

Learning object repositories issues for VET  
sector organisations

**VET Learning Object Repository Project**

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## Introduction

While every training organisation is different, they all have one thing in common: the need for content to build training resources. This content can take on a variety of forms, such as face-to-face tutorials, video clips, audio clips, workshops, study-guides, assessments etc. The ability to access, use and re-use each of these resources when designing a course is of great benefit not only to the course designer but also provides a tangible return on investment for the organisation.

This desire for re-usability has spurred a growing trend towards a “learning objects” approach to developing learning materials. The proliferation of Learning Management Systems (LMS) has been another enabling factor in this approach, and more and more VET sector organisations are now using an LMS to deliver courseware. However, to make the most of re-usability, there is a need to create these learning objects in a standard fashion so that they can not only be used and re-used within the organisation’s LMS but also have the potential for use elsewhere.

### ***What this paper is about***

This paper outlines the main issues that must be considered when implementing a learning object approach to content development and delivery in the VET sector. It also provides guidelines for dealing with these issues. The main issues covered in this paper include:

- metadata
- content packaging
- learning object repositories
- learning management systems
- intellectual property and copyright
- standards

The paper is not meant to be a set of “how to” instructions for managers, but rather is intended to invoke further consideration of the above issues so that organisations may better understand learning objects and the implications they hold for the VET sector.

## What are learning objects

The term “learning object” has been defined in a number of different ways by various individuals, organisations and standards bodies. In their Flexible Learning Leader 2002 Report, Higgs, Meredith and Hand state that there is anxiety amongst people in the VET sector over the lack of a clear definition of the term “learning object”.

One of the more widely accepted definitions of a learning object is that provided by the International Electrical and Electronic Engineering Associations (IEEE) Learning Technology Standards Committee (LTSC) as:

“any entity, digital or non-digital, which can be used, re-used or referenced during technology-supported learning.”

While this definition is an adequate starting point, it does suggest that a “learning object” should be a self-contained resource that meets a specific learning objective

In the VET sector there is a wide range of resources that can be shared and repurposed (re-usable objects). Self-contained resources that address a specific

learning objective are a small component of the many re-usable objects in the VET sector.

As the VET Learning Objects Repository Green paper noted, it may well be that a common definition for learning objects is inappropriate. As Higgs et al (2003) have pointed out, "One of the weaknesses with many learning object implementations has been the concentrated effort on learning objects themselves rather than the systems they inhabit or need to play out in."

The reason for this lack of a common definition stems from the fact that learning objects need to come in a vast variety of shapes and formats. Think of learning objects as you would any educational resource. They range in diversity from a chapter in a book, to points and visuals on an overhead transparency or PowerPoint slide, and can be applied to a range of purposes, in a range of settings by designers, managers, trainers, content writers and learners. With this breadth of diversity, it is easy to see the difficulty in providing an exact definition that encompasses the full range of educational resources. Likewise, learning objects have a similar range of diversity.

As Higgs et al note it may be more productive then if we simply consider what are commonly considered to be essential characteristics of a learning object. In consultation with a range of VET practitioners, managers and content developers, the VET Learning Objects Repository Project has identified the following five characteristics as being essential to learning objects within the VET sector.

### **Discoverable**

In order for a learning object to be usable it needs to be discoverable. For this reason, all resources contain (or are associated with) metadata. Metadata is information about information. Like index cards in a library, metadata records will help people find and maintain learning objects.

While metadata can provide a lot of information about a learning object, at a minimum it should provide a brief description of the object as well as providing other important information such as subject, resource type, publisher and date created.

### **Interoperable**

Interoperability is about being able to share objects across repositories, organisations and learning and content management systems. To enable this interoperability objects should conform to standards in two main areas:

1. *Metadata* - using common standards to describe objects allows computer systems to take a standard approach to searching and displaying the metadata descriptions.
2. *Packaging* - selecting a range of objects from a repository and combining them into a learning sequence requires them to be packaged in a standard way that allows them to be used in a range of learning management systems. The Sharable Content Object Reference Model (SCORM) is an evolving standard that supports this concept.

To enhance interoperability in the VET sector, all objects should have a minimum set of metadata based on international standards. Compliance with

the SCORM standard is not necessary for all objects. Whether it is required or not will depend on the intended end use of the object.

**Context-able**

Context is very important in terms of providing authentic learning within the VET sector. Learning resources should therefore either have an existing level of context (i.e. contextualised) or should be adaptable to a variety of contexts (i.e. context neutral).

There is much debate about the ideal level of context for learning resources, and it is generally accepted that the less context a resource has the more re-usable and adaptable that resource is. It is important to remember therefore that when designing or using learning resources that the appropriate level of context is applied.

**Editable**

An important feature of all learning resources within the VET sector is that they can be retrieved, saved, edited and used. Once edited, a learning resource may take on a considerably different appearance or function. In this case, it may actually be considered a new resource that can then be reused by others.

**Re-usable**

The ability to be able to re-use existing objects is also important for the VET sector as it means greater access to a wide range of resources and less overhead in developing resources from scratch.

***Benefits and risks of learning objects***

There are benefits and risks in almost everything we do. Adapting a learning object approach to content development and management is no exception. Also, while there has been much research conducted into the potential of learning objects, much of this research, at least within the Australian VET sector, remains untested. It is still not known to what extent learning objects will be adopted by the sector and what affect they will have. However, as the MASIE Center notes (MASIE 2003), experts in the field do expect the following benefits and risks as a minimum.

