

# Training Materials for the Information Age

## How to package content as independent, re-usable learning objects that really teach.

by Gary Sprague

By now, we all know how to design training that has a measurable impact on the jobs people do. We can define the job tasks, write effective objectives and test items, and produce training materials that deliver the content appropriately. The methodology we follow to do this is well defined and incorporated into our daily training regimes.

But in the “information age” new ideas are emerging that are beginning to influence the way some organizations think about the information they produce. For them, it is no longer enough to write a lesson plan that achieves a defined training outcome for a selected target audience. They want information that can easily be shared, adjusts to a variety of settings and media, delivered on-demand, any time, to any group or individual, and even accommodate a recipient’s personal learning style.

The ability to produce highly effective content that can be used, re-used and shared across the enterprise (or the world) to anyone that needs it is bringing about new standards for how information is designed. Fortunately, these standards do not clash with our performance-based training methods. Rather, they are based on a fresh look at familiar instructional design elements combined with Internet, database and new software interface technologies.

This presentation will suggest ways to package learning content as independent, re-usable learning objects that can be more effective than traditional training materials. Primary considerations will focus on ways to orient learning objectives, the assignment of learning strategies, the addition of several new kinds of “properties” and adherence to IEEE, AICC and other standards for web-learning objects.

## INTRODUCTION

In this section, we will address the following topics:

- Definition of a “learning object”
- Potential benefits of using the learning object approach to content
- Challenges associated with making them practical
- A three part solution to making learning objects work

### What is a “learning object”?

The term “learning object” has, over the past three or four years, competed with a number of alternative expressions: content object, re-usable learning object (RLO), re-usable information object (RIO), knowledge object, and so on. More recently, there has been a general acceptance of the term learning object but variations still abound.

Like the term itself, its definition is beginning to stabilize but variations are still common. A learning object is generally thought to be an independent chunk of content that can be presented alone or in various combinations with other learning objects to form a unit of instruction.

*Simplified definition of a learning object- VISION software version*

Vendors of software products that deal with learning objects are coming up with specific definitions of their own, based on their product concepts and technical strategies. The VISION learning content management system is predicated on a definition of its own.

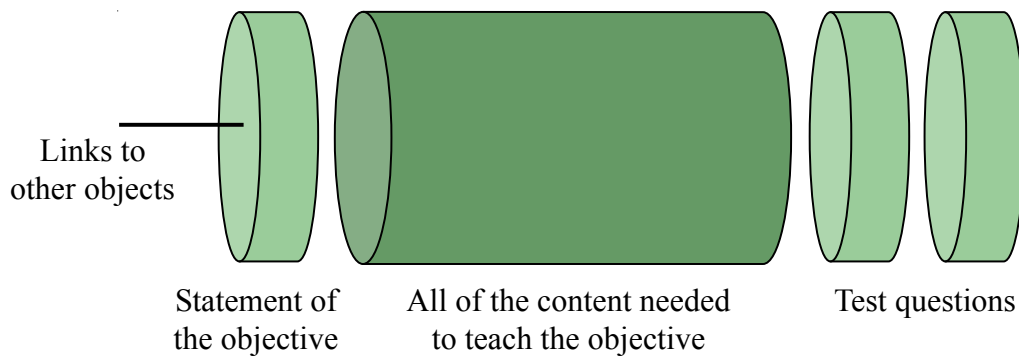
In the simplest terms, a learning object in VISION is a block of content that contains:

- an instructional objective statement;
- all of the content needed to present the objective,
- associated test question(s),
- links to other objects,
- and a set of additional, user-defined properties.

## *Illustrated learning object*

This illustration represents a learning object as having several components: an objective statement, the content and test questions. It also shows “links” to other objects as an additional property.

Not all definitions of a learning object specifically identify an objective as the central organizing entity.



