E-learning, spans the gamut from asynchronous self paced learning, through asynchronous collaboration and synchronous collaborative experiences, to web-based performance support. Generally speaking e-learning can be defined as “the use of Internet technologies to deliver a broad array of solutions that enhance knowledge and performance.” (Rosenberg, 2001, p. 28) and it makes delivery of focused learning at the job site a reality.

Technological advancements, the accessibility of computers, the connectivity provided by the internet and intranets, and improvements in instructional design approaches have all come together so that for the first time performance can be developed and supported at the desk-top, at a cost that most companies can afford. “Technology is an agent of change, and major technological innovations can result in entire paradigm shifts...the internet is poised to bring about a paradigm shift in the way people learn.” (Wiley, 2000, p. 2)

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 some larger corporations. Hodgins (2000, p. 1) 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.

For instructional designers this is the good news and the bad news. Many are being asked to seamlessly, and with no training or preparation, begin

designing meaningful and effective learning objects. However, designing objects requires a different mindset than most instructional designers bring to the table. It is different from facilitated learning and from multimedia or web learning. The constraints and opportunities are different and the challenges many.

By considering learning objects from a corporate perspective the author is able, in this article, to consider the use of learning objects for performance-based learning only. The goal is to help a corporate performer complete a task. Looked at in this light, we are using learning objects to create learning that is “outcome-based rather than content-based. It focuses on what people want (or need) to do, rather than on what there is to know.” (Downes, 2001, p. 18)

Defining Learning Objects

This is a relatively new field and the terms and definitions are still being developed. It is important to remember that the models and standards of the early adopters should be carefully considered then modified to meet a specific corporation’s need. Like with performance support systems, there is no one size fits all. It depends on the goal, the audience, the technology (infrastructure), the financial and non-financial resources, and the corporate culture. Unlike other target RLO markets, corporations are not generally concerned with selling their learning objects. Rather, they want to be able to manage and share assets and objects between internal groups. The business driver is an internal one.

We are concerned with a smaller ‘universe’ than the web, mostly organizations that want to share objects internally. While they may want to bring objects into their system or occasionally share objects, adherence to a universal standard is less important than efficacious search and retrieval. (Schatz, 2002, p. 5)

The RLO architecture, methodology, and approach adopted must support the business goals and corporate appetite for the approach.

Reusable Learning Objects

David Wiley (2000, p. 3) outlines the basic idea behind learning objects as “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.” Wiley and the majority of the other authors covered in the literature review, define reusable learning objects as being “digital entities deliverable over the internet” (Wiley, 2000, p.3) 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)

For the purpose of this paper, reusable learning objects are defined as “self-contained learning components...that are stored and accessed independently. Learning objects can be re-assembled to create new courses or sequenced to form individual learning paths.” (English, 2001, p. 1) In more detail, a learning object is a collection of assets covering a topic or complex task satisfying one learning objective. Traditionally many corporations create courses made up of modules and lessons that are, in turn, made up of topics. Depending on the material to be covered, the audience, and the corporate learning and performance standards in place, a specific corporation may define their learning objects as being the same scope as their traditional lessons or as their traditional topics.

Again, for the purpose of this paper, the size of a learning object will be defined as a meaningful division of learning that can be accomplished in one sitting. But what does that mean: What are the appropriate dimensions of a learning object? Wayne Hodgins (2000, pp. 9 – 10) refers to the Baby Bear analogy in answering this question indicating that RLOs should be:

not too big, not too small, not too hot, not too cold, etc. In the case of learning objects, we get then in 'just the right' size/amount, time, way (learning style), context, relevance, medium of delivery (paper, DVD, Medium of delivery (paper, DVD, on-line, synchronous, on screen, etc.), location (desk, car, house, palm, field, etc.)

Perhaps the best definition of scope should be based on "the amount of information that can be digested by a learner at the time the learning is occurring." (Mills, 2002, p. 2) This leaves it open to corporations to set their own standards for size and scope or perhaps even different standards for different content areas and job types.