<b>Benefits of Learning Objects</b>		
<b>For Learners</b>	<b>For Administrators</b>	<b>For Developers</b>
Personalised courses can be constructed to meet individual requirements.  Learning comes in digestible chunks.  Learning is available on a just-in-time basis.	Courses can be customised to suit the needs of different audiences.  Courses can be constructed using components from a wide range of sources.  Components can be re-used to meet a range of learning needs.	Objects can be built or modified using many different authoring tools.  The same objects can be employed across a variety of hardware and software platforms.  Learning objects and assets can be stored in a Content Management System so that the developer can search for

		them and repurpose them.
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<b>Risks of Learning Objects</b>		
<b>For Learners</b>	<b>For Administrators</b>	<b>For Developers</b>
Learners will require self-motivation to select learning objects.	Administrators will see this as more work to organise learning objects into courses and training programs.	Developers will need to build many small objects as opposed to a few larger courses. This will be perceived as counterproductive because of the additional work in development as well as design.
The implementation of learning objects will require a paradigm shift in the way learners view education. Education and training are traditionally viewed as events which we refer to as training courses.	When administrators try to link several learning objects together to make a training course or program, they may find that the navigation of each learning object is unique.	A manager or content owner requesting a course on a program or process may not want to break the materials into small learning objects that stand alone and are labelled with "assembly required."
		If developers wanted to repurpose existing learning objects from other developers, they would need to have access to the original development tool.

## Content Packaging

Content packaging refers to the packaging of learning objects such as an individual course or a collection of courses into interoperable, distributable packages. Content packaging provides a standardised way to exchange learning objects between different systems or tools. Learning objects described and packaged using a content packaging specification should be interoperable LMSs that support the same specification.

In response to the need for content packaging specifications, several organisations have developed specifications. The AICC Course Structure File (CSF) file format provides advanced capabilities for representing lesson prerequisites; however, the implementation requires a group of files organised as both Windows' INI files (or similar) and comma-separated value (CSV) data files.

The IMS Content Packaging provides a common framework for the packaging and description of learning material. The specification is aimed at both content developers and learning management system vendors. Content packaged in XML format in accordance with the specification could be distributed on a range of compliant learning management systems.

Overall, the IMS Content Packaging Specification has received wide acceptance and has become something of the defacto standard for most LMSs. It is also an important part of SCORM.

For more detailed information on IMS content packaging visit <http://www.imsglobal.org/content/packaging/index.cfm>

## Metadata

No discussion on learning objects would be complete without at least an introduction to the role of metadata. As Higgs et al (2003) note, "Metadata tagging has come to be one of the central aspects of any learning object based approach."

Metadata is structured data which describes the characteristics of a resource - essentially it is information about information. It helps us to locate the specific information we are looking for. Cataloguing systems that we use in libraries, museums and archives are classic examples of how we use metadata for non-digital information.

In the digital world if you need to find something you can use a search engine such as Yahoo. However, you might get some surprising items in response to your search. This is because, in the digital world, metadata systems are still developing and most searches are based on key words only. The search engine will return you all instances of the word you searched for no matter what the context.

The real measure of good metadata is the level of discovery; that is the ability to deliver a contained set of results with a high proportion of relevance to the subject matter.

There are several metadata standards currently in existence. These standards have been developed by national or international organisations in consultation with users and industry groups. The standards are important because they create consistency and enhance interoperability. The main standards relevant to learning objects in the VET sector are:

1. Dublin Core (DC)
2. EdNA Metadata Standard
3. IEEE Learning Object Metadata (LOM) Standard.

The EdNA standard is currently in wide use in Australian education and is quite adequate for most VET applications; Dublin Core is excellent for administrative metadata; while the LOM standard is useful for describing educational attributes and is the standard required for SCORM compliance.

While it is clearly desirable for all organisations within the VET sector to adopt and use one of the existing metadata standards for resource discovery and management, many organisations may find that the existing standards do not meet their needs in terms of resource management. For example, the IEEE LOM Standard provides roughly 64 metadata elements – more than would be practical for everyday use (Fisher S., Tozer, L., Friesen, N. & Roberts, A. 2002).

Fortunately, it is not necessary for an organisation to choose and adhere to one and only one metadata standard. In many cases, it is more appropriate for an organisation to develop its own Metadata Application Profile.

A metadata application profile is a template outlining the metadata elements that are to be used to describe an organisation's resources. It can consist of elements from one or more standards and custom elements for local and unique organisational requirements<sup>1</sup>.

In developing a metadata application profile the organisation should consider the following:

1. Decide whether or not you require metadata. For small internal repositories a "Google" type search may be all that is required for search and retrieval. However, with non-text objects such as graphics, Flash interactions and movie clips you will require at least a description to enable search and retrieval.
2. What are the search and retrieval requirements of your target audience? By carrying out a needs analysis of user preferences you can determine if a simple keyword search is all that is required or whether users want to browse by industry qualification or type of learning material. This information will inform the amount and type of metadata required.
3. At what level does metadata need to be applied? You may want to apply metadata to every web page in a resource or you may want to only create it for objects that have been selected for re-use.
4. Metadata is not just for search and retrieval. It is used to store digital rights management information and can assist with the maintenance of resources.
5. Do you want your metadata to be interoperable? If you want your learning objects to be discoverable across a range of repositories then it is important to base the metadata application profile on existing metadata standards.
6. Who will apply the metadata? A single person such as a repository manager could fulfil this role, or several people could be involved. For instance, content creators could provide a description while development programmers could be responsible for adding technical metadata.