## **Potential benefits of learning objects**

The idea of the learning object is important because it is seen as a key to the way training will be transformed in the information age. We’re all familiar with the changes that business and industry is experiencing worldwide. Some of the changes that make headlines every day are:

- Mergers and acquisitions
- Shorter time to market with rapidly evolving products and services
- Globalization and decentralizing of physical assets

We accept these changes as part of the new business landscape. But they will have a profound impact on the way the workforce is trained. Believe it or not, the use of learning objects could play an important role in the transformation.

Let’s imagine a hypothetical corporation. It is undergoing all of the changes we hear about. It just merged with several other companies in the same industry. The result is a bunch of entities on several continents. In the past, they were in competition with each other. Now they are attempting to do business as one. The goal of course, is to leverage the new common business structure to become more efficient, competitive and profitable. How does the idea of learning objects help?

### *Sharing common content to eliminate redundancy*

For one, this enterprise wants to consolidate assets and eliminate redundancy. It is easier to sort content by pieces that are common and unique if they are organized in small packets that can be moved, mixed and shared.

### *Sharing content across authors to expedite development*

The firm is racing products to the market. Content developers are hard pressed to produce effective training before it is time to change it. If content is stored in easily accessed, small packets, an instructor can “grab” the pieces that will shorten her development time. If the content is stored as large, word-processed files, the job of finding, cutting and pasting relevant materials would be overwhelming.

### *Delivering web-based content*

Then there is the Internet. Here is a perfect technology to take advantage of the learning object approach. Let’s say the objects are stored in a database. A product change is introduced and field technicians all over the world need an update. The objects that change are assembled into a unit of instruction to form web-based update modules. Of an entire lesson or course, only the changed objects need be delivered.

### *Performance support on-demand*

With the right configuration management approach to the content objects, if one of the technicians at a site wants to perform a task or procedure, the content that might appear buried within several courses can be extracted by a filter and assembled on the spot. The technician gets what he needs without having to search huge reference documents.

### *Better change management*

What happens when the product does change? Oftentimes, the affected content is buried among lessons stored everywhere. Learning objects introduce the possibility of connecting on one end the change agents, and the other to the content itself. Test questions are connected to the learning object. This will shorten the trail and the time it takes to track down affected areas and make the change in both the content and the exam bank.

The object-oriented approach to content holds the potential of an information source that is at once more agile, flexible and usable in a fast-paced dynamic environment.

## **Challenges in realizing the potential**

Of course, nothing is quite as easy as it first appears. The benefits of the learning object-approach will not be easy to harvest. There are formidable challenges to making them practical. Some of the challenges in realizing their potential are:

- Stringing nuggets together to make a cohesive whole seems impractical. Content usually needs to “flow” from subject to subject. Mixing content out of a natural sequence could result in blobs of material that don’t make sense in isolation.
- For a learning object to be useful, it must stand on its own as an instructional unit. Content for one subject often overlaps others and the instructional merit is not always achieved until mid-way through the material. At minimum, the idea of self-contained nuggets represents a paradigm shift for authors of instructional materials.
- When a string of objects comes up, perhaps from a random or key word search, how will we handle prerequisites? Even if an object is self-contained, it may not be effective if a prerequisite concept is not presented first.
- If learning objects represent a more granular approach, we could be creating a content management nightmare by multiplying tenfold the number of “widgets” we have to produce, track and control.
- The idea of sharing and re-using objects is compelling. But if a developer needs to update a widely shared object, how can he be sure the change will not cause the content to be inappropriate for some of the instances where the object appears?

These are only some of the serious challenges that must be overcome if the learning object approach is going to work. Clearly, simply breaking our content into smaller pieces is unlikely to help us realize the potential of the object-oriented approach. We need a much better plan than that.

## A three-part solution

Organizations seeking to maximize the benefits of learning objects should concentrate broadly on a “system solution.” In doing so, there are three fundamental components of the solution.

1. Instructional design- how learning objects are designed and developed in the first place.
2. Content management- how large numbers of learning objects are organized, shared, tracked, and maintained.
3. Information retrieval- how a set of learning objects can be found in various contexts, connected together appropriately, rendered as useful instructional product, and distributed on-demand to the point of need.

