UNIT 19 REUSABLE LEARNING OBJECTS

Structure

19.0 INTRODUCTION

After affecting sweeping changes in the way people communicate and do business, the Internet is bringing about a paradigm shift in the way people learn. Consequently, a major change is also happening in the way educational materials are designed, developed, and delivered. Many of these developments, including Web2.0 technologies have been discussed in Unit 17 of this block. Two more important aspects are yet to be discussed and these are learning objects and learner management systems. Learning object is more to do with designing and production of learning content whereas as learner management system is to do with how this content is delivered to the learner and the management of learner and the learning process. We will focus on learning object in this unit and learner management system in the next unit.

Reusable Learning objects (RLOs) enable and facilitate the use of educational content online. Internationally accepted specifications and standards make them interoperable and reusable by different applications and in diverse learning environments. This unit will look in to the nature of this emerging technological construct and will help you get to know reusable learning objects (RLOs) and the related concepts and issues. This unit introduces many of the concepts involved: standards, reusability, applications, and so on. The knowledge that we will build on throughout this unit will form a foundation for you to create your own plan for developing and delivering e-learning based on RLO.

In this unit, we would address the following questions:

- What are learning objects and reusable learning objects?

- What are the characteristics of reusable learning object which makes it distinct from other learning content?
- How to catalogue and make the RLO accessible to the users?
- What is the structure of learning objects and how to develop one?
- What are the benefits of learning object and are there any demerits?
- What are the delivery options?
- What are the standards of learning objects and who makes them?

19.1 LEARNING OUTCOMES

After going through this unit, you are expected to be able to:

- *Define* 'learning objects' including Reusable Learning Objects (RLO);
- *Describe* the history of learning object movement;
- *Describe* the characteristics of learning objects;
- *Discuss* the use of learning objects and their cataloguing;
- *Describe* packaging and publishing learning objects (including SCORM); and
- *Describe* the advantages and disadvantages of learning object strategy.

19.2 REUSABLE LEARNING OBJECTS

The term learning object means many things to many people and there are many definitions. The concept of learning object is still emerging and it is worthwhile to look into many of these definitions to get better understanding of what people mean when they refer to learning object.

According to the Learning Technology Standards Committee (LTSC) of the Institute of Electrical and Electronics Engineers (IEEE), "A learning object is any entity, digital or non-digital, which can be used, re-used or referenced during technology supported learning. Examples of technology-supported learning include computer-based training systems, interactive learning environments, intelligent computer-aided instruction systems, distance learning systems, and collaborative learning environments."

In its white paper titled "Reusable Learning Object Strategy," Cisco Systems, Inc., defined a two-level hierarchy of objects in which five types of reusable information objects — concept, fact, principle, process, and procedure — are used to build a larger structure based on a single terminal objective, called the *reusable learning object.*

According to Cisco's white paper, titled "*Cisco Systems Reusable Information Object Strategy*," a learning object is based on a single learning or performance objective, built from a collection of static or interactive content and instructional practice activities. Any learning object can be "tested" through assessments that measure the learning or performance objective and are either positioned with the learning object or collected as an assessment group. Within the learning object, content, practice, and assessment groupings are built from raw media assets such as text, audio, animation, video, Java code, applets, Flash, and any other asset needed for the given delivery environment. Finally, everything found in the learning object is identified with metadata so that it can be referenced and searched both by authors and learners.

New Media Consortium (NMC) as part of its Learning Object Initiative defined learning object as any grouping of materials that is structured in a meaningful way and is tied to an educational objective and according to them the "materials" in a learning object can be documents, pictures, simulations, movies, sounds, and so on. Structuring these in a meaningful way implies that the materials are related and are arranged in a logical order. But without a clear and measurable educational objective, the collection remains just a collection.

University of Wisconsin - Extension: Glossary available at http://www.uwex.edu/ics/design/glossary.htm#l defines Learning objects as "small electronic units of educational information that are flexible, reusable, customizable, interoperable, retrievable, facilitate competency-based learning, and increase the value of content."