The greater the level of granularity, (the smaller the object) the more flexibility there is for reuse. However, the more granular the learning object, the more that are required and the more difficult they will be to manage. This directly affects the cost of production and maintenance. A balance needs to be struck, depending on a corporation's specific requirements, between "the extra precision gained from smaller granules and the extra cost..." (Schatz, 2002, p. 2)

Learning objects are also self-contained, context-independent units. While some may argue that each element in a learning intervention must be contextualized, in corporate performance-based training environments de-contextualized, easily accessible information and learning bits focused on a specific task or goal are often what is most useful and most desired. Being self-contained and context-independent allows learning objects to be modular and free standing with no backwards and forward referencing across objects. There can be nothing in a reusable learning object that refers to other objects. From a design point of view it means that there can be nothing in an object that requires it to reside in a sequence. A learning object must be "extractable or 'stand-alone'". It really should possess the ability to be plucked from one learning environment and placed into another." (Mills, 2002, p. 2)

While a learning object must be able to stand on its own, there is no reason the instructional designer cannot sequence objects into modules. The key is that each learning object must also be viable on its own, outside any sequence. Providing a pre-set object structure may make sense in some corporations from both a business and a learning perspective. With some corporate 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, needs, and business 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)

Learning objects must also be reusable and transportable: Transportable among applications and environments and repurposable to different delivery structures. 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 RLO must be labeled to make identification of content, topic, purpose, etc. readily apparent and to make the object easily retrievable. There are “two requisite components of a learning object: the object content and its metadata tag.” (Longmire, 2000, p. 2) Meta-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

meta-tagging, learning objects make it easy to find and access content anywhere and anytime and they are easy to update and display.

At this point the author would like to establish the difference between information objects and learning objects. Although the terms are often used interchangeably, they are different constructs. Sandy Mills in her article [Learning about Learning Objects with Learning Objects](#) explains the difference as:

while learning objects are information objects they are differentiated by their intent and design. The intent of a learning object's designer is to facilitate learning, while information objects are designed to be a reference, and not necessarily for the purpose of retaining skills or concepts by the user. (2002, p. 1)

This is a clear and important difference. There are a plethora of information objects masquerading as learning objects but as we all know, information is not learning.

Assets

Learning objects are made up of assets. An asset is 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, most assets are informational. Combined together they can become learning.

Assets can also be reusable and transportable. They can be reused between learning objects in different courses and they can be reused in performance support systems. If a company is deploying learning over an intranet and are using a learning object approach, then concurrently creating an integrated performance support system, using the same assets being developed for the learning, makes a lot of sense. Key performance related assets can be organized and displayed to the performers at the moment and place of need.

A good example of assets combined into an object is one on de-icing fluids developed for an airline's re-certification de-icing course. Every Fall the several thousand airline ramp employees across the country must re-certify on de-icing procedures including operating the de-icing truck; the chemical mix and testing of the two types of de-icing fluids; safety precautions when operating de-icing equipment; operation of the de-icing bucket and hoses; and, the critical de-icing points on each aircraft type. Much of this information is also available through the performance support system easily accessed in the ramp employee's ready room. This dual use of the information and the performance and task-based nature of the learning made re-current de-icing an excellent candidate for a reusable learning object approach.

The learning object description below is an excerpt from the design document. This excerpt covers the Fluids learning object in a module called Methods. In this course, within in this corporation, a learning object equates to a lesson. The bold bulleted line at the top of each asset is the descriptive label applied to make locating the object and assets in the database easier. Note that a suggested sequence is prescribed. However, if after a pre-test, only certain assets or objects were deemed necessary for the particular learner, specific assets or objects could be accessed in whatever order required.

MODULE: Methods

LEARNING OBJECT 1: Fluids

ASSETS:

- | |
|---|
| <ul style="list-style-type: none">• introduction, text, de-icing recurrent: de-icing / anti-icing<ul style="list-style-type: none">• Definition of the two terms including fluid heat melting, prevention of contamination reformation (holdover time) |
| <ul style="list-style-type: none">• activity, graphic, de-icing recurrent: de-icing / anti-icing<ul style="list-style-type: none">• Key terms are displayed. Definitions are displayed. Performer must match one to the other. (de-icing, anti-icing, fluid heat melting, holdover time, etc.) |

