Australian Flexible Learning Framework

Supporting Flexible Learning Opportunities

Using metadata for online learning resources

VET Learning Object Repository Project

flexiblelearning.net.au

An initiative within the Australian Flexible Learning Framework for the National Vocational Education and Training System 2000-2004

Managed by the Flexible Learning Advisory Group on behalf of the Commonwealth, all States and Territories in Conjunction with ANTA

AUSTRALIAN NATIONAL TRAINING AUTHORITY

Contents

Introduction

Through technologies such as the Internet, teachers and trainers can potentially access a vast array of learning resources in a matter of minutes. These resources can take on a variety of forms such as video and audio clips, HTML pages on the web, downloadable e-books, word processed assessment templates and the list continues.

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 given birth to a growing trend towards a “learning object” approach to developing learning materials. By creating content in small chunks (learning objects) it is easier to share, re-use, recontextualise, and repurpose than content that is tightly coupled in larger courses.

Central to the learning object approach is the role of metadata (Higgs et al 2003). Simply defined, metadata is the data that describes things. It is “meta” because it applies to anything we want to reference, point to, locate, or re-use. In the learning objects world, metadata is not only essential to aiding the discovery and use of resources it also has the potential to facilitate resource maintenance and management.

This paper provides an overview of the main issues and some of the things to consider when creating metadata and metadata systems in relation to the Australian VET sector.

What is Metadata?

The field of e-Learning is constantly growing, as are the vast sources of information available and appropriate for learning. Content is increasingly being broken down into smaller pieces so that it can be mixed, matched, and assembled into highly relevant and mass customised learning objects tailored to match specific needs of specific individuals. Because of this, it is getting more and more difficult to find and assemble “just right” and relevant information. Without metadata, we would drown in the chaos and inefficiency resulting from an overflowing sea of unidentified learning objects, content, code, and most other “things”.

Metadata can, and ideally needs to be, applied to all sizes and types of content and resources used for learning, from the smallest piece of raw data, or asset, all the way up to a complete course or curriculum. Using metadata this way allows each level of content to be easily searchable and re-usable. For example, it is just as easy to find and re-use one piece of text or illustration, one page in a chapter, one chapter of a course, or an entire course.

Metadata has three main uses within an educational context: Categorisation, Taxonomies and Re-Use (MASIE Center 2003). Each one enables reduced cost and significant timesaving as well as human performance improvement.

Categorisation

One of the first and most common uses of metadata comes when it is used to add value by organising information into categories. Good examples are the Yahoo!

search categories which make looking for information on the Web (i.e. cars, entertainment, health, etc.) much easier and faster. Finding information faster obviously saves time, money, and frustration. It also significantly improves productivity and job performance. However, doing this across different systems, organisations, countries, and disciplines can only be achieved when a common metadata standard is adopted and implemented.

Taxonomies

While it is useful to organise content into categories, it is even more powerful to structure and organise metadata categories into ordered groups of relationships known as taxonomies. As in biology, there are enormous benefits from having such a structure or taxonomy for metadata. It can organise the content and also capture the relationships between categories. In this way, metadata taxonomies allow different systems and structures to be recognised, translated, and understood.

Re-Use

As content and metadata become more structured and their granular size decreases, the re-usability of the content and the metadata begins to increase exponentially. It is not hard to see how this ability to create once and re-use multiple times can provide some of the highest multipliers and return on investment (ROI) imaginable. Once again, metadata plays a pivotal role.

Metadata Standards

There has been a lot of work done by standards organisations to define metadata elements sets, known as *schemas,* to describe learning content/objects. Metadata standards create consistency and enhance interoperability. Some of the more important 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
4. IMS Metadata Specification
5. SCORM (Sharable Content Object Reference Model)

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.

Dublin Core

The Dublin Core Metadata Element Set (DCMES) was one of the first metadata standards for digital information to be widely adopted. The Dublin Core Metadata Initiative is an open forum that develops standards for online metadata to describe any type of web resource. The standard has a core set of 15 elements that cover a broad range of domains.

Many domain specific standards organisations adopted the Dublin Core set and then added elements to cater for their particular industry information. One example is the Australian Government Locator Service (AGLS). AGLS was developed in late 1997 as the resource discovery metadata standard for Australian governments and was endorsed for use by all levels of government in Australia in November 1998.

EdNA

The EdNA metadata standard is based on the Dublin Core Metadata Element Set (DCMES) and is consistent with Australian Government Locator Service (AGLS). This standard also includes a few EdNA specific categories such as:

- EDNA.Audience
- EDNA.Approver
- EDNA.CategoryCode
- EDNA.Entered
- EDNA.Indexing
- EDNA.Review
- EDNA.Reviewer
- EDNA.Version

These additional categories are primarily for the purposes of administration and maintenance.

Whilst the EdNA metadata standard is being used quite broadly, currently there is no agreement in the sector about minimum requirements for metadata for a specific resource. This means that the metadata applied to a resource may differ from organisation to organisation. This potentially poses problems for interoperability across different systems if used on a national resource sharing level between one or more sectors or organisation. An agreed minimum set would prevent this problem easily.