The following are the Learning Object's structural components:

- Objective: A statement describing the intended criterion-based result of an instructional activity.
- Learning Activity: an element of the instruction that teaches to an objective.
- Assessment: an element that determines if an objective has been met

Learning objects are authored in small pieces, assembled into a database, and then delivered to the learner through a variety of delivery media as a lesson or assemblage of lessons grouped in units, modules, courses, programmes or as an independent role play, exercise, case study, labs etc.

To conclude a digital learning object consists of content, metadata and an interface. The content is made up of instructional, practice, and assessment assets, which are the materials or "blocks" that make up the learning object. This may contain images, animations, text passages, videos, audio etc. Metadata refers to a collection of keywords, attributes, and descriptive information that tells authors, learners, and systems about a learning object so that it can be referenced and searched. The interface is the part of the learning object with which the user interacts. It includes the graphic design, navigational elements, and other controls that the user sees.

19.2.1 Characteristics of Learning Objects

Ideally, learning objects should have the following characteristics:

- **Usability -** In order to be defined as a learning object, there must be some intrinsic instructional value. It should result in a complete learning sequence, objective, skill or competency by combining a series of elements including content, media, and interactivity.
- **Adaptability** - Adaptability ensures the learning object is tailored perfectly for the individual and situational needs. They allow for easy customization of courses for a whole organization or even for each individual.
- **Reusability** – A single LO may potentially be used in multiple contexts for multiple purposes. It should allow users to incorporate it into multiple applications without much additional effort. Such LOs can be distributed through learning object repositories in order to share and reuse the object in the future.
- **Contextual Neutrality** - In order to maximize their reusability, learning objects are required to minimize the amount of information specific to a

given context. This would make it portable, reusable, and relevant as an independent learning experience.

- **Interactivity** – With the advancement of technology the learning objects are becoming more and more interactive. Engaging learners, making them active participants in the learning experience, is key to having them meet the learning objective.
- **Traceability -** Every LO has descriptive information allowing it to be easily found by a search. This usually achieved by having metadata which facilitates reuse by others.
- **Independent** - learning objects are discrete and coherent chunks of information, activities or assessment, which are self-contained in that they can contain a complete learning sequence. Each learning object is capable of either standing alone or standing in unison with other learning objects to create any number of courses.
- **Interoperability** - To be reused in multiple delivery media, learning objects should be created free of any particular format and this is usually achieved by following internationally accepted standards.

Check Your Progress 19.1

Notes: a) *Write your answers in the space given below.*
b) *Compare your answers with those given at the end of this unit.*

1) Define Learning Object in your own words.

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2) List five characteristics of Learning Objects.

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19.2.2 Advantages of Learning Objects

Learning objects have a number of advantages as follows:

- **Financial** - Ensuring that all resources are shared will reduce duplication of effort and encourage reuse by students and educators all over the world. Avoiding re-creating material that already exists is one of the important advantages of RLO
- **Flexibility** – The same learning object can be used in many different ways, in different learning contexts, within different curriculum frameworks and even for completely different learning purposes.
- **Customisation** – Developing new learning objects is very much easier when adapting existing objects. The context around the learning object, and often the learning object itself, can be customised by each user to

suit their needs (eg literacy levels, focus of inquiry, level of expertise in the content, take into account prior learning etc)

- **Future-proofing** – The use of international standards for interoperability ensures freedom from proprietary solutions that tie an organisation to a single vendor.
- **Time Saving -** Time is critical to the quality of teaching. By saving time through using a large pool of learning objects staff can spend more time with students or developing new and exciting learning objects. Overall the student learning experience is enhanced.
- **High quality resources** – Using multimedia in learning objects allows for simulations, animations or use of video and sound to improve the quality of the learning experience offered to students.
- **Access** – Students and teachers can access resources from many different places, at different times and for their own purposes, e.g. for problem-solving, consolidation of a skill etc. LO will load more quickly over the Internet and generally requires less memory.
- **Ease of production** – From LO author's point of the availability of specific templates and software for creating LOs and a consistent design, development process and standards will give more time to focus on actual content and create quality learning objects.
- **Just-in-time learning** – RLO gives the learners what they need just when they need it.
- **Learning Style** – Learners may be able to get the same information in multiple formats, allowing them to choose their preferred method.