<ul style="list-style-type: none"> • concept, text, de-icing recurrent: glycol <ul style="list-style-type: none"> • Bullet point text outlining <ul style="list-style-type: none"> • why it is important to use only sufficient amounts of glycol (environment, cost) • what is type 1 fluid (composition and concentration) and when is it used • measuring the concentration (refractometer & brix) • what is type 4 fluid and (composition and concentration) when is it used • what happens if the incorrect fluid is used 	<ul style="list-style-type: none"> • fact, photo, glycol (type 1 & type 4)
<ul style="list-style-type: none"> • activity, graphic, de-icing recurrent: differences between fluids <ul style="list-style-type: none"> • Chart is displayed with some cells completed. Performers must drag appropriate text into the empty cells. 	
<ul style="list-style-type: none"> • concept, text, de-icing recurrent: refractometer & brix <ul style="list-style-type: none"> • Why one checks the concentration, at what levels can the fluid be used, the 10 degree buffer, etc. 	<ul style="list-style-type: none"> • concept, photo, refractometer • concept, animation, brix readings (animation on brix readings and the buffer)
<ul style="list-style-type: none"> • procedure, text, de-icing recurrent: refractometer & brix <ul style="list-style-type: none"> • Step-by-step procedure for taking a brix reading 	
<ul style="list-style-type: none"> • procedure, video, refractometer and brix 	
<ul style="list-style-type: none"> • assessment, graphic, de-icing recurrent: use of fluids <ul style="list-style-type: none"> • The performer is asked to drag a drop of fluid to the appropriate place on the refractometer. (if they get this wrong they are shown where the drop should have been placed) • The reading from the refractometer is displayed along with a description of the weather and aircraft conditions the performer should take into account. • The performer then must click on a radio button to indicate whether or not they should use the fluid. 	
<p>Note: may want to repeat this a couple of times with different data.</p>	

The Cisco Reusable Learning Object 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. As such, it is worth taking a

look at their reusable learning object structure. The Cisco RLO contains an overview, a summary, and from five to nine reusable information objects (RIO), what I have been calling assets. See Figure 1. In the Cisco model (developed with significant input from Ruth Clark-Colvin, a world renowned instructional designer and author) each learning object is based on a single objective, derived from a specific job task. Each information object is based on an objective that supports the learning object objective.

Each RIO is defined as a concept, fact, process, principle, or procedure – and tagged appropriately. Several RIOs – 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. Each RIO, which also includes introduction, summary, an assessment items, is designed to meet a specific learning objective derived from a specific job task. (Barron, 2000, p. 2)

As mentioned above, a Cisco RIO is made up of three components: content Items, practice Items, assessment items. Working with clients I have found that assets rather than information objects provide the greatest flexibility and return on investment. The main difference between the Cisco model and the model recommended in this paper is that in the recommended model it is the learning object that contains the content, practice and assessment, not the asset or information object. In the recommended model, any one asset may be content, practice, or assessment but they combine at the object level. So, practice and assessment may cover the content of several assets allowing for a more task rather than step based approach. See Figures 2 and 3. A significant benefit of the design shown in Figure 3 is the instant reusability of assets at the job-site as performance support. For a Cisco information object to be deployed as support the practice and assessment need to be masked or removed. A content asset can be used to support performance as is.

Cisco's information objects are classified to provide information for reuse and to allow for templated development of each classification. The classifications they use are: concept, fact, process, principle, and procedure. Templates have been created for each so every concept information object will be structured in the same way. This allows for consistency when a large number of people are creating the information objects. From a learning point of view this may or may not be an effective approach. Experience with clients has shown that a broader yet simpler classification system works with the object / asset classification schema. The classifications include: introduction, instructor note, fact, procedure, concept, policy, summary, activity, and assessment. These classifications have been found to make sense to instructional designers and, instructional designers are more readily able to consistently tag assets using them. With the CISCO schema many of the designers found it difficult to determine if something was a process or a procedure, a principle or a concept. In some industries these distinctions are clear, in others muddy.

A common metaphor used to explain assets and objects is Lego blocks. Content assets can be snapped together with a practice asset and some assessment assets to create a learning object. Learning objects can be snapped together to create lessons and modules. See Figure 4. Assets can also be snapped into a performance support site. 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)