IEEE LOM

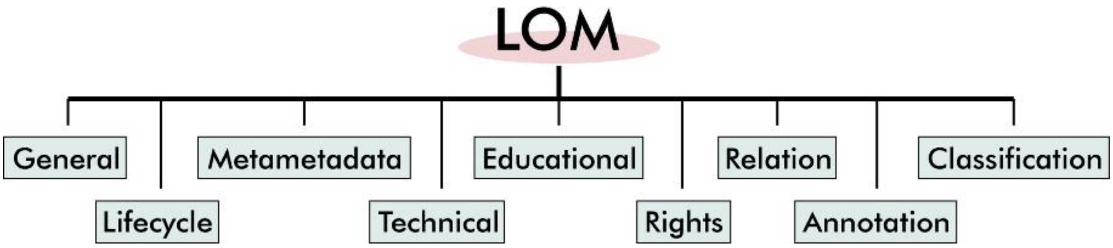
The IEEE (Institute of Electrical and Electronics Engineers) is one of the world's accredited standards bodies. They worked collaboratively with other standards bodies in the education domain to create the Learning Object Metadata (LOM) standard.

The LOM standard is broken up into nine categories. These categories are based on the definitions found in the LOM Information Model. The nine categories of metadata elements are:

1. The General category is used to describe general information about the learning object as a whole.
2. The Lifecycle category is used to describe features related to the history and current state of the object and those which have affected it during its evolution.
3. The Meta-metadata category is used to describe information about the metadata record itself.
4. The Technical category is used to describe technical requirements and characteristics of the learning object.
5. The Educational category is used to describe the educational and pedagogic characteristics of the learning object.

6. The Rights category is used to describe the intellectual property rights and conditions of use for the object.
7. The Relation category is used to describe features that define the relationship between the object and other targeted components.
8. The Annotation category is used to provide comments on the educational use of the object and information on when and by whom the comments were created.
9. The Classification category is used to describe where the learning object falls within a particular classification system.

The IEEE LOM definition is best represented as a simple hierarchy. The IEEE conceptual model for metadata definitions is a hierarchy. At the top of the hierarchy is the "root" element. The root element contains many sub-elements. If a sub-element itself contains additional sub-elements, it is called a "branch". Sub-elements that do not contain any sub-elements are called "leaves". This entire hierarchical model is called the "tree structure" of a document as depicted below.



Adapted from IMS Learning Resources Metadata Best Practice and Implementation Guide, Version 1.2.1 Final Specification 2001

The LOM standard has been adopted by many organisations world-wide. It has also been adopted as a component of other standards necessary for sharing and re-use, most notably SCORM and IMS.

IMS Metadata specification

The specifications describe metadata elements based upon the Learning Object Metadata (LOM) work done within the IEEE Learning Technology Standards Committee – LTSC (known as IEEE LOM). This specification provides a way to format the IEEE LOM in XML. This is sometimes called the XML binding.

According to the IMS Global Learning Consortium (2001) the IMS metadata is broken up into nine categories. These categories are based on the definitions found in the LOM Information Model.

SCORM

The SCORM Metadata Application Profile directly references the IEEE Learning Object Metadata (LOM) standard and the IEEE Draft Standard for Extensible Markup Language (XML) Binding for Learning Object Metadata Data Model. The metadata specification defines a very rich data model of approximately 64 metadata elements; however, only a small subset of the data elements is required to achieve SCORM compliance.

In the SCORM environment content is stored in content packages (in accordance with the IMS Content Packaging Specification). A package is just like a directory file and it can be compressed (zip file or jar file). It contains learning resources and some instructions in a special XML file called a manifest file.

Metadata describing a package and the resources it contains is stored in the manifest file. This metadata is optional but highly recommended, as it will facilitate search and retrieval. The metadata must be in the LOM standard and there are a number of mandatory fields in order to achieve SCORM compliance.

Understanding the role of metadata standards

It is fair to say that there is a lot of confusion about the role of metadata standards, and how it can be used and applied. A lot of this confusion has come about as individuals try to interpret different metadata standards, and in doing so have read into these standards a number of "rules" that need to be obeyed. The following section should help clarify some of these concerns.

It is not necessary to use all elements within a standard: The task of entering metadata can be quite daunting, especially when you consider that standards like the IEEE LOM have almost 80 elements. This has caused more than one group to either give up or never even begin the process.

As there are no mandatory elements as prescribed by the different standards, different implementations can have anything from just two or three elements up to well over a 100. Each community of practice will want to make its own decisions as to which elements to use and which ones to make mandatory or optional. Examples of this setting of mandatory metadata elements can be seen in SCORM as well as further decisions from groups such as CanCore and IMS.