For a more detailed discussion on metadata see the VET Learning Object Repository Project's "Using metadata for online learning resources".

## Repositories

It is generally accepted in the literature that to make the best use of learning objects they need to be stored in some sort of database or repository. The essential functionality of the repository therefore is to store, retrieve and maintain learning objects.

From their recent research, Higgs et al (2003) suggest that in order to provide access to learning objects, a repository must have the following functionality:

- **search/find** – the ability to locate an appropriate learning object. This can include the ability to browse
- **quality control** – a system that ensures learning objects meet technical, educational and metadata requirements

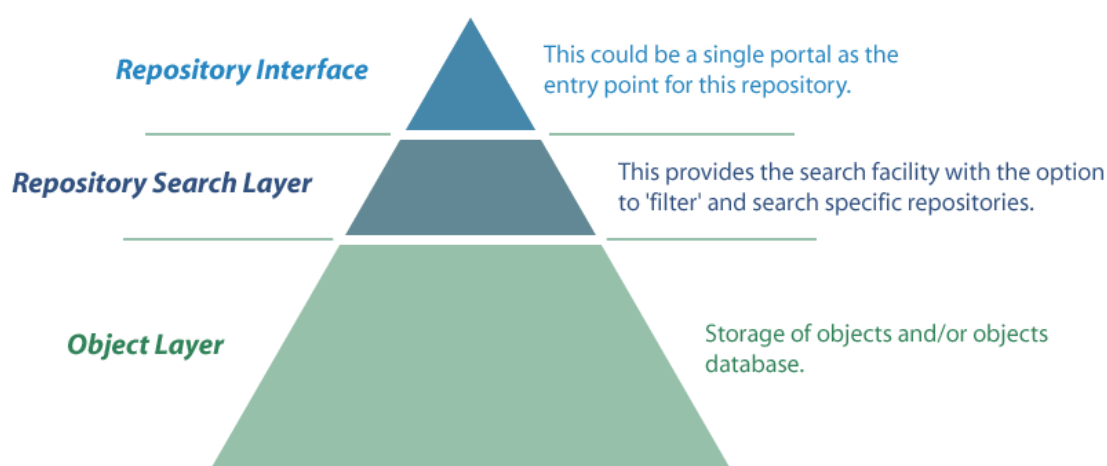
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<sup>1</sup> See the VET Learning Object Repository Project's "Using metadata for online learning resources" for an example of organisational specific metadata application profile.

- **request** – a learning object that has been located
- **maintain** – implement appropriate version control
- **retrieve** – receive an object that has been requested
- **submit** – provide an object to a repository for storage
- **store** – place a submitted object into a data store with unique, registered identifiers that allow it to be located
- **gather (push/pull)** – obtain metadata about objects in other repositories for wider searches and information via a clearing house function
- **publish** – provide metadata to other repositories.

Some VET sector organisations are currently developing and using learning object repositories. Typically these repositories are stand alone, and are often restricted for use within the organisation.

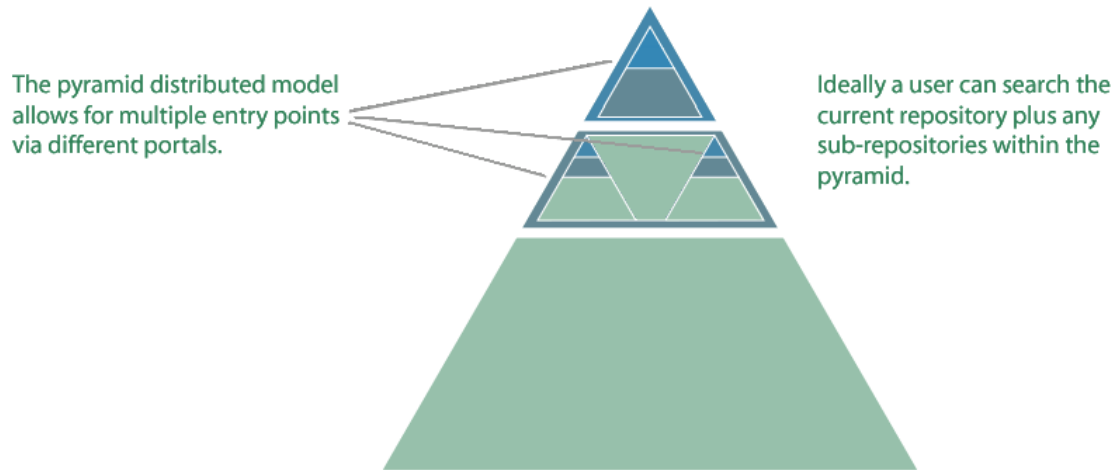
One proposal for intra-organisational repositories follows the pyramid model. That is a three-tiered approach in which the top layer of the model provides the search interface for the repository. The middle layer provides the searching facility with the ability to only search selected objects within the repository based on which filters the user selected at the top layer. The third and final tier represents the repository itself, a storage area for learning resources. Diagrammatically the pyramid model can be represented as follows:



While these intra-organisational repositories are useful to promote sharing and re-use within the organisation they are limited and run the risk of becoming closed systems (Downes 2002). Furthermore, there is a recognised need within the Australian VET sector to develop a network of interoperable repositories, with a view to facilitating access, sharing and transfer of learning objects based on compatible standards.