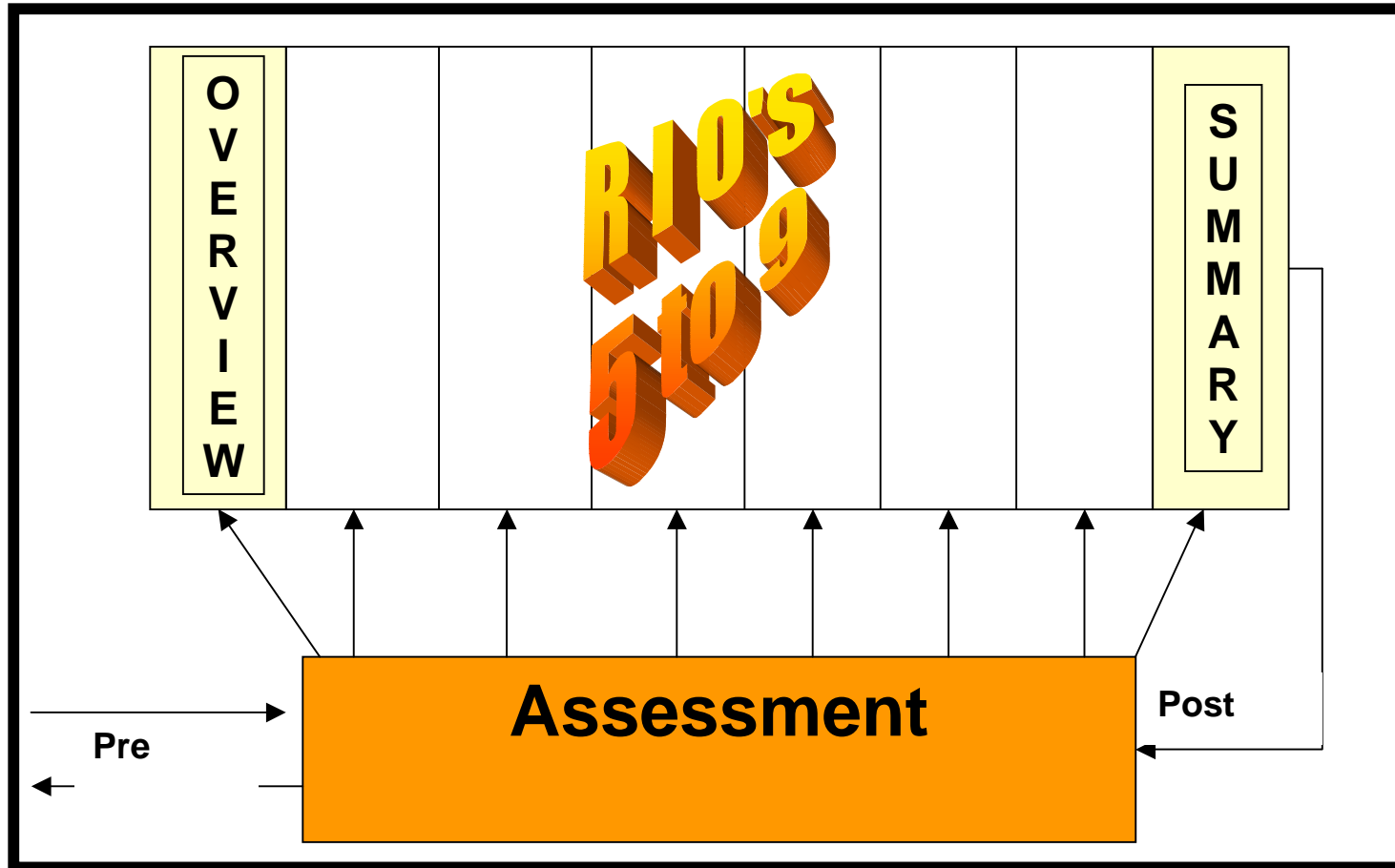


Figure 1: Learning Object (from CISCO Systems, 2002, p. 4)

CISCO Model

O V E R V I E W	Content	Content	Content	Content	Content	S U M M A R Y
	Practice	Practice	Practice	Practice	Practice	
	Assess	Assess	Assess	Assess	Assess	

Learning Object

*Each white column is an information object.

Figure 2: Information Objects (from CISCO Systems, 2002, p. 4)