Rather than focus on the number of elements that are used, MASIE suggests that it is more important to note that both the number of elements used and which elements are used is critically dependent upon what the metadata is describing. SCORM, for example, differentiates between the metadata for courses, distinct from the metadata for content and metadata for raw assets.

It is not necessary to choose and implement only the one metadata standard: The benefit of standards is that even when there are multiple standards for similar purposes, it is possible to "map" or convert from one to another. 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.

Standards are meant to provide guidance: Specifications for groups such as tool developers are intended to be replaced by words meaningful to those using them. The element names used for each metadata element are only "tokens".

> It is unlikely that LOM element names such as “semantic density,” “interactivity level,” or “intended end user role” are appropriate labels for most communities creating or using metadata contained within these elements. It is therefore up to each individual community of practice to determine the tokens that make sense to them and use these. Interoperability is maintained because the meaning or semantics of the element are maintained; just the term used to reference this element is changed, the term or token used makes no difference to the system which manages the metadata, but matters a great deal to the users interacting with the system or the metadata and content.

Standards and Namespaces

Namespace declarations are the XML infrastructure that allows the construction of mixed metadata sets within an application profile. A designer can invoke several such declarations to include elements from existing schemas that can be combined in a modular way to form a compound schema that meets the functional requirements of a community of practice without destroying the possibility of interoperability with existing schemas that also use these elements in other combinations.

The declaration of various namespaces within a block of metadata allows the elements within that metadata to be identified as belonging to one or another element set.

In the example of a metadata application profile given on page 11, the profile uses a number of elements from different schemas. However, within the profile itself each element can be identified by its prefix as follows:

- All Dublin Core elements are prefixed with DC:
- All EdNA elements are prefixed with EDNA:
- All IEEE LOM elements are prefixed with LOM:[1]

Using this infrastructure, metadata system designers can select elements from suitable existing metadata element sets, taking advantage of the investment of existing communities of expertise, and thereby avoiding reinventing well-established metadata sets for each new deployment domain.

Mapping between standards

The EdNA standard is currently in wide use in Australian education. Metadata in this format can be harvested by EdNA Online and displayed on their website. The harvesting community currently includes:

- AEShareNet
- AMOL
- FLAG
- Western Australian Education Department
- Tasmanian Education Department
- Queensland Department of Education

[1] This particular example also includes two elements from the Department of Education and Training. These are prefixed with DET.

The EdNA standard is adequate for most VET applications. However the LOM standard is useful for describing educational attributes. It is also the standard required for the Sharable Content Object Reference Model (SCORM) compliance.

SCORM is a set of specifications that aim to enable the re-use of learning materials across a range of platforms and environments. Many Learning Management Systems (LMSs) such as WebCT are moving towards a SCORM compliant environment. There is an interest therefore in developing SCORM compliant objects that can then be shared amongst SCORM compliant content and learning management systems[2].,

SCORM uses a mandatory subset of LOM elements to describe resources[3]. Organisations intending to develop SCORM compliant objects should incorporate these mandatory LOM elements in their application profile. It is also feasible to use EdNA metadata elements and to later map them to LOM elements for use in SCORM compliance. Table 1.1 shows how this can be done.

SCORM IMS/LOM mandatory elements	**EdNA equivelant**
1.0 <general >	
1.2 <title>	DC.Title
1.3 <catalogentry>	
1.3.3 <catalog>	Could be automated to the name of a collection or repository
1.3.2 <entry>	DC.Identifier - possibly
1.5 <description>	DC.Description
1.6 <keywords>	DC.Subject
1.0 </general >	
2.0 <lifecycle>	
2.1 <version>	
2.2 <status>	
2.0 </lifecycle>	
3.0 <metametadata>	
3.4 <metadatascheme>	Could be automated to ‘LOMv1.0’
3.0 </metametadata>	
4.0 <technical >	
4.1 <format>	DC.Format
4.3 <location>	Nothing comparable
4.0 </technical >	
6.0 <rights>	
6.1 <cost>	
6.2 < copyrightandotherrestrictions>	DC.Rights
6.0 </rights>	
9.0 <classification >	
9.1 <purpose>	IMS suggest “End users can refer to their preferred classifications. If *Purpose* (9.1) equals Discipline, then this category corresponds with the Dublin Core element DC.Subject.”

[2] For a more complete discussion on SCORM, see the VET Learning Objects Repository Project’s “Potential Benefits and Challenges in the use of SCORM in VET”.
[3] It should be noted that these mandatory elements are not a requirement of the IEEE LOM standard; rather they are a conformance requirement of SCORM which uses LOM.

9.3	<description>	
9.4	<keyword>	
9.0	</classification >	

Table 1.1

Note that your EdNA metadata will not contain all the information required by the mandatory SCORM LOM elements. However, some of these such as 2.1 version and 2.2 status could have a consistent value automatically applied to all resources.

Metadata Application Profiles

No single metadata element set will accommodate the functional requirements of all organisations or communities of practice, metadata application profiles allow designers to “mix and match” schemas as appropriate.