Cisco has identified the following benefits of learning objects to authors and learners:

For Authors

For authors, a learning object strategy accomplishes the following:

- Supports the design of many learning approaches, including receptive, directive, guided discovery, and exploratory
- Ensures through the use of object-specific templates, that design and development of learning products are consistent across the organization
- Provides a consistent design structure early in the development process, maximizing resource allocation while minimizing development risks
- Provides guidelines for authors, improving their ability to write effective and efficient performance-based training, assessments, and resources
- Enables detailed searches that allow authors to find, reuse, and repurpose any object or media
- Allows authors to combine old and new objects to build new solutions to meet the needs of their learners
- Supports both reuse and repurposing from the smallest media element up to larger course structures and learning contexts
- Enables application of delivery formats and styles to the learning objects as they are "published" for delivery (also known as single-source development), saving time and resources when authors are developing and maintaining learning products
- Supports a broad range of delivery types, including instructor-led training (ILT), self-paced e-learning training, performance-support tools, virtual classrooms, personal digital assistants (PDAs), or blended delivery solutions

For Learners

For learners, a learning object strategy accomplishes the following:

- Provides a mechanism for learners to self-assess their skills and knowledge in order to receive a prescribed course of action for future learning
- Supports the acquisition of new skills and knowledge through education, experience, or exposure
- Supports multiple delivery types, media types, and presentation styles to fit a learner's needs, preferences, and work environment
- Enables through the use of detailed metadata about each object, custom learning paths to be tailored to the knowledge and skills that individual learners need for their job
- Enables learners to search on job-specific objects and efficiently access the right amount of knowledge as it is needed
- Delivers a consistent learning experience with each deliverable using learning objects, including job aids, classroom training materials, elearning, and blended delivery formats
- Supports multiple learning approaches, ranging from passive, receptive training to discovery and problem-solution based training

19.2.3 A Critique on Learning Objects

Many people have critiqued the entire learning objects way of thinking from a number of perspectives. Friesen (2003), in a well-known paper titled "Three objections to learning objects and e-learning standards," clearly articulates some of the most popular objections. These objections are given in brief below:

Objection 1: What's a learning object, anyway?

The first objection is to do with very definition of learning objects. Many people have defined it in different ways and also there is no consensus regarding its granularity. He further observes that the term "learning object" suggests neither simplicity, compatibility nor any obvious relative advantage over prevailing teaching practice. He concludes his objection by stating "In order for the positive potential of learning objects to be realized, they need to be labelled, described, investigated and understood in ways that make the simplicity, compatibility and advantages claimed for them readily apparent to teachers, trainers and other practitioners" (Friesen, 2003).

Objection 2: Where is the Learning in E-Learning Standards?

Though he agrees upon that the standards in e-learning ensures interoperability, portability and reusability of content what he object is to its simultaneous claims to pedagogical relevance and pedagogical neutrality. In contradistinction to SCORM's (one such standard to be discussed later in this unit) own claims to "pedagogical neutrality," some of the experts have been asserting that SCORM is **limited** in its pedagogical scope, neutrality or relevance. He has concluded his objection by saying "specifications and applications that are truly pedagogically neutral cannot also be pedagogically relevant" (Friesen, 2003).

Objection 3: Education in a Militarized Zone?

His third objection is to the disproportionately large influence of large corporations and the American military on specifications and standards. He feels that the military technical standards and specifications cannot be

considered as solutions to pedagogical problems. Friesen summarizes, "vision of e-learning specifications and systems for military applications is rather far a field from the practices, contexts and values that dominate public (and other forms of) education. The obvious fact is that the goals of public education, however they might be construed, are radically different than those of the American military" (Friesen, 2003).