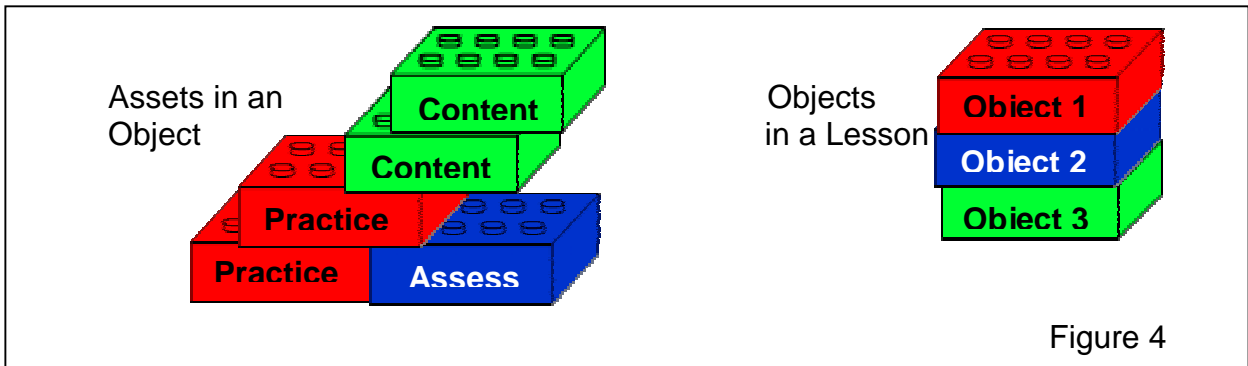
Recommended Model

Content	Content	Practice	Practice	Content
Practice	Content	Content	Content	Content
Content	Assessment	Assessment	Assessment	Assessment

Learning Object

*Each box is an asset (Content, Practice, or Assessment)

Figure 3



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 (assets). 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.

Why Corporations are Interested in Learning Objects

A critical element of sustained corporate success is the intellectual capital. As Davenport and Prusack (1998, p. 17) state “A knowledge advantage is a sustainable advantage.” Capturing knowledge, developing training, and maintaining content costs money. 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 e-learning initiatives allowing organizations to improve the capture and use of knowledge through flexibility, ease of updates, adaptivity, interoperability, and increased value of content and cost avoidance.

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. The same content “can

be assembled as training modules, documentation, reference, promotional brochures, technical manuals.” (Colvin, 1998, p. 1) Having a library of learning objects to draw on will also shorten course development time allowing for faster deployment of the learning required to develop performers to the necessary level of competency.

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 asset and object easy to identify and locate. Once located a piece of content is changed once. All places linked to that content are updated instantly.

Adaptivity refers to the ability to recombine assets into any number of objects adapting them to meet specific needs. Objects can quickly be created and combined to meet individual knowledge, skill and attitude gaps within a competency-based model. Learning departments can now create “prescriptive, dynamic learning for customers within their time frame for learning.” (Influential Trends, 2001, p. 1)

By interoperability we mean that organizations can set specifications regarding the design, development and presentation of objects based on organizational needs while retaining interoperability with learning systems at other organizations.

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. All of this, along with the technical feasibility provided by intranets, extranets, and the internet, makes learning objects a very attractive proposition and one for which return on investment is fairly easy to postulate.

The Instructional Design of Learning Objects

There is a different instructional mindset applied to creating assets and objects. It requires a small but immense change in thinking on the part of the instructional designer.

Instructional design theorists are questioning the assumptions underlying existing design methodologies that are proving brittle in the face of challenges posed by the newer instructional modes...The instructional object has been proposed within different speciality fields for its productivity benefits, for its standardization benefits, and as a means of making design accessible to a growing army of untrained developers. (Gibbons et al., 2000, p. 3)

Traditionally we have created intricate and integrated learning programs that are designed to endure intact. With objects one thinks holistically but then designs and creates at the smallest level, keeping the end goal in mind. "Object content doesn't flow across objects either as an argument or as cumulative knowledge." (Longmire, 2000, p. 4) Instead of looking at training as a linear procession with a beginning, middle, and an end, we now think of training as clusters of independent, stand alone bits of knowledge which are related and can be viewed together but which also can be viewed singly. "Just as you can enter and leave a web site at any page and leave at any point, so too can training consumers." (Schatz, 2000, pp. 2 – 3)

Creating New Content as Learning Objects

When creating learning objects you start in much the same way as with traditional courses by defining the gap and the audience, deciding what must be trained and what can be supported rather than trained, determining the learning approach and media(s), and identifying the terminal learning objectives.

This is the point at which the process begins to differ. Traditionally one would sequence the objectives and create learning and assessment that flows from one

piece to another with carefully crafted links and segues. In object design, each learning objective (which will become an object) is deconstructed into sub- or enabling objectives each of which will become one or more assets. Each asset is then designed to work in multiple contexts. When all the assets are designed objects are created and then a recommended sequence of objects is identified for learners. As Steven Schatz says, “you are creating individual grapes in a bunch. Consumers may eat one or all. It is up to them, not us.” (Schatz, 2000, pp. 2 – 3)

It is the creation of these assets for use in multiple contexts that seems to pose the greatest hurdle for instructional designers. By focussing on performance-based learning design strategies designers are better able to create at the minute level while keeping the many potential contexts of the asset in mind. It often takes many drafts to get each asset right, especially in a first learning object project. The author recommends that a coach experienced in RLO design and deployment work with the designers reviewing and providing constructive feedback on their early efforts. When multiple designers are working on the same intervention or program, the coaching model also helps promote consistency in style and tone.