A metadata application profile is an assemblage of metadata elements selected from one or more metadata schemas and combined in a compound schema. Application profiles provide the means to express principles of modularity and extensibility. The purpose of an application profile is to adapt or combine existing schemas into a package that is tailored to the functional requirements of a particular organisation or community, while retaining interoperability with the original base schemas. Part of such an adaptation may include the elaboration of local metadata elements that have importance in a given community or organisation, but which are not expected to be important in a wider context.

One of the benefits of this approach is that communities of practice are able to focus on standardising community-specific metadata in ways that can be preserved in larger metadata architectures. It will be possible to snap together such community-specific modules to form more complex metadata structures that will conform to the standards of the community while preserving cross-community interoperability.

As Duval, Hodgins, Sutton and Weibel (2002) note, metadata application profiles are able to achieve this via the following mechanisms:

- **Cardinality enforcement:** The status of some data elements can be made more stringent within an application profile. For instance, an optional data element can be made mandatory. This allows for the creation of minimal metadata standards within the profile allowing for greater interoperability.

- **Value Space Restriction:** For some data elements, the value space can be made more restrictive than in the standard. This mechanism can apply when the standard is very loose about the values for a data element. Within the VET sector this could be implemented through the restriction of values for resource type to a predefined vocabulary.

- **Relationship and dependency specification:** An application profile can define interrelationships between data elements and their value spaces. For instance, the presence of one data element may impose the requirement that another element be present. Similarly, an application profile can restrict the value set of a data element, based on the value of another data element; if a resource is categorised as a text document then it cannot be of type MP3.

- **Declaration of namespaces:** Application profiles support the use of multiple namespaces, such that designers may choose elements appropriate to their needs from various different element sets. Schema designers may also add local elements through the use of a locally defined namespace.

The main goal of metadata application profiles is to increase the usability and interoperability of metadata within a community of practice, by going beyond the universal consensus of a single standard, without compromising the basic interoperability that the standard enables across the boundaries of these communities.

Metadata Application Profile Example

Table 1.2 describes a metadata profile compiled by OTEN in Sydney. It uses elements from the Dublin Core (DC prefix), EdNA (EDNA prefix) and LOM (LOM prefix) standards and two elements from the Department of Education and Training (DET) metadata set.

File No	Element name	Label	Mandatory
1	DC.Identifier	Identifier	Yes
2	DC.Title	Title	Y
3	DC.Description	Description	Y
4	DC.Subject	Subject	Y
5	DC.Publisher	Publisher	Y
6	DC.Creator	Creator	Y
7	DC.Date	Date	Y
8	DET.Version	DET version	Y
9	DET.Status	DET status	Y
10	DC.Type (scheme=DCMI Type)	Type	No
11	DC.Type (scheme=edna-document)	EDNA document type	N
12	DC.Type (scheme=edna-curriculum)	EDNA curriculum type	N
13	DC.Type (scheme=edna-event)	EDNA event type	N
14	DC.Format	Format	N
15	DC.Language	Language	N
16	DC.Coverage.spatial	Geographic coverage	N
17	DC.Coverage.temporal	Temporal coverage	N
18	DC.Rights	Rights	N
19	DC.Relation	Relation	N
20	DC.Contributor	Contributor	N
21	DC.Source	Source	N
22	EDNA.Audience (scheme=edna-audience)	Audience	N
23	EDNA.Audience.edna.sector (scheme=edna-sector)	Educational sector	N
24	EDNA.Audience.edna.userlevel (scheme=edna.userlevel)	User level	N
25	EDNA.Approver	EDNA Approver	N
26	EDNA.CategoryCode	EDNA Category Code	N
27	EDNA.Indexing	EDNA indexing	N
28	EDNA.Review, EDNA.Reviewer	EDNA Review	N
29	EDNA.Version	EDNA metadata version	N
30	LOM.General.Aggregation Level (LOM 1.9)	Aggregation level	N
31	LOM.Metametadata.Contribute.Entity	Metadata creation	N