Using a distributed system, it would be possible to connect a number of these individual repositories in such a way that the learning object metadata is contained in a number of connected servers or websites. Distributed learning object repositories typically employ a peer-to-peer architecture in which a variety of repositories may be searched from a single portal.

Ideally future users should be able to conduct distributed searches across a number of repositories rather than having to access and search each directly. This can be represented using the Pyramid model as shown below:



The benefits of the distributed model over a central repository include:

- Quality assurance and maintenance procedures are easier to manage and more cost effective at an organisational level. It is unclear who would be responsible for funding and managing a central repository.
- A large central repository could quickly become unmanageable.
- Organic growth is more feasible - small-scale implementations, directed by practitioners can inform future initiatives.
- The ability to meet the needs of different organisations. Organisations, industry and business models differ considerably both intrastate and interstate. A central repository may fail to meet all the needs of the various organisations.

While the distributed approach seems to have a number of advantages, one of the major obstacles is interoperability, i.e. the ability for different repositories within the system to interact and share learning objects with others. For organisations thinking of developing repositories with the view to the repository being included as part of a larger distributed model this is of significant concern.

In recent years, the IMS Global Consortium has put a lot of time and effort into addressing this issue, and in January 2003 released the IMS Digital Repository Interoperability Specification (DRIS).

The DRIS is intended to be an international specification for the development and implementation of interoperable repositories. It defines a repository as a collection of assets or metadata that describes assets that are accessible via a network. The specification builds on other relevant specifications such as IMS content packaging and the IMS metadata specification.

The specification addresses how users and tools interact with repositories to input, discover, locate, and deliver learning object metadata and the associated content. It does this by defining a specific set of functions and protocols that enable a diverse range of e-Learning systems to communicate with each other. The specification allows for a wide range of content formats such as may be found in a learning object repository.

The following table summarises some of the major recommendations of the specification:

<b>Summary of recommendations contained within the IMS DRI specification</b>	
Searching	Use Xquery for XML metadata Use Z39.50 for SQL databases
Web Services Messaging	Use SOAP with attachments over HTTP
Metadata	Use IMS Metadata Specifications
Content Packaging	Use IMS content packaging specifications
Learning Object Specification	DRI does not prescribe a specification for learning objects
Identification of Learning Objects	Use the DOI – Digital Object Identifier

The current DRIS does not address areas such as digital rights management, verification, e-commerce payment and processing, which are seen as important areas for future development.

For a more detailed discussion on the DRIS see the VET Learning Objects Repository's Project Guidelines for Standards. A full version of the documentation is available at <http://www.imsproject.org/digitalrepositories/index.cfm>.

## Learning Management Systems

A learning management system (LMS) essentially is a tool capable of managing a range of organisational learning activities. These activities could vary from instructor-led classroom-based training to educational seminars or web-based online training. From an end-user point of view, an LMS provides a learning environment supporting a range of learning content with integrated access to various self-assessment and communication tools. Administratively, an LMS makes it easy to enter, track, manage, and report on learning activities and competencies within the organisation.

Commercial LMSs such as WebCT and Blackboard are already in common use in the VET sector. The types of courseware supported by these LMSs is wide and varied, but typically includes a number of web pages and supporting media that are linked together in such a way as to meet a particular learning outcome. Many LMSs claim to be IMS content packaging compliant. In essence, an IMS compliant LMS is able to read the instructions contained in the xml manifest and structure the content package accordingly.

IMS compliance has significant benefits for both content developers and content delivery organisations as it means that content can be taken from one LMS and used in another, opening the doors to truly re-usable content. However, as Newman notes, not “every piece of courseware works with every LMS” (Newman 2002). Nevertheless, an LMS claiming to be IMS compliant is going to achieve much greater levels of interoperability than one that isn't.

## Intellectual property and copyright

Organisations within the VET sector have been in the business of developing resources mainly for internal consumption. Higgs et al (2003) report that, “education and training is becoming big business, albeit that government financial policy has driven this, that is education and training is now undertaking far more ‘fee-for-service’ activities than it did in the past to help support its own existence.” The commercial exchange of resources at a national or global level requires new development

processes that include pricing models, marketing avenues, quality assurance, publishing and copyright procedures.

The Copyright Amendment (Digital Agenda) Act 2000, came into operation across Australia in 2001. The introduction of the Digital Agenda also raised the issue of Digital Rights Management or DRM. The DRM process involves the recording, transmitting, interpreting and the enforcing of digital rights. Essentially, the management of digital rights aims to:

- protect the legal rights of copyright
- ensure moral rights are protected
- allow reasonable access to copyright materials
- track and record usage of materials.

Most organisations currently share information in some way, mostly informally and between practitioners. However, in terms of learning objects, this is only the tip of the iceberg. One of the key characteristics of learning objects is their re-usability. Through the use of repositories, a well designed learning object may attract the attention of a number of other training organisations wanting to access the object.