All three components are inter-twined. For example, in order to develop useful specifications to guide authoring teams in how a learning object should be designed, we must consider the content management problem. We know it would be counter-productive to allow the proliferation of objects that are too complex or too many to manage. On the other, any content management system, in order to be practical, will provide features that should be considered at the instructional design stage. So we need to consider both at once.

Likewise, we can't evaluate a content management system without clarifying our information retrieval goals. What kind of outputs do we expect from our learning content system in order to justify its existence? The answer might point to the need for features in the content management system. Or, it might indicate the requirement to add properties to our learning object design specifications.

When we discuss learning objects then, we must consider learning object design, object management, and information retrieval together.

## LEARNING OBJECT DESIGN

In this segment, we will address the following topics:

- The impact on the object-approach on instructional design
- A general guideline for designing instruction as learning objects
- What are instructional design strategies?
- Classifying an object by the type of content it represents
- The components of an instructional strategy
- An example design specification
- Instructional components as properties of learning objects
- Technical properties: HTML, XML, XSMIL and industry standards

### **The impact of objects on instructional design**

The use of an object-oriented approach to content amplifies some of the familiar problems associated with the design of instructional materials. It also presents some new ones. Consider this checklist of instructional design requirements in light of a new, granular approach to content:

- Achieve consistency in scope, form and quality across objects and authors
- Objects need to be self-contained and instructionally effective
- Not illogical when mixed in different sequences with other objects
- Appealing, interactive and sensitive to different learning styles
- Design standard is realistic for authors to achieve with speed and efficiency
- Design can be employed by available instructors, developers and SMEs
- Results are adaptable to rapid change and easy to update

There is no magic bullet to address all of these, and other, considerations. Indeed, some apply today among developers of any form of course materials. But when we consider the challenges of shifting to a whole new approach to content design, we would appreciate something that addresses a number of the issues in one swipe.

## **General guideline for packaging content as learning objects**

When it comes to the design of an object of content, consider the following general guidelines:

1. Orient the object around an instructional objective.
2. Assign an instructional strategy to each objective.
3. Use the strategy as a prescription for content development.
4. Attach the content and the test questions to the object.

Other guidelines are self-evident. We need to provide authors with training and help to ensure they can work with the strategies effectively. Each organization needs standard formats for how the content will appear in training products. Editorial guidelines will be required to help authors use terms, writing styles and other techniques to ensure that an object will make sense when it appears in a sequence with other objects.

## **What are instructional design strategies?**

In general, the guidelines are centered on the use of instructional strategies. What are they? Instructional strategies are methods, or rules that can be applied to the presentation of instruction. Think of them like a prescription, or a “treatment plan” for getting information across to the learner. A particularly useful strategy would address some or all of the familiar instructional design problems. A “best-of-all-possible” strategy would also address the additional issues raised when we try to compose content as learning objects.

A set of such strategies happens to exist in the form of a method of instructional design called the Component Display Methodology. Educational Psychologist M.David Merrill, and others developed the methodology over years of research.

The Component Display Methodology is predicated on three key elements:

1. The domain of most content we need to convey falls into types or classifications.
2. Each objective will represent one type of content; hence it can be classified.
3. Each classification is associated with an instructional strategy that best conveys that type of content.

This means that every objective will be written to represent a single type of content. Once it is classified by the type of content it represents, an instructional strategy is applied to prescribe how the content should be organized to best teach that type of objective. The strategy is comprised of a series of instructional events, or components

### Content types

The kinds of content and classifications that are attributed to Component Display vary. Example content classifications include:

<b>Fact</b>	<u>Recall</u> : remember simple, factual information.
<b>Structure</b>	<u>Recall</u> : remember the parts of a structure and their functions.
<b>Concept</b>	<u>Use</u> a concept to recognize or classify something.
<b>Process</b>	<u>Use</u> knowledge of a process to pinpoint the cause of a fault, or predict consequences of a manipulation, in a system.
<b>Procedure</b>	<u>Use</u> a procedure to do something step by step.
<b>Rule</b>	<u>Use</u> a formula, algorithm or operational guidelines to perform a complex operation.