	(role=creator) (LOM 3.3.2), LOM.Metametadata.Contribute.Date (role=creator) (LOM 3.3.3)		
32	LOM.Metametadata.Contribute.Entity (role=validator) (LOM 3.3.2), LOM.Metametadata.Contribute.Date (role=validator) (LOM 3.3.3)	Metadata validation	N
33	LOM.Metametadata.Metadata Scheme (LOM 3.4)	LOM metadata version	N
34	LOM.Technical.Location (LOM 4.3)	Location	N
35	LOM.Technical.Requirements.Name (Type=Operating System) (LOM 4.4.2)	Required operating system	N
36	LOM.Technical.Requirements.Minimum Version (Type=Operating System) (LOM 4.4.3)	Operating system: minimum version	N
37	LOM.Technical.Requirements.Maximum Version (Type=Operating System) (LOM 4.4.4)	Operating system: maximum version	N
38	LOM.Technical.Requirements.Name (Type=Browser) (LOM 4.4.2)	Required browser	N
39	LOM.Technical.Requirements.Minimum Version (Type=Browser) (LOM 4.4.3)	Browser: minimum version	N
40	LOM.Technical.Requirements.Maximum Version (Type=Browser) (LOM 4.4.4)	Browser: maximum version	N
41	LOM.Technical.Installation Remarks (LOM 4.5)	Installation remarks	N
42	LOM.Technical.Other Platform Requirements (LOM 4.6)	Other platform requirements	N
43	LOM.Technical.Duration (LOM 4.7)	Duration	N
44	LOM.Educational.Interactivity Type (LOM 5.1)	Interactivity type	N
45	LOM.Educational.Learning Resource Type (LOM 5.2)	Learning resource type	N
46	LOM.Educational.Interactivity Level (LOM 5.3)	Interactivity level	N
47	LOM.Educational.Typical Learning Time (LOM 5.9)	Typical learning time	N
48	LOM.Educational.Description (LOM 5.10)	Comments on use of resource	N
49	LOM.Educational.Language (LOM 5.11)	Language of intended	N
50	DET:Version	References the version number.	These last two elements are from the Department of Education and Training (DET) metadata standards and are used by OTEN for tracking purposes.
51	DET:Status	References the status.	

Table 1.2 Example Metadata Application Profile. Source: TAFE NSW Online Project 8 Metadata

Working with metadata

The concept of metadata is not exactly new; librarians have been cataloguing information on resources for centuries. What is new, and where the difficulty arises, is its implementation in a digital world. As with the creation of any new process or system, implementing metadata is not easy; however, through good design and planning the finished product has the potential to offer significant benefits.

This section will provide some general recommendations for organisations considering implementing metadata for resource discovery.

Metadata storage

The two main formats for metadata are:

- HTML syntax embedded within a web resource.
- XML or RDF syntax in a separate file from the resource.

The best method to adopt will depend on a number of factors including how the metadata /objects will be stored and harvested.

HTML is a well-established format that people are familiar with and most existing resources are based on this format.

The Extensible Markup Language (XML) and the Resource Description Framework (RDF), which is encoded in XML are more recent technologies. They have a number of advantages over HTML in that:

- XML is extensible and scalable. This means that it is easier to add new elements and attributes to existing elements.
- Information in XML can be easily transformed into alternative formats using Extensible Stylesheet Language Transformations (XSLT) stylesheets.
- XML is the syntax for Xquery and SOAP-based protocols which are recommended for future repositories by the IMS Digital Repositories Specification (2003).
- XML is also the syntax in evolving technologies such as RSS which has been adopted by EdNA for expanding access to their resources.
- XML in a separate file can be used to describe any type of resource whereas embedded HTML is restricted to web pages.

The Open Training and Education Network 2002 report titled “TAFE NSW Online Project 8 Metadata” recommends that metadata should be encoded using extensible markup language (XML).

Metadata entry

Resource discovery is one of the fundamental benefits that metadata can provide. Therefore, it is important to be able to gather or “harvest” metadata from any source of metadata elements. When a query is made (looking for some number of specific metadata elements), it is important that elements can be found in multiple metadata collections or repositories. This is important to both facilitate the discovery of the best resource that matches the query and to enable the largest possible discovery of resources. This type of searching and these types of metadata repositories which can consist of multiple individual repositories are often referred to as “federated.”

Many metadata elements are objective in that they define characteristics which are objective such as the title, author’s name, date created, etc. Equally, however, many metadata elements are very subjective in that they are based on an opinion or perspective relevant to the community using the resource.

It is often the more subjective metadata that proves to be the most important in finding the best resource for a given student or learning objective. In consultation with a range of focus groups, the VET Learning Objects Repository Project discovered that many VET sector practitioners value both subjective and objective metadata, with some people suggesting that the inclusion of a ranking system would be a useful addition to metadata.

The source of metadata is something that will vary dramatically from organisation to organisation. The presence of a broad range of individuals and groups contributing to the available metadata for a given learning resource will likely improve the metadata’s quality in terms of usefulness. It is often mistakenly assumed that it is the responsibility of the original resource creators (such as authors) to also supply the metadata. Others might think that this is the domain of librarians or indexers. While all of these groups are likely to be able to contribute significantly to the metadata elements available for a given resource, so too would many other groups such as teachers, managers, publishers, associations, and learners themselves.

Many organisations use “fill-in-the-blank” type forms or pull-down lists to gather metadata from those creating it. Much metadata has been and will continue to be created manually but there is no reason for this to continue and it is evident that this method does not scale well and typically creates many errors and low-quality metadata. Although this works, MASIE (2003) notes that eliminating or minimising such form-based and overall manual metadata entry will greatly improve the quantity and quality of metadata.

Minimal metadata requirements

It is a fact that a complete and well-designed application profile, populated with quality metadata, is going to improve the discovery of learning objects. However, quality metadata comes at a cost, and these costs need to be considered as part of the overall costs of developing the learning objects. Ultimately the amount of metadata required should be determined by search and retrieval and object management requirements. These are often hard to define up front and will evolve as the business processes associated with object re-usability mature.