AEShareNet is an initiative established to streamline the licensing of intellectual property to enable Australian training materials to be shared efficiently and to assist practitioners in discovering and using online resources. It is not a true repository but is a legal framework that this is the embodiment and formalisation of several years of collaborative agreement building (sometimes called “the AEShareNet model”)<sup>1</sup> Gilding and Fripp (2003).

In reviewing the AESharenet model it was noted that many organisations were “woefully ignorant” and followed practices that exposed them to litigation risk. Fripp & Macnamara (undated) report that, “Large numbers of educational resources could not be ‘copyright cleared’ because of third party owned ‘objects’ inside the resources which were not able to be disseminated/traded into the wider community.”

Considerable investment is already being made by many VET sector organisations to develop learning objects. However, as Hand, Higgs P. E., Higgs P. L., Ianella, Macnamara, Mason and Meredith (2003) note, “many of these producers have not considered how these learning objects might be used outside their own organisations or at best, within State systems. Subsequently, they receive very little recognition or benefit from them.”

To facilitate this Hand et al (2003) suggest a Learning Object Exchange (LOX) model. Generally a LOX provides a mechanism to make the discovery, use and trade of learning objects more efficient.

Several metadata schemas have been developed specifically for describing digital rights information. The Rights section of the IEEE LOM provides the following basic elements:

```
<rights>
  <cost>
  <copyrightandotherrestrictions>
  <description>
</rights>
```

Such metadata, however, cannot deal with the more complex rights such as the acquisition, creation, distribution, transfer and constraints associated with the active

sharing and re-use of learning objects. This has resulted in the emergence and use of Rights Expression Languages (RELs).

RELs are capable of setting the permissions associated with a learning object and the conditions and obligations that need to be followed in order for these permissions to be exercised. However, it needs to be stressed that “a rights expression language can neither resolve legal questions nor create a policy for collecting fees” (IEEE 2003).

For organisations accessing and using learning objects via a repository, then you are obliged to ensure that the object is used appropriately, i.e. in conformance with its assigned digital rights.

Higgs et al (2003) recommend that training organisations planning to deliver “fee-for-service” type activities should seek legal advice about those activities in relation to their legal obligations under the law. They will also need to keep practitioners informed of their responsibilities and provide procedures to ensure compliance with laws and regulations.

As can be seen, the issue of digital rights management is significant in regards to learning objects and learning object repositories. For a more in depth discussion of digital rights management see the Framework for rights enabled learning object exchange trial, a project initiative within The Australian Flexible Learning Framework as part of New Practices in Flexible Learning Project available from <http://flexiblelearning.net.au/projects/rightsenabled.htm>.

## **What about standards**

One of the most crucial issues for an organisation wanting to adopt learning objects is interoperability; the ability for a learning object to be used and re-used across a variety of platforms and systems. To do this, it is important to consider the role of standards and what they mean for the organisation.

Think about whether standards need to be adhered to across the organisation from the outset or whether areas within an organisation should be phased into conformance as the need for interoperability increases.

## ***Understanding conformance and compliance***

As noted by the MASIE Center (MASIE 2003) the term compliant (an adjective) means “conforming to requirements” but the real issue is “to follow a standard” as represented by the action verb “conform”.

Conformance is usually defined as testing to see if an implementation (i.e. product or application) meets the requirements of a standard or specification (Gray, Goldfine, Rosenthal & Carnahan 2000).

As already mentioned in this paper, standards and specifications currently exist for content metadata and content packaging. There are also a range of other e-Learning

standards for content sequencing, question and test interoperability etc<sup>2</sup>, as an organisation developing learning objects it is important to ensure that these learning objects being developed conform to the appropriate standard.

The most common way to test for conformance is via a test suite. A test suite is a combination of test software, test procedures, and test documentation that can be used to test a product for conformance. The test software works by running a series of checks against a number of requirements comparing the actual output against a series of expected and predetermined results. The test procedures define the administrative and technical processes for testing a product. The test documentation describes how the testing is to be done.

If a product successfully meets all the requirements for conformance, then you may want to seek certification. Certification validates a product's conformance for interoperability against the standard. Certificates can only be issued by a certifying body such as the IEEE.

As an alternative to seeking conformance, many organisations may choose to conduct a product self-test. This is a less formal means for developers to assess for themselves the ability of their product to conform to the relevant standard. It allows them to identify and correct problems that may prevent the product from passing formal conformance testing as described above.

See the VET Learning Objects Repository's Project Introduction to Standards and Specifications for Learning Objects and Repositories for a more detailed list standards supporting online learning relevant to the VET sector.

## Implications for VET sector organisations

Some VET sector organisations will implement specific methods to progress the concept of re-usability through learning objects; however, for the majority of training providers there will be logistic, economic and political constraints to any major undertakings.

Individual organisations should therefore conduct a full and complete analysis of business needs of the organisation to see if adopting a learning objects approach can meet these needs. The following table provides some simple guidelines that may assist in this area.

### **Guidelines for implementing a learning objects approach to content development**

Decide why you are moving to a learning objects based approach.

- Interoperability with a Learning Management System
- Improved re-use of content
- Improved consistency of content
- Access to a wider range of content
- Improved search and location of specific content
- Integration with content management and repositories

Determine whether the key business drivers are "cost" or "performance" based.