Notice that only two types of content require recall. These are “lower level” objectives. The rest require the use of a concept, process, procedure or rule to actually do something. These are higher level, interactive strategies. By using this approach, we can see the level of objectives we are writing very clearly, and strive to frame them at the higher, more interactive level.

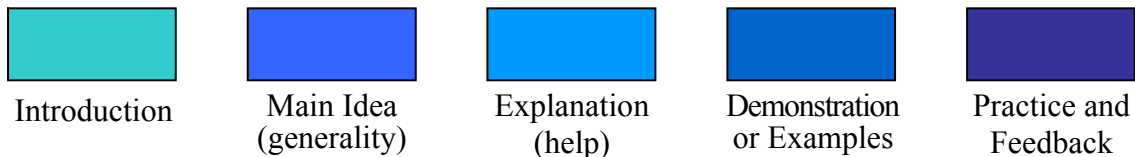
Each objective (or object) is assigned one of the above classifications. This influences the way objectives are written in the first place. By causing an objective statement to be framed to represent only one type of content, the scope of the objective becomes more manageable. It will also be more consistent with the scope of other objectives because a universal rule is being applied.

## Instructional components

Every strategy in the Component Display Methodology is implemented by displaying a set of instructional components, or events. By displaying the components, the objective is presented in a way that best teaches that type of content.

Most classifications are presented with the same type of components, but how the components are developed is different for each strategy.

The components that make up each strategy (with a few exceptions) are:



This model breaks the content into smaller, “sub-components.” Each component has certain characteristics, based on the kind of content. Learners can proceed through the components from left to right. This gives them the main idea, or “generality” first. The other components help them understand and use the main idea to attain the objective.

Some learners prefer to proceed through the components in a non-linear path. For example, one learner might want to first view the examples, try the practice, and perhaps see if she can extrapolate the main idea. This way the content is adaptable to different learning styles.

## For example

Let’s say we want to teach someone about how an automobile engine works. We know we’ll break the content down by “systems.” One system is the cooling system. How do we approach this one?

We want the learner to understand how the cooling system works. We could write an objective as a FACT, or informational objective to teach all the components, technical specifications and so on. This would require a lot of recall on the part of the learner. We may need this type of objective, but first let’s shoot higher, for something more interactive.

So, we'll write a "PROCESS" objective, which will require the learner to use knowledge of a process (cooling system process) to identify a fault or predict consequences.

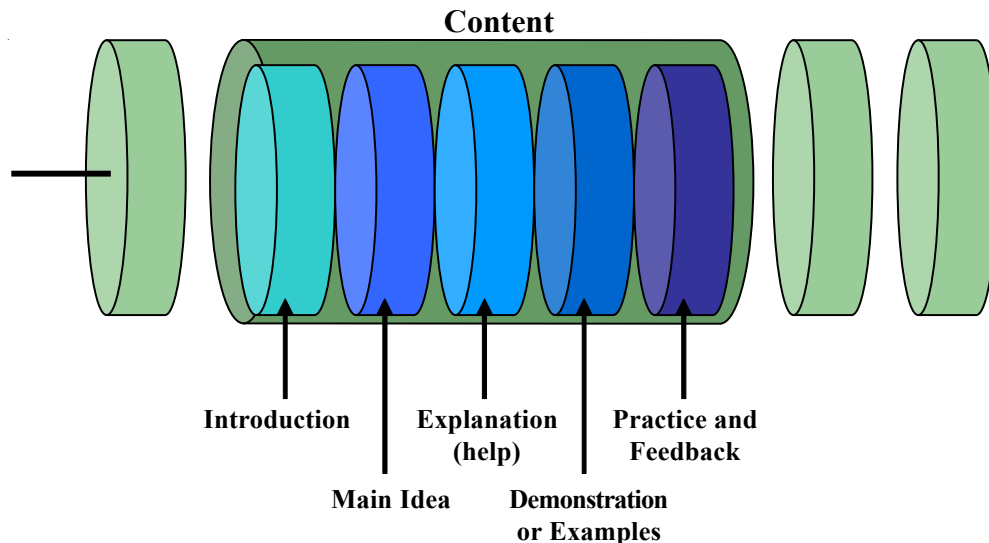
We write this objective: "Given a description of operating conditions and indications of a cooling system problem, identify the most likely cause of the problem."