Metadata standards like the IEEE LOM do not prescribe a set of mandatory elements, allowing flexibility for different communities of practice to make their own decisions as to which elements to use and which ones to make mandatory or optional.

The best approach is to begin with a minimum mandatory set of elements based on the most common evolving standards. As an example, the Open Training Education Network (OTEN) TAFE NSW Online Project 8 Metadata, suggests seven elements based on the Dublin Core standard plus an additional two that are specific to the NSW Department of Education and Training. This results in a set of nine mandatory elements that are consistent with the Australian Government Locator Service (AGLS) standards as described in Table 1.3[4].

Element Name	Description	Example
DC:Identifier	An unambiguous reference to the resource within a given context.	Recommended best practice is to identify the resource by means of a string or number conforming to a formal identification system. Formal identification systems include but are not limited to the Uniform Resource Identifier (URI) (including the Uniform Resource Locator (URL)), the Digital Object Identifier (DOI) and the International Standard Book Number (ISBN).
DC:Type	The nature or genre of the content of the resource.	Type includes terms describing general categories, functions, genres, or aggregation levels for content. Recommended best practice is to select a value from a controlled vocabulary (for example, the DCMI Type Vocabulary). To describe the physical or digital manifestation of the resource, use the FORMAT element.
DC:Description	An account of the content of the resource.	Examples of Description include, but are not limited to: an abstract, table of contents, reference to a graphical representation of content or a free-text account of the content.
DC:Subject	A topic of the content of the resource.	Typically, Subject will be expressed as keywords, key phrases or classification codes that describe a topic of the resource. Recommended best practice is to select a value from a controlled vocabulary or formal classification scheme.
DC:Publisher	An entity responsible for making the resource available	Examples of Publisher include a person, an organisation, or a service. Typically, the name of a Publisher should be used to indicate the entity.
DC:Creator	An entity primarily responsible for making the content of the resource.	Examples of Creator include a person, an organisation, or a service. Typically, the name of a Creator should be used to indicate the entity.
DC:Date	A date of an event in the lifecycle of the resource.	Typically, Date will be associated with the creation or availability of the resource. Recommended best practice for encoding the date value is defined in a profile of ISO 8601 [W3CDTF] and includes (among others) dates of the form YYYY-MM-DD.
DET:Version	References the version number.	These last two elements are from the Department of Education and Training (DET) metadata standards and are used by OTEN for tracking purposes.
DET:Status	References the status.	

Table 1.3

4 Descriptions and examples from www.dublincore.org.

If an organisation is intending to create SCORM compliant content it would be advisable to incorporate the mandatory SCORM LOM elements as their minimum metadata set.

Table 1.4 shows the mandatory elements for SCORM Content Aggregations, SCOs and Assets. Full details on metadata requirements for SCORM compliance can be obtained from the *Sharable Content Object Reference Model (SCORM™) Version 1.2 Conformance Requirements* available on the ADL SCORM website.

A Content Aggregation and A Shareable Content Object (SCO) metadata instance shall contain the following mandatory elements:		**An Asset metadata instance shall contain the following mandatory elements:**	
LOM Element Number	Element	LOM Element Number	Element
1	General	1	general
1.2	Title	1.2	title
1.3	catalogentry		
1.3.1	Catalog		
1.3.2	Entry		
1.5	Description	1.5	description
1.6	Keyword		
2	Lifecycle		
2.1	Version		
2.2	Status		
3	metametadata	3	metametadata
3.4	metadatascheme	3.4	metadatascheme
4	Technical	4	technical
4.1	Format	4.1	format
4.3	Location	4.3	location
6	Rights	6	rights
6.1	Cost	6.1	cost
6.2	copyrightandotherrestrictions	6.2	copyrightandotherrestrictions
9	classification		
9.1	Purpose		
9.3	Description		
9.4	Keyword		

Table 1.4

Metadata and vocabularies

A critical component to the success of metadata is the enabling of metadata creation in a collaborative framework and a distributed manner. Free text, or natural language metadata, can be assigned by the creator in very little time. It is useful for terms that do not fit in to controlled vocabulary and it provides the opportunity to apply Australian usage and industry specific terminology.

This is a great idea but has the danger of everyone creating their own keywords that don't match anyone else's keywords. In addition, free text does not allow for alternative spellings or plurals.

Controlled vocabularies overcome this problem by giving people standard terms to index metadata with. It provides economical and effective searching as a single search will retrieve all related material. Controlled vocabulary provides consistent retrieval whereas the use of free text leads to individuals using different terms to search the same subject and therefore not retrieving all relevant and related material.