<sup>2</sup> See the VET Learning Objects Repository's Project "Introduction to Standards and Specifications for Learning Objects and Repositories" for a more detailed list of e-Learning standards relevant to the VET sector.

- Carry out a standards-compliance inventory of your current systems and content including:
  - Learning Management Systems
  - Internal Content
  - Third-Party Content

Determine which standards need to be supported for which systems.

- Develop a plan for each of the key components
  - Content deployment: learning management system and other delivery systems
  - Content management: content management systems and repositories
  - Content creation: authoring tools
  - Migrating internal content
  - Third-Party Content

Implement a pilot project that addresses the following key factors:

- Content deployment
- Content management
- Content creation
- Content acquisition
- Content migration

Learn from the pilot project by:

- Measuring the results
- Developing an appropriate business model
- Creating specific achievable and measurable goals for the organisation.

*(Adapted from Forth & Childs)*

While the large-scale use of learning objects is not yet commonplace in the Australian VET sector, there are a number of international success stories (Khirallah & Swanson 2002). Most notable is the often quoted example of CISCO and the CISCO Learning Institute; a brief case study which is presented in Appendix A.

It should be noted, that the CISCO model was developed to meet the CISCO organisational environment and its needs, and may not necessarily be suitable for application in the Australian VET sector. However, there is no doubt that the use of learning objects as outlined above has the potential to provide significant benefits for VET sector organisations in the sharing and re-use of learning material.

## Summary

This paper has presented an overview of learning objects and has discussed a range of issues regarding their implementation and use within Australian VET Sector organisations.

In their Flexible Learning Leader 2002 Report, Higgs, Meredith and Hand state that there is anxiety amongst people in the VET sector over the lack of a clear definition of the term “learning object”. The reality is there are many different types of learning objects, and that rather than pursuing a single definition, it would be more useful for the VET sector to establish a set of common characteristics to enable the exchange of these learning objects through repositories effectively.

Metadata is an integral component of learning objects and is the key to not only discoverability but also interoperability. There are currently two main metadata

standards relevant to learning objects in the VET sector; EdNA Metadata Standard; Dublin Core (DC) and the IEEE's Learning Object Metadata (LOM) Standard. The LOM provides more elements for describing educational attributes while the EdNA and DC are excellent for administrative metadata. LOM also forms the basis for IMS metadata as implemented by SCORM. It is important that all potential repositories within the VET sector adhere to appropriate standards and abide by a suitable minimum metadata requirement.

Content packaging refers to the packaging of learning objects as individual courses or a collection of courses into interoperable, distributable packages. The IMS content packaging specification has become the defacto standard for many organisations, is widely supported by a number of LMSs and is also an important part of SCORM.

To make the best use of learning objects, they need to be stored in a repository as this facilitates the sharing and repurposing of learning material. Some VET Sector organisations are currently developing and using learning object repositories. Typically, these repositories are stand alone: however, it is possible for these individual repositories to be interconnected as a distributed system, allowing users to search and retrieve learning objects across a number of connected repositories. Distributed systems offer advantages over a central repository system.

Intellectual property and digital rights management are two of the biggest issues for organisations considering adopting and using learning objects. Developers of learning objects need to consider how these objects will be used; will they be used freely or through a licensing agreement; will re-use and customisation be allowed? There are no easy answers to these questions, and ultimately it will be up to individual organisations to assign the necessary usage rights to the resources they develop.

## ***Implications for the VET Sector***

Australian Flexible Learning Framework plans for 2004 have identified the need to establish a range of interoperable resource repositories with a view to facilitating access, sharing and transfer of learning resources in the VET sector based on compatible standards.

To achieve this, three specification areas have been identified as critical to improving interoperability in access and use of online resources: content packaging; metadata; digital repository specifications. The following implications for VET can be drawn from this review of the available standards.

### **Content packaging**

IMS content packaging is a well accepted specification world-wide and is likely to be the key reference in this area for Australian VET sector if consistency with international movements is to be sought. It also forms an important part of the SCORM reference model.

Extending on the use of IMS content packaging, SCORM itself holds many potential advantages for the sector. These include the ease of integration with an LMS, promoting the sharing and re-use of learning content, and the benefits of being interoperable across a range of platforms. SCORM is supported by a variety of Learning Management Systems such as WebCT and Blackboard. In recent times, the courseware development industry has also seen a number of development tools

such as Macromedia Flash and Dreamweaver release add-ins that facilitate the development of SCORM compliant content

It should be noted, however, that there is some debate about the suitability of SCORM for the Australian VET sector. In an article appearing on the CETIS website in late 2002, Dan Rehak<sup>3</sup> is quoted as saying that SCORM “has a limited pedagogical model unsuited for some environments”. (Kran, W. & Wilson, S. 2002.) It has also been characterised as “oriented to a single user, self-paced, instructionist content centric specification.” (Higgs, P., Meredith S., and Hand T., 2003) These potential educational limitations have been recognised as requiring further exploration before the adoption of the SCORM model in its entirety is recommended.

To inform the debate further, a discussion paper has been prepared as part of the VET Learning Objects Repository Project to be titled “Potential Benefits and Challenges in the use of SCORM in VET”. In addition a series of practical trials are being conducted using material from the Flexible Learning Toolboxes to examine the suitability of SCORM content packaging for the VET sector.