Here is a specification for how the content for this learning object might be developed according to the Process strategy:

<b>Introduction</b>	Brief statement to introduce the content (one short paragraph).
<b>Main Idea</b>	Drawing or graphic showing flow of water through the components. Describe what is happening at each component.(One page; illustration with explanation)
<b>Explanation</b>	Explain how each component affects the water temperature. Briefly describe how the component works (about two pages).
<b>Examples</b>	Explain how the system reacts to a set of conditions. Examples to cover (1) faulty thermostat, (2) low water, 3) malfunctioning pump.
<b>Practice</b>	Give indications and require diagnosis for range of problems: leaky hose, thermostat stuck open, thermostat stuck shut.

**Properties of a learning object**

Now let's look at the properties of a learning object in light of the use of instructional strategies. The strategy adds more details to the properties of the object. The content block is broken into components, or events of instruction.



Assignment of a content type and strategy addresses a number of issues associated with the use of learning objects. The strategy promotes consistency in size and scope of the objects because each object will only address one type of content. It also helps to ensure that the content will be presented with all of the parts necessary to actually teach. It also provides a standard prescription that authors can follow to develop this type of content. Learning objects will be complete, consistent, and instructionally effective. Learners can use the content according to their individual learning style.

## CONTENT MANAGEMENT

In this segment we will discuss:

- Data management and tracking challenges with the use of learning objects.
- A content management framework.
- How instructional design considerations and configuration control requirements overlap.

### Content management framework

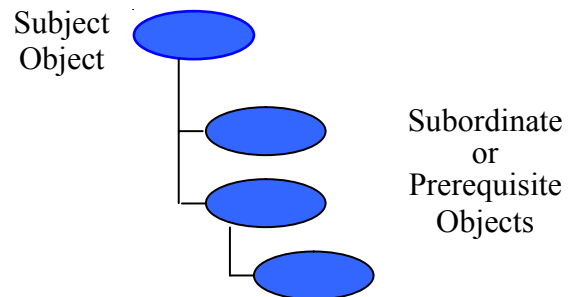
When we develop an object, it must be stored, tracked, used, kept up to date and so on. One of the most important considerations in doing this well is the type of framework, or data structure to which each object is attached. The framework should put every object into a logical context that aids later finding and using it.

#### *Object-to-object perspective*

At minimum the framework should allow users to establish and display objects in relation to each other and their prerequisites. This is tantamount to a learning objectives hierarchy.

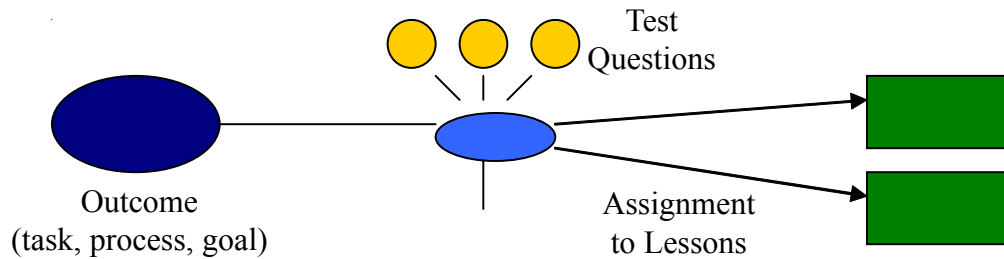
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*Object-to-process perspective*

The framework display should also show how an object is connected to the other components in the instructional design process: tasks or outcomes, test questions, assignment to lessons.