Other criticisms of learning objects are the following:

- **Learning objects and the context**: Instructional designers work to make learning objects as free from surrounding context as possible in order to increase their potential for reuse; however, in the current pedagogical practices of constructivism the social and other context of learner plays a vital role in learning and understanding. Therefore in the name of reusability the move to decontexualize educational materials is troubling.
- **Copyright:** The burden of clearing copyright for learning objects to be used in the course production process can block the process altogether.
- **Technical Content:** One of the frequent criticisms of RLOs is that they only work with technical content and not suitable for other content areas.
- **Lower order learning**: Another common criticism is that RLOs can only be strung together to form step-by-step directive learning architectures. This is where the learner cannot explore, apply problem-solving skills, or achieve higher cognitive learning objectives such as synthesis and evaluation.
- **Translation:** Online learning objects written in one language will not be easily usable internationally because they have to be translated into other languages

Check Your Progress 19.2

Notes: a) *Write your answers in the space given below.*
b) *Compare your answers with those given at the end of this unit.*

1) Describe three advantages of Learning Objects.

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2) What are the objections to Learning Objects?

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19.3 LEARNING OBJECTS: METADATA STANDARDS AND SPECIFICATIONS

The term metadata refers to a collection of keywords, attributes, and descriptive information that tells authors, learners, and systems about a learning object. It is the information about the learning object itself as opposed to the information in the learning object. "Metadata, literally "data about data," is descriptive information about a resource. For example, the card catalog in a public library is a collection of metadata. In the case of the card catalog, the metadata are the information stored on the cards about the Author, Title, and Publication Date of the book or resource" (Wiley, 2001).

Similarly street names and house numbers are widely accepted descriptors that make it easier for people to find a particular building. The street names and numbers are a form of metadata. The purpose of metadata is primarily to enable searching and retrieval of learning content. It does this through provision of information about the content (it can be thought of as a virtual index card). The task is to define the structure and format of fields for this card and their range of values (taxonomies) where appropriate.

Why metadata?

- Metadata is useful for search engines and online repositories locate and identify learning objects
- Tracking ownership and attribution information and handling rights management issues
- Communicating with learning management systems (LMS)

The goal of standards is to provide fixed data structures and communication protocols for Learning objects and cross-system workflows. This enables interoperability between application, such as Learning Management System (LMS) or in-house developed content, by providing uniform communication guidelines that can be used throughout the design, development and delivery of Learning Objects. There have been a number of efforts worldwide to develop standards for learning object interoperability. The standards are of because they support- Interoperability, durability, manageability, re-usability, and accessibility. These standards focus on content metadata, content packaging, and run-time communication to support tracking of student activities.

To this end, there are several organizations working toward standards and to make sure learning content is 'interoperable' with various learning management technologies. In recent years, groups like the Aviation Industry Computer-Based Training (CBT) Committee (AICC), the IMS Global Learning Consortium, Inc., the Institute of Electrical and Electronics Engineers (IEEE), the Alliance for Remote Instructional Authoring and Distribution Networks for Europe (ARIADNE), the Dublin Core, Sharable Content Object Reference Model (SCORM) and CanCore have developed specifications or guidelines for various aspects of learning object development and use. What follows is a brief discussion on each of these standards.

19.3.1 The Aviation Industry CBT (Computer-Based Training) Committee (AICC)

AICC is an international association of technology-based training professionals. The AICC develops guidelines for aviation industry in the

development, delivery, and evaluation of CBT and related training technologies. The objectives of the AICC are as follows:

- Assist airplane operators in development of guidelines which promote the economic and effective implementation of computer-based training (CBT) media.
- Develop guidelines to enable interoperability.
- Provide an open forum for the discussion of CBT (and other) training technologies.

The AICC promotes interoperability standards that software vendors can use across **multiple** industries so that a vendor can sell their products to a broader market for a lower unit cost. Since AICC recommendations are fairly general to most types of computer based training they are widely used outside of the aviation training industry. Who ever is concerned about reuse and interoperability of online learning, the AICC standards are important to be considered. The AICC also actively coordinates its efforts with broader learning technology standards organizations like IMS, ADL, ISO SC/36, and IEEE/LTSC.

AICC Guidelines & Recommendations (AGR's)

The AICC develops technical guidelines (know as AGR's) and their related specifications. Each AGR makes a technical recommendation in a specific area. The AICC has 11 AGR's (AGR-002 thru AGR-012). AGR-001 is listing of all AICC AGR's and is not considered an actual recommendation. The term "AICC Compliant" means that a training product complies with one or more of the 9 AICC Guidelines & Recommendations (AGR's). The most common meaning of "AICC compliance" (when associated with CBT courseware or CMI systems) is compliance with the AICC documents *AGR-006* (File-based CMI Systems) **or** *AGR-010* (Web-based CMI Systems). These AGRs define the communication between CMI systems and CBT courseware. Some of these AGR are given in the Table 19.1.