## **Metadata**

Metadata is an integral component to any repository and is the key to not only discoverability but also interoperability.

There are currently two main metadata standards relevant to learning objects in the VET sector: EdNA Metadata Standard and the IEEE’s Learning Object Metadata (LOM) Standard.

The EdNA metadata standard is currently being used quite widely across the VET sector for resource discovery and is the standard applied to the Flexible Learning Toolboxes (national online resources developed for the VET sector through the Australian Flexible Learning Framework).

Given its wide use, the EdNA standard could be expected to form the basis of a metadata application profile for the sector. The mapping of EdNA metadata to other metadata systems would be an essential part of the task.

The IMS LOM standard is useful for describing educational attributes and provides a rich structure for classification of learning resources. It has recently become the defacto standard for many international organisations. While the full metadata set may be too complex for many users, any metadata application profile developed for the VET sector would be well-advised to reference (or map to) the LOM to facilitate interoperability with other major systems including SCORM.

Currently, there is no agreement within the VET sector about minimum metadata requirements. This potentially poses problems for interoperability across different systems if used on a national resource sharing level between one or more sectors or organisation. A national system of resource repositories would benefit significantly from the development of a common metadata application profile for the sector.

## **Digital Repository Specifications**

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<sup>3</sup> Described as one of the “chief architects” of SCORM.

The IMS Digital Repositories Interoperability specification is the first international specification in this area and only recently released. This is largely a technical document that establishes a range of specifications for the search, retrieval and storage of learning resources within a digital repository.

The IMS DRIS is an obvious choice as the basis for trialling the development of interoperable learning object repositories within the VET sector. The process of trialling can be expected to highlight adaptations which may be necessary to meet the conditions required by the sector. However, the process of test and trial is essential if solutions to interoperability problems are to be found.

## Appendix A: Cisco Case study

In the late 1990s, Cisco recognised the benefits of creating database-driven training objects that could be searched, modified and re-used as opposed to large inflexible training courses. During their transition to an object approach they have overcome many challenges and learnt lessons that can inform similar initiatives.

On the topic of 'What is a Learning Object' Cisco has found that regardless of the terminology chosen by them or others "the labels are arbitrary" and "the concept of learning objects and the guidelines for creating such objects are what is important."

One of the main advantages espoused about an object approach is the ability to *re-use* content. The concept of re-use has been hotly debated since generic content is more apt for this purpose but also less likely to be instructionally sound or completely relevant to each specific implementation.

Over the last four years Cisco have acknowledged that their focus has changed from *re-use* to *repurposing*. They note that "many authors are more comfortable with the idea of "repurposing" content; in other words, they find learning objects a useful "base" for content that they can modify to fit their specific needs."

Accordingly, the idea of *re-use* as being the sole benefit and business driver for an object approach needs to be reconsidered. In their latest Reusable Learning Object Strategy (Version 4.5) white paper, Cisco advise that:

"each organization should look at the possible return on investment (ROI) of reuse versus repurposing, and the level of change allowed for any existing learning object. Based on the level of ROI required by the organization, authoring guidelines can be established."

Cisco defines the following as benefits of an object approach for organisations:

1. Reduces the costs, when the strategy is implemented correctly, in each phase of the development process by using a standardised structure and format.

This is particularly true where a template approach can be employed. In the VET sector a wide range of formats and styles are used to create rich and contextualised learning environments. This variety dilutes the benefits of a standardised approach but is more appropriate for the VET sector.

2. Scales the development model by allowing the use of many development partners through the publication of standard and related tools for learning object development.

The VET sector can employ evolving tools for the creation of metadata, objects and quiz questions.

3. Increases the speed to successful performance and competency by employees by using a database of existing learning objects to build new solutions quickly.

This benefit will only be realised if databases/repositories are adequately marketed, easy to use and contain quality objects. Staff will also need to be

trained in their use and have incentives to encourage them to adopt the object approach.

4. Decreases development and maintenance time to support both exams and courses by using a common database of learning objects.

In the VET sector resources that can assist with the development of assessment tools have the potential to decrease development time. ANTA's Assessment Generator<sup>4</sup> is an example of such a resource. Banks of questions and answers and software tools for generating quizzes can also reduce development time.

5. Personalises learning approaches and delivery types, resulting in improved learner satisfaction and enhanced transfer of knowledge and skills.

In the VET sector simulations and other media intensive objects can be repurposed and thus available at a lower cost than having to create them from scratch. This makes it more feasible to create various flavours of objects to accommodate different learning styles and learner requirements.

Generic interactive objects and quizzes can be developed in software such as Flash and stored in databases and repositories. The content displayed within these objects can be stored in XML files which are easy to adapt. By simply changing the information in the XML file the objects can be customised for specific learners and learning outcomes.

6. Aligns content found in learning content management systems with knowledge management systems across the enterprise.  
In VET, this could enable content found in one organisation's learning content management systems to be aligned with that of other VET organisations and others in the global learning community.