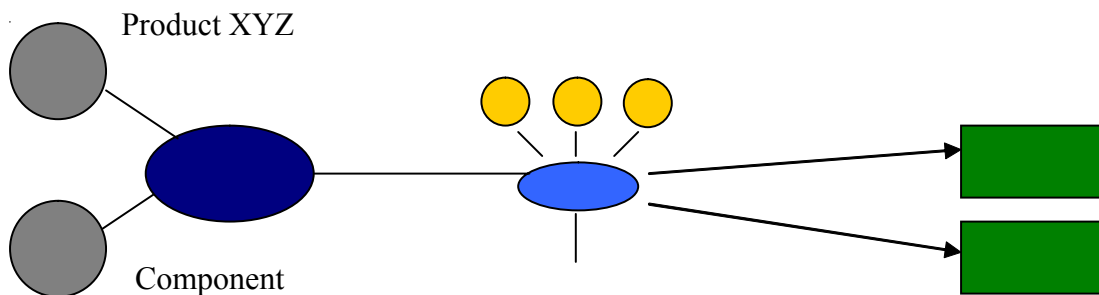


By allowing links between outcomes and object(ives), and objectives to lessons, we are reflecting a performance-based instructional design process. This means that with additional features, the content management system becomes an facilitator of the instructional design process.

The pathways established with this perspective provide a means to retrieve learning objects from an outcome (or work centered) context. This is the key to a multiple purpose database objects. On one hand, objects can be assembled to reflect course or lesson structure. On the other, objects can be found to support work at hand, as in an Electronic Performance Support System (EPSS). The connection with test questions opens a broad range of exam generation options.

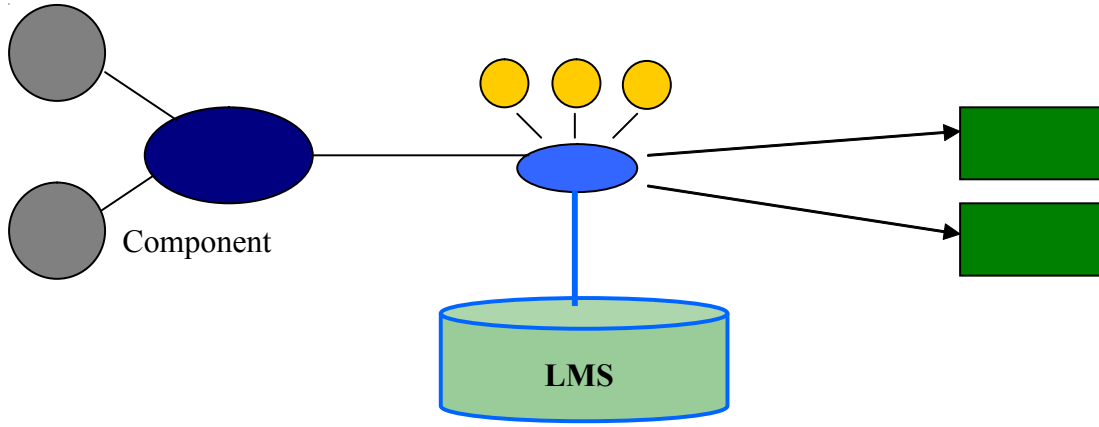
*User-defined links*

The object management system should also be extensible, allowing users to create links to allow custom query paths.