Table 19.1: AICC Guidelines & Recommendations (AGRs)

1989	:	Common platform guidelines for CBT delivery (AGR-002).
1992	:	A DOS-based digital audio guideline (AGR-003) before the advent of window multimedia standards. The guideline enabled end-users to use one audio card for multiple vendors' CBT courseware. Due to the huge amount of CBT legacy courseware, this guideline is still in use.
1993	:	A guideline for CMI (LMS) interoperability in 1993. This guideline (AGR-006) resulted in the CMI systems that are able to share data with LAN-based CBT courseware from multiple vendors.
1996	:	A navigation icon guideline (AGR-009) to help standardize the student user controls in CBT.
1998	:	The CMI (LMS) specifications were updated to include web-based CBT (or WBT). This new web-based guideline is called AGR-010.
1999	:	The CMI (LMS) specifications were updated to include a JavaScript API interface. (This is the basis of the SCORM runtime environment).
2005	:	The Package Exchange Notification Services (PENS) guideline (AGR-011) allows Authoring/Content Management system to seamlessly integrate publishing with LMS systems.
2005	:	Training Development Checklist (AGR-012) describes a check list of AICC guidelines to consider before purchasing or developing CBT/WBT content or systems.

19.3.2 Dublin Core

The Dublin Core Metadata Initiative (DCMI) is an open organization, incorporated in Singapore as a public, not-for-profit Company limited, engaged in the development of interoperable online metadata standards that support a broad range of purposes and business models. DCMI's activities include work on architecture and modeling, discussions and collaborative work in DCMI Communities and DCMI Task Groups, annual conferences and workshops, standards liaison, and educational efforts to promote widespread acceptance of metadata standards and practices. (The name "Dublin" is due to its origin at a 1995 invitational workshop in Dublin, Ohio; "core" denotes that its elements are broad and generic, usable for describing a wide range of resources).

The Dublin Core Metadata Initiative provides simple standards to facilitate the finding, sharing and management of information. DCMI does this by:

- Developing and maintaining international standards for describing resources
- Supporting a worldwide community of users and developers
- Promoting widespread use of Dublin Core solutions

Table 19.2: Simple Dublin Core Metadata Element Set (15 elements)

Sr.No.	Elements	Description
1.	Contributor	An entity responsible for making contributions to the resource.
2.	Coverage	The spatial or temporal topic of the resource, the spatial applicability of the resource, or the jurisdiction under which the resource is relevant.
3.	Creator	An entity primarily responsible for making the resource
4.	Date	A point or period of time associated with an event in the lifecycle of the resource.
5.	Description	An account of the resource.
6.	Format	The file format, physical medium, or dimensions of the resource.
7.	Identifier	An unambiguous reference to the resource within a given context.
8.	Language	A language of the resource.
9.	Publisher	An entity responsible for making the resource available.
10.	Relation	A related resource.
11.	Rights	Information about rights held in and over the resource.
12.	Source	A related resource from which the described resource is derived.
13.	Subject	The topic of the resource.
14.	Title	A name given to the resource.
15.	Type	The nature or genre of the resource.

The development and maintenance of a core set of metadata terms (the DCMI Metadata Terms) continues to be one of the main activities of DCMI. DCMI promotes the adoption of standardized approaches to metadata and the architectures which support the creation and exchange of interoperable metadata. In addition, DCMI is developing guidelines and procedures to help implementers define and describe their usage of Dublin Core metadata in the form of Application Profiles. This work is done in a work structure

that provides discussion and cooperation platforms for specific communities (e.g. education, government information, and corporate knowledge management) or specific interests (e.g. technical architecture, accessibility).