The following eight phase methodology for the design and development of learning objects for new content has been developed by the author while working with client instructional design and programming groups. This methodology contains elements of Dick and Carey’s instructional design methodology, and the P++ programming process.

The process begins after the need has been assessed and a training related performance gap identified. The process, while described here in a linear fashion, is actually a set of overlapping and concurrent phases. Project management, change management, risk management, and team communication underlay and continuously support all the steps and activities.

The first phase in the methodology is called Evaluate Feasibility. Initial scoping, information gathering, and analysis are carried out to confirm that a learning object approach is economically viable, technically and organizationally feasible, and valid to address the identified gap. Instructional interventions are extremely effective when they are the right solution. They are also time and resource consuming. Therefore, feasibility must be evaluated and potential ROI identified before the project is begun. More specifically, during the Evaluate Feasibility phase the following tasks are carried out: identify business objectives; identify project objectives; apply a feasibility analysis model that addresses economic, technical, organizational, and instructional feasibility issues; and, identify evaluative criteria and gather baseline data (criteria which, when measured, will indicate whether or not the gap has been closed).

The next three phases: Analyze Need, Analyze Functionality, Align Team and Plan Project, can occur concurrently. During the Analyze Need phase information gathered during the needs assessment is refined and clarified. The next several levels of information required for the design, production, and implementation phases are obtained. Specifically, the following analysis activities are carried out: job analysis; task analysis; learner analysis; performance gap analysis; and the analysis of any available information on previous learning object implementations in the company.

Given the technology-based nature of learning object interventions, the intranet and/or extranet, delivery (desktop) hardware, and available software must be analyzed for opportunities and constraints. This is done during the Analyze Functionality phase when the following activities are completed: analyze the platform from which the learners will be accessing the learning (Browser, bandwidth, etc.); identify and analyze the software options for development in terms of flexibility, applicability to the intervention, and ease of conversion to XML; analyze the capabilities and constraints of the company's LCMS; choose an authoring tool for both production and prototyping; analyze the classification and tagging schema (the labelling applied to each asset and object); and, identify what on screen layouts are available for both performance support and learning to determine if additional layouts are required.

Learning object interventions require the input and cooperation of many different groups and skill sets. The success or failure of the project may hinge on the effectiveness of team interactions and project planning, thus the fourth phase of the project, Align Team and Plan Project. During this phase one will: identify the skill sets required for the project; select the team members based on required skills ensuring the instructional designer and the developer both have learning object expertise; determine and document communication protocols; determine and document team member roles and responsibilities for each project step; determine and document the change management / scope management process that the team will follow; identify risks to the project, determine how likely each risk is to occur, decide what impact that risk could have on the project, and develop and document strategies to mitigate the risk; decide on the project management tool and process to be followed; and, draft the first project plan and time line.

The next three phases: Design, Develop, and Implement, overlap. The Design phase involves several iterations of prototyping, requiring heavy input and review from the subject matter experts. While this extends the time required for this phase, it also overlaps design with development and shortens the overall development cycle while providing a superior product. The key deliverable for this phase is the learning object design document. (Figures 5 – 7) This document is formatted to capture the instructional design at the level of detail required if more than one person is creating the assets and objects. The format also allows the designer to dictate both content and format while displaying the design in a way that is easy for subject matter experts and clients to understand. This facilitates review and sign-off.

During Design section one of the design document is completed listing all the modules and the objects in each module. Section two of the design document is then completed listing all the assets in each object. Completing section three involves (a) organizing the assets in the display template chosen for each object and (b) detailing each asset including recommendations for creation in more than one media. Next,

sign-off on the design document is obtained from both the subject matter experts and the client then a storyboard template is created.

The next step in the Design phase is to hold joint application design (JAD) sessions to design the architecture, determine protocols and navigation, and obtain sign-off on objectives and storyboard template. During the JAD the enabling objectives (assets) and terminal objectives (objects) to prototype will be selected in order to ensure each main aspect of the learning is prototyped.