Some of the advantages in using controlled vocabularies include:

- **Ease of use and consistency in entering metadata**: software can be used to select values from a list, avoiding typing and preventing spelling mistakes.
- **Improved searching**: controlled vocabularies assist resources to be found more reliably by preventing mismatch, eg the metadata says "child care" but the user searched for "childcare".
- **Supports browsing**: A controlled vocabulary can be used directly for browsing for resources.
- **Allows matching to other data**: Metadata which uses controlled vocabularies allows links to be made between similar items (eg find other records with the same terms), or (by way of a mapping) to make a connection between different types of items, for example finding all the resources which relate to a particular qualification.

The advantages then become a reality in that metadata is created in a collaborative and distributed manner while the data entered is standardised.

The Resources for Teaching Learning and Assessment (RTLA) Collaborative Interoperability project has identified the following six areas as being the most important in describing and discovering learning resources (Backroad Connections 2002), and which are most important for interoperability within the VET sector:

- Material type:
- Subject matter:
- Qualification level:
- Granularity:
- Industry:
- Occupation:

Of these six, subject matter is potentially one of the most important applications of controlled vocabularies in relation to the VET sector but it is also the area with the most confusing range of possible coding systems.

There is currently a range of thesauri in use across the nation with different sectors preferring different thesauri. In relation to the EdNA project, VOCED (Vocational Education) has been identified as the preferred standard for the VET sector, whereas ATED (Australian Thesaurus of Education Descriptors) is the preferred standard tor the Higher Education sector.

A full discussion on the role of these thesauri within the VET sector is beyond the scope of this paper; however, one of the anticipated deliverables of the 2003 Collaborative Interoperability project is a Vocabularies discussion paper. The aim of this paper is to provide an introduction and overview to issues of controlled vocabularies used in the Australian vocational education and training (VET) sector with an emphasis on vocabularies relevant to resources for teaching, learning and assessment. The paper will also provide background to inform recommendations developed by the Collaborative Interoperability project.

When released the paper will be available at http://flexiblelearning.net.au/projects/interoperability.htm.

Adopting a practical approach

As part of their report “Making Sense of Learning Specifications & Standards”, the MASIE Center notes that while the task of implementing metadata within an organisation is a daunting one, those who have taken the initiative report that the benefits of metadata are continuously expanding across the organisations.
To help organisations take this initiative the report further describes a series of “pragmatic recommendations and suggestions” for organisations considering the implementation of metadata. A summarised version of these suggestions is presented in Table 1.5.

Practical suggestions for implementing metadata
When developing and implementing metadata within an organisation, set expectations to the degree of difficulty and duration. MASIE notes that “it will be more of a marathon than a sprint” and should be viewed as the development of a process model for the future rather than simply a one-off project. The organisation needs to be committed to the implentation process; this includes senior managers. This can be encouraged by developing an organisational understanding about the benefits of using metadata, including direct ties to organisational goals and ROI. Collaboration is most important. If there are multiple learning groups within your organisation, involve them in the decision-making process, especially if content can be leveraged between them. Make the implementation of Learning Object Metadata an integrated effort between learning management and IT or the group that manages metadata. This is especially important if the organisation has pre-existing metadata tagged documents that may require mapping. If at all possible, involve someone with metadata and taxonomy experience who can guide the learning group through its decision-making process. Think of the lifecycle of a learning object (from original creation to modification to retirement) and who has to “touch it”. They can provide information regarding what kinds of attributes they would like to store within a metadata scheme. Develop plans and procedures for the assignment of metadata as part of the authoring, review, editing, quality assurance, etc., workflow stages of the learning object. It is strongly recommended to create standard operating procedures around content entry into a common content repository. These procedures will then become the basis for such critical issues as metadata structures, system notifications, and security. In choosing metadata elements/tags, consider that even though most organisations choose to adopt and use SCORM values, they also need to add LMS-specific and company-specific metadata to their Learning Object Metadata structures.

Table 1.5

Summary

MASIE notes “whether in academia, government, or the corporate world, metadata is emerging as one of the cornerstones of more effective learning as well as more efficient storage, retrieval, assembly, use, and overall strategic management of literally all resources and assets”.

There has been a lot of work done by standards organisations to define metadata appropriate to learning objects. Metadata standards create consistency and enhance interoperability. The main standards relevant to learning objects in the VET sector are:

- Dublin Core (DC)
- EdNA Metadata Standard
- IEEE Learning Object Metadata (LOM) Standard
- IMS Metadata Specification
- SCORM (Sharable Content Object Reference Model)

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.

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.

In order to meet these needs, organisations may need to create a Metadata Application Profile. To facilitate interoperability, these metadata application profiles should be based on existing standards and consistent within a community of practice. This typically will require extensive consultation with all members of the community. As a matter of policy, the community of practice should also agree to setting the minimum number of mandatory elements to be used.

Wherever possible, metadata should be created in the XML syntax and stored separately from a resource. Storing metadata in HTML creates a significant maintenance burden should the metadata need converting, whereas metadata stored in XML format could be converted by applying an XSLT stylesheet.