The Dublin Core metadata standard is a simple yet effective element set for describing a wide range of networked resources. The Dublin Core standard includes two levels: Simple and Qualified. Simple Dublin Core comprises fifteen elements; Qualified Dublin Core includes three additional elements (Audience, Provenance and RightsHolder), as well as a group of element refinements (also called qualifiers) that refine the semantics of the elements in ways that may be useful in resource discovery. The Dublin Core basic/ simple element set is outlined in Table 19.2. Each element is optional and may be repeated. Most elements also have a limited set of qualifiers or refinements, attributes that may be used to further refine (not extend) the meaning of the element.

Qualified Dublin Core

Qualified Dublin Core (Table 19.3) includes seven additional elements (Audience, Provenance, Rights Holder, Instructional method, Accrual Method, Accrual Periodicity, and Accrual Policy), as well as a group of element refinements (also called qualifiers) that refine the semantics of the elements in ways that may be useful in resource discovery.

Table 19.3: Qualified Dublin Core

Sr.No.	DCMES Element	Element Refinement(s)
1.	Title	Alternative
2.	Creator	
3.	Subject	
4.	Description	Table of Contents, Abstract
5.	Publisher	
6.	Contributor	
7.	Date	Created, Valid, Available, Issued, Modified, Date Accepted, Date Copyrighted, Date Submitted
8.	Type	
9.	Format	Extent, Medium
10.	Identifier	Bibliographic citation
11	Source	
12.	Language	
13.	Relation	Is Version Of, Has Version, Is Replaced By, Replaces, Is Required By, Requires, Is Part Of, Has Part, Is Referenced By, References, Is Format Of, Has Format, Conforms To
14.	Coverage	Spatial, Temporal
15.	Rights	Access rights, License
16.	Audience	Mediator, Education level
17.	Provenance	
18.	Rights holder	
19.	Instructional method	
20.	Accrual Method,	
21.	Accrual Periodicity,	
22.	Accrual Policy,	

The Simple Dublin Core and the Qualified Dublin Core described above are part of a larger set of metadata vocabularies and technical specifications maintained by the Dublin Core Metadata Initiative (DCMI). The full set of vocabularies, DCMI Metadata Terms [DCMI-TERMS] (see Table 19.4), also includes sets of resource classes (including the DCMI Type Vocabulary [DCMI-TYPE]), vocabulary encoding schemes, and syntax encoding schemes. For a description for all other terms one is required to view the DUBLIN CORE website at http://dublincore.org/documents/dcmi-terms/)

Table 19.4: DCMI Metadata Terms

Properties in the */terms/* namespace	abstract, access Rights, accrual Method, accrual Periodicity, accrual Policy, alternative, audience, available, bibliographic Citation, conforms To, contributor, coverage, created, creator, date, date Accepted, date Copyrighted, date Submitted, description, education Level, extent, format, has Format, has Part, has Version, identifier, instructional Method, is Format Of, is Part Of, is Referenced By, is Replaced By, is Required By, issued, is Version Of, language, license, mediator, medium, modified, provenance, publisher, references, relation, replaces, requires, rights, rights Holder, source, spatial, subject, table Of Contents, temporal, title, type, valid
Properties in the legacy */elements/1.1/* namespace	contributor, coverage, creator, date, description, format, identifier, language, publisher, relation, rights, source, subject, title, type
Vocabulary Encoding Schemes	DCMI Type, DDC, IMT, LCC, LCSH, MESH, NLM, TGN, UDC
Syntax Encoding Schemes	Box, ISO3166, ISO639-2, ISO639-3, Period, Point, RFC1766, RFC3066, RFC4646, URI, W3CDTF
Classes	Agent, Agent Class, Bibliographic Resource, File Format, Frequency, Jurisdiction, License Document, Linguistic System, Location, Location Period Or Jurisdiction, Media Type, Media Type Or Extent, Method Of Accrual, Method Of Instruction, Period Of Time, Physical Medium, Physical Resource, Policy, Provenance Statement, Rights Statement, SizeOrDuration, Standard

19.3.3 Instructional Management Specification (IMS)

IMS is originally an abbreviation for Instructional Management Specification, and is now also commonly used as the short form for the IMS Global Learning Consortium. The IMS Global Learning Consortium creates standards for the development and adoption of technologies that enable high-quality, accessible, and affordable learning experiences. IMS GLC is now enabling the next generation of Digital Learning Services, combining new forms of digital content, assessment, applications, and administrative services.