Still during Design, storyboards for the first set of assets are created and reviewed by the subject matter experts. The assets are programmed and then tested on-line by the design team and by the subject matter experts. The on-line assets are revised based on feedback and a prototyped learning object is created from the prototyped assets. The learning object is reviewed by the design team and by the subject matter experts and revised as required. The cycle is completed for the next set of assets to be prototyped. Concurrent with the second prototype design cycle, dissemination of the prototyped learning object through the LCMS should be tested. Make sure to obtain client sign-off on each learning object prototype.

The Develop phase is next. Based on the design document, each asset is storyboarded. Since the organization of assets into objects is detailed in the design document, this phase creates the objects as well. The main steps in Develop are: finalize the development and production schedule; produce storyboards for all the assets and objects; have the subject matter experts review and provide feedback on each storyboard as it is developed; revise each storyboards based on feedback; obtain client sign-off on each revised storyboard; program the assets and objects in the selected layouts; validate each learning object with subject matter experts not involved in the project up to this point; revise and revalidate each learning object; obtain client sign-off on each object.

The last two phases in the process are Implement and Evaluate. Implement and Evaluate overlap since the first two levels of evaluation occur during the

Implement phase and provide input to the post-implementation report. During Implement the implementation plan is reviewed and revised and the intervention is implemented. The specific steps in this phase are: review and revise the implementation plan and schedule; train the implementers; implement; develop and submit the post-implementation report; and, act on post-implementation report recommendations.

Evaluate is the same as the summative evaluation phase in many of the traditional instructional design methodologies containing first, second, third, and fourth level evaluation (as described below). The first and second level evaluations are conducted during or at the end of implementation providing data and input to the post-implementation report. As in the traditional methodologies, first level evaluation relates to gathering learner and implement reactions to the structure and content of the intervention. Second level relates to measuring the acquisition of skill, knowledge, and attitudes against the project objectives.

Three to six months after implementation a third level evaluation is conducted measuring usage and the effectiveness of the knowledge and skills taught. In deciding on when to conduct the third level, consider the company's business cycles and any other changes to tools, process, compensation, or staffing that might also affect job performance. About one year after implementation fourth level evaluation is carried out measuring improvements in productivity, decreases in errors, etc., as well as any other evaluative criteria identified in the Analyze Feasibility phase, should be measured.

Revising Existing Content as Learning Objects

It is often easier for corporations to create their first learning objects while revising a current curriculum. The material is familiar and the curriculum needs to be revised anyways. It is often an easier sell to internal audiences and a safer way for instructional designers to explore and experiment with object and asset design.

When working with existing content, the author recommends a six phase instructional design methodology. The six phases are: identify and eliminate duplicate terminal objectives, identify enabling objectives, design, develop, implement, and evaluate. The last four phases are identical to the phases of the same name described previously and so will not be re-described here. This methodology assumes that the designer is working with a complete program or curriculum. It can also be applied to repurposing a single course or set of courses.

Phase one of the methodology is Identify & Eliminate Duplicate Terminal Objectives. By looking at the entire curriculum, which was most likely developed in an ad hoc manner over time, a significant number of overlapping terminal learning objectives are likely to be discovered. Removing overlapping objectives can substantially reduce the time and effort taken to revise the curriculum. The specific tasks in this phase are: identify every terminal objective in every lesson in the program; identify and eliminate any duplicate terminal objectives; create a list of terminal objectives to be used in the repurposed learning, ensuring that they are written in a consistent and measurable format. An Objectives Worksheet, used in this phase and the next, is provided in the Appendix A.

Each terminal objective will have one or more enabling objectives. Assets are created based on enabling objectives. Just as terminal objectives are often duplicated in a program so are enabling objectives. The difference is, rather than eliminating duplicate enabling objectives one identifies where they are located and ensures that related assets are applicable to each instance of the objective. During the Identify Enabling Objectives phase, every enabling objective related to each of the remaining terminal objectives is identified. Then, a list of enabling objectives to be used in the repurposed learning is created ensuring that they are written in a consistent and measurable format. See Appendix A for the Objectives Worksheet. Lastly, each enabling objective is considered in terms of how often it appears in the learning and whether it will also be relevant to performance support.