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<sup>4</sup> See <http://www.flexiblelearning.net.au/productsandservices/assessmentgenerator.htm>

## References

Advanced Distributed Learning 2002, *The SCORM Implementation Guide: A Step by Step Approach*, Advanced Distributed Learning available online at <http://www.adlnet.org>

Advanced Distributed Learning 2003, *Sharable Content Object Reference Model (SCORM) Version 1.2*, Advanced Distributed Learning Inc available online at [www.adlnet.org](http://www.adlnet.org)

Advanced Distributed Learning 2003, *Sharable Content Object Reference Model (SCORM™) Version 1.2 Conformance Requirements*, Advanced Distributed Learning Inc <http://adlnet.org/index.cfm?fuseaction=rcdetails&libid=285&bc=false>

Cisco Systems 2003 Reusable Learning Object Authoring Guidelines: How to Build Modules, Lessons, and Topics, Cisco. Available online at [http://business.cisco.com/servletwl3/FileDownloader/igprd/104119/104119\\_kbns.pdf](http://business.cisco.com/servletwl3/FileDownloader/igprd/104119/104119_kbns.pdf)

Cisco Systems 2001, Reusable Learning Object Strategy v4.0 Cisco. Available online at [http://business.cisco.com/servletwl3/FileDownloader/igprd/86575/86575\\_kbns.pdf](http://business.cisco.com/servletwl3/FileDownloader/igprd/86575/86575_kbns.pdf)

Cisco Systems 2003, *Reusable Learning Object Strategy: Designing and Developing Learning Objects for Multiple Learning Approaches*, Cisco. Available online at [http://business.cisco.com/servletwl3/FileDownloader/igprd/104108/104108\\_kbns.pdf](http://business.cisco.com/servletwl3/FileDownloader/igprd/104108/104108_kbns.pdf)

Downes, S. 2002 *Fast Buck Artistry*, Stephen's Web. Available at <http://www.downes.ca/cgi-bin/website/view.cgi?dbs=Article&key=1039643254>

EdNA, 2002, *EdNA Metadata Standard Version 1.1*, EdNA Available online at [http://www.edna.edu.au/metadata/documents/edna\\_metadata.pdf](http://www.edna.edu.au/metadata/documents/edna_metadata.pdf)

Fisher S., Tozer, L., Friesen, N. & Roberts, A. 2002, *CanCore Metadata Guidelines, Version 1.1*, CanCore, Athabasca University, Edmonton Learning Centre. Available online at [www.cancore.ca](http://www.cancore.ca)

Forth S. & Childs, E. 2003, *White Paper on E-Learning Specifications and Standards*, Recombo: Innovative Training Solutions available online at [http://www.innovativetraining.ca/Samples/Specifications and Standards White Paper.pdf](http://www.innovativetraining.ca/Samples/Specifications%20and%20Standards%20White%20Paper.pdf)

Fripp, C. & Macnamara, D. (undated) *Copyright Management in the World of Learning Objects*, Paper presented at the EDUCAUSE in Australasia conference, Adelaide Australia.

Gilding, J. & Fripp, C. (2003) *AEShareNet: Reflections on an Innovative Venture to Move Copyright Licensing into the Digital Age*, [Australian Library Journal](#).

Gray, M., Goldfine A., Rosenthal L., Carnahan L. 2000, *Conformance Testing*, National Institute of Standards and Technology. Available online at <http://www.oasis-open.org/cover/conform20000112.html>

Hand T., Higgs P. E., Higgs P. L., Ianella, R., Macnamara D., Mason J., & Meredith S. 2003; *Framework for rights enabled learning object exchange trial*, Australian Flexible Learning Framework; New Practices in Flexible Learning.

Higgs, P, Meredith, S & Hand, T. 2003 *Technology for Sharing - A research project to inform VET Australia about Learning Objects and Digital Rights Management including systems and metadata to support them*. Flexible Learning Leader 2002 Report, Australian National Training Authority (ANTA).

*IEEE Discussion Paper: A report of the IEEE Learning Technology Standards Committee Digital Rights Expression Language Study Group*, IEEE LTSC WG4 2001 IMS 2003, *IMS Content Packaging Version 1.1.3 Specification*, IMS Global Learning Consortium, Inc. Available online at <http://www.imsglobal.org/content/packaging/index.cfm>

IMS 2003, *IMS Digital Repositories Specification Version 1.0*, IMS Global Learning Consortium, Inc, Available online at <http://www.imsproject.org/digitalrepositories/index.cfm>

IMS 2003, *IMS Metadata v1.2.1 Specification*. IMS Global Learning Consortium, Inc. Available online at <http://www.imsproject.org/metadata/index.cfm>

Khirallah, D. R. & Swanson, S. November 2002, *New Schools Of Thought*, InformationWeek, InformationWeek.com. Available online at <http://informationweek.com/813/elearning.htm>

MASIE 2003, *Making Sense of Learning Specifications & Standards: A Decision Makers Guide to their Adoption*, The MASIE Center e-Learning CONSORTIUM available online at [http://www.masie.com/standards/s3\\_2nd\\_edition.pdf](http://www.masie.com/standards/s3_2nd_edition.pdf)

Newman T., November 2002; SCORM in a teacup? e-learning age,. Available on line at [http://www.informationtransfer.com/elearning/download/InformationTransfer\\_SCORM.pdf](http://www.informationtransfer.com/elearning/download/InformationTransfer_SCORM.pdf)

Wiley, D. A. 2000; *Connecting Learning Objects to Instructional Design Theory: A Definition, A Metaphor, and A Taxonomy*. reusability.org. Available from <http://www.reusability.org/read/>

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