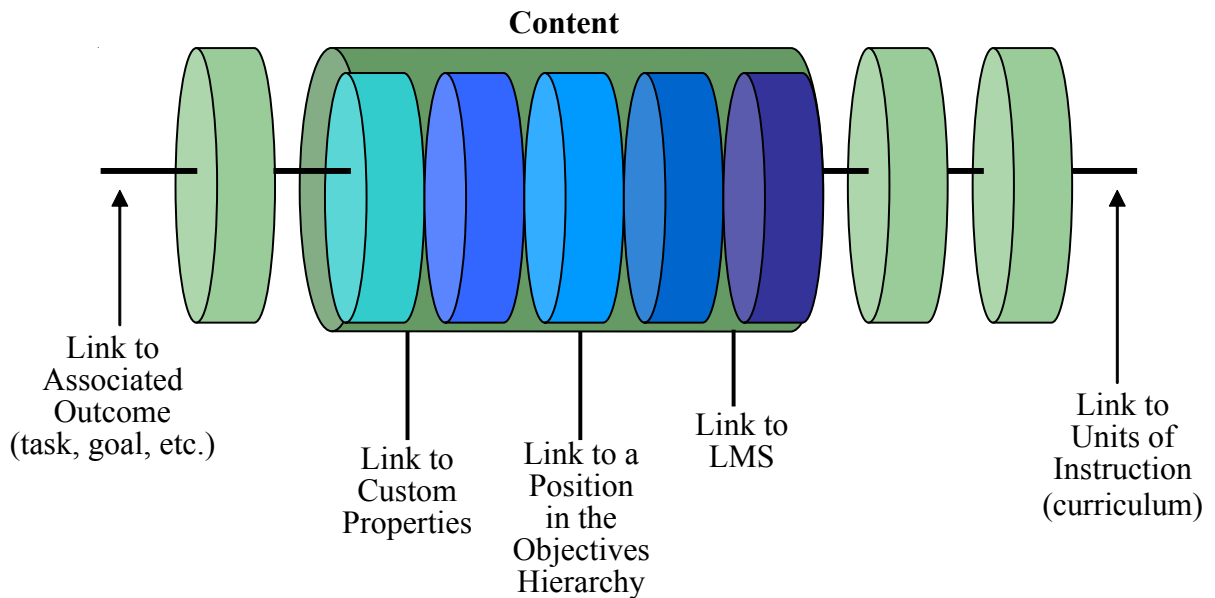
With the ability to extend links in the framework, the ability to find an object is greatly enhanced. For example, with the above pathways, we can find the object from a task perspective or from the perspective of Product XYZ. With appropriate filters, we could also find all objects associated with tasks that are applicable to product XYZ.

*Integration- linking to the LMS functionality*



**Impact of perspectives on learning object properties**

Let's take another look at the learning object properties. If the object management system can show the various perspectives, then the corresponding links become additional properties to every learning object.



## Additional features required

The system will need an array of user interface features such as:

- Quick and easy navigation among the objects
- Easy moving, copying, sharing of objects.
- Ability to track use of shared objects
- Security to prevent loss of control on modification of objects
- Change impact features
- Features that help prevent inappropriately linked or missing objects

Technically, all of these features extend the properties of the learning object.

## INFORMATION RETRIEVAL

In this segment we will discuss:

- Information retrieval perspectives
- Ability to find from instructional design and custom links, rather than depend on key word search.
- Explain how different perspectives, outcomes and formats can be enabled with a learning object system engineered around the SAT/ISD process framework.
- Give examples of on-demand learning solutions from both the on-the-job perspective and the training (course) perspective, based on one set of learning objects.

### **Perspectives for information retrieval**

Learners need information from a variety of perspectives. For example, a learner may need a course or lesson in order to extend his knowledge into new areas, or maintain a qualified status. But on the job, he will invariably benefit from having at his fingertips accurate, current information about a product or piece of equipment he is about to service. Or, if he wishes to acquire new skills to fill an important “niche” and hence become more valuable to the organization, he will want to find the learning objects associated with the niche, get a custom “pre-test” to see what he already knows, and then assimilate just the content necessary to fill the gap.

Accommodating perspectives like these depends on tracing the connections in the schemas. It is more reliable to use a performance-based framework than key-word search to find objects that someone might need to safely and effectively do their work.

### **Outcomes for learning**

Once a set of learning objects is compiled, it must be transformed into an outcome that the individual can learn from. At this point the properties of the learning objects are applied or filtered to create an instrument of learning in a particular form.

A compiled set of independently stored learning objects might be used and re-used in a variety of settings, to include: on-line (web-based), computer-based, print-based, instructor classroom-based materials, student materials for self-paced or classroom use, and exams or quizzes.