As stated above, the last four phases of the methodology: Design, Develop, Implement, and Evaluate are the same as for new content. The same coaching model as described for new content should also be applied to a redesign project. Let the instructional designers learn and perfect this new skill using a constructivist approach that embraces trial and error, reflection, coaching and feedback, and perhaps even peer review. An instructional designer can be considered a knowledge worker and should be trained as such.

Whether designing new content or repurposing existing learning, Warren Longmire (2000, pp. 3-4) recommends ensuring that the language and terminology is appropriate for all the audiences that could possibly be addressed and consistent across all objects with a topic or course. To this end, a content editor could be a useful addition to the design team. In addition, Longmire reminds us to keep in mind that the content will be displayed on-screen and should be developed with this in mind. These points are familiar and apply to good instructional design. We must make sure not to overlook them in object design.

A Design Document for Learning Objects

As mentioned earlier and often, design of learning objects is different from other approaches and requires a slightly different style of design document. The instructional designer should, through the design document, prescribe not only the content of each asset but also the display of each asset when combined into an object. The design document shown in figures 5 to 7 supports the required level of detail.

There are three main sections in a learning object design document. The first section simply lists the modules and the objects in each module. See Figure 5.

MODULE	OBJECTS	PAGE
INTRODUCTION	1. Learning Objectives	2
	2. What is a Project	4
	3. What is Project Management	5
	4. What does a Project Manager do	7
	5. Phases of a Project	8
	6. Assessment	10
PREPARATION	1. Overview	11
	2. Tools	12
PLANNING	1. Overview	15
	2. Tools	16

Figure 5

The second section lists all the assets in each object. See Figure 6. The text description of each asset should mirror the labels that will be applied during coding. In this example only three labels are used. Many corporations are selecting about five to seven from the approximately one hundred and fifty presented by the standards bodies.

MODULE:	Introduction
LEARNING OBJECT 1:	Learning Objectives
ASSETS:	<ul style="list-style-type: none"> ● fact, text, learning objectives ● concept, photo, learning objectives

Figure 6

The third section of the design document takes each asset in an object and organizes it in the design template you have chosen. The instructional designer can then use this document to get sign-off from the client on content, sequencing and display. See Figure 7. It is important to note that most Learning Content Management

Systems come with standard display templates that provide options for how learning objects will look on screen. If at all possible, the instructional design team should influence the selection or design of the display templates for both learning and for performance support.


MODULE:	Introduction
LEARNING OBJECT 1:	Learning Objectives
TEMPLATE:	XML7854
ASSETS:	
<ul style="list-style-type: none"> • fact, text, learning objectives <p>At the end of the program, learners will be able to:</p> <ul style="list-style-type: none"> • Describe what a project is, and isn't. • Describe what project management is. • Describe the role of the project manager. • State why consistency in project management is important. • Describe the project management process being recommended. • List the five phases of the project management process and briefly describe each phase. • State the use of each tool, which step in the process it supports, the benefit to using each tool. • Describe how they would be able to apply the project management process to a project they are currently working on. 	<ul style="list-style-type: none"> • concept, photo, learning objectives 

Figure 7

Conclusion

The design and deployment of learning objects is a new frontier for instructional designers but it is a frontier with some familiar topography. Solid design principles applied in a new way can provide corporations with the interoperability, adaptability, flexibility, and accessibility opportunities related to knowledge that are necessary to compete in today's global, connected, and fast-paced markets. The challenge for instructional designers working in corporations is to focus on performance-based learning opportunities and make the minute but monumental shift in thinking required to develop at the asset and object level.

To meet this challenge instructional designers need to be trained and supported. Opportunities to develop and hone asset and object design skills should be provided on low-impact, low-visibility projects. The risk of time and budget overruns on a corporation's first reusable learning object project are high and failure can have serious consequences for future funding.

Plan, train, coach, and revise are the watchwords on a first RLO project as they are on any quality instructional design initiative.

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Appendix A

Objectives Worksheet

Course / Program: _____	Instructional Designer: _____	Date: _____
Module / Lesson: _____	E-mail: _____	Version: _____
	Phone: _____	

	Terminal Objective	Enabling Objectives	Relates to TO's #	Learning (✓)	Support (✓)
1		a			
		b			
		c			
		d			

	Terminal Objective	Enabling Objectives	Relates to TO's #	Learning (✓)	Support (✓)
2		a			
		b			
		c			
		d			

	Terminal Objective	Enabling Objectives	Relates to TO's #	Learning (✓)	Support (✓)
3		a			
		b			
		c			
		d			