A common vocabulary or thesaurus is important to facilitate metadata interoperability. There is currently a range of thesauri in use across the nation with different sectors preferring different thesauri. At present there is no common vocabulary in use within the VET sector.

The task of creating and entering quality metadata can be quite daunting for any organisation. This paper has not only provided an overview of the major issues involved but has also included some practical advice from the MASIE Center to help organisations take the initiative.

Implications for the VET sector

There is a current need within the Australian VET sector to develop a network of interoperable resource repositories, with a view to facilitating access, sharing and transfer of learning objects based on compatible standards. To support this, there is a need to develop a range of technical specifications and complementary implementation requirements for interoperable repositories specific to the Australian VET sector.

In developing these standards, the following issues need to be considered:

- Business requirements for the development of interoperable resource repositories for the VET sector.
- Existing IMS Digital Repository Interoperability specifications should be adopted to ensure interoperability of VET sector resource repositories, recognising that state and territory jurisdictions operate across various platform/vendor technologies.
- Implementation guidelines to support VET sector agencies in future development of resource repositories.

Metadata

There is a need to develop a national metadata application profile that suits the needs of the Australian VET sector and allows for access, search, selection, use, trade and management of learning resources within a digital repository. This application profile needs to be based on existing international metadata standards such as (Dublin Core, EdNA and IEEE's LOM) and be scalable to include both VET specific and organisation specific elements. The resulting metadata application profile should support metadata encoded using XML as described in the IMS content packaging specification as implemented by SCORM.

The development of such a metadata application profile should be informed by and contribute to other relevant national initiatives including other Framework projects, projects conducted by ANTA and cross-sectoral work occurring through the AICTEC Standards subcommittee, the Framework's Interoperability Reference Group and education.au. This has been identified as a priority issue for the Resources in Teaching and Learning Colloborative Interoperability Project in 2004.

Vocabularies

A common vocabulary or thesaurus is important to facilitate metadata interoperability across the Australian VET sector with the aim of facilitating both discoverability and management of learning resources within a digital repository. While there are several vocabularies currently in use nationally, there is no agreed standard on a preferred vocabulary for the VET sector.

There is a need to research these existing vocabularies and determine their suitability for the VET sector. This should be done in conjunction with and be informed by other relevant national initiatives including other Framework projects, projects conducted by ANTA and cross-sectoral work occurring through the AICTEC Standards subcommittee, the Framework's Interoperability Reference Group and education.au. This has been identified as a priority issue for the Resources in Teaching and Learning Collaborative Interoperability Project in 2004.

References

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

Backroad Connections Pty Ltd 2002, *What is Interoperability and Why is it Important? (Version 1.01),* Australian Flexible Learning Framework Quick Guides series, Australian National Training Authority available online at http://www.flexiblelearning.net.au/guides/interoperability.html

Carnegie Mellon University 2003, *Content Developers' Guide to Simple Sequencing, Carnegie Mellon University,* Pittsburgh, Pennsylvania, USA, available online at http://www.lsal.cmu.edu/lsal/expertise/projects

Duval, E., Hodgins, W., Sutton, S., Weibel, S. L. 2002, *Metadata Principles and Practicalities*, D-Lib Magazine, Volume 8 Number 4, Available online at http://www.dlib.org/dlib/april02/weibel/04weibel.html

EdNA 2002, *EdNA Metadata Standard Version 1.1*, EdNA Available online at http://www.edna.edu.au/metadata/documents/edna_metadata.pdf

Higgs, P., Meredith, S. and 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).

IMS 2001, *IMS Learning Resources Metadata Best Practice and Implementation Guide, Version 1.2.1 Final Specification*, IMS Global Learning Consortium, available online at http://www.imsglobal.org/metadata/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

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

Open Training and Education Network (OTEN) 2002 *TAFE NSW Online Project 8 Metadata: Report and Recommendations Overview.*

Acknowledgments

The VET Learning Objects Repository Project is managed by WestOne Services.

WestOne would like to acknowledge the following contributors to this paper:

Linda Arnold	Resource Generator
Vivienne Blanksby	Office of Training and Tertiary Education
Maxine Brodie	Macquarie University
Graeme Brownfield	Office of Training and Tertiary Education
Michael Coghlan	Douglas Mawson Institute of Technology
Les Comley	Resource Generator
Carol Fripp	AEShareNet
Gerry Green	TAFE Queensland
Tim Hand	Open Training & Education Network
Peter Higgs	TAFE Tasmania
Louise Housden	West Coast College of TAFE
Jill Jamieson	Challenger TAFE
Dennis McNamara	AEShareNet
Kerry Munston	TAFE Queensland
Dan Nicholas	EdNA Online Project
Gary Putland	education.au.edu.au
Simon Sinnot	The Learning Federation
Ralph Wirski	Edith Cowan University

This report has been researched and written by WestOne

For more information on the Australian Flexible Learning Framework contact:

Framework Communications Team
Phone: (07) 3225 3544
Fax: (07) 3237 0419
Email: aaron.snell@det.qld.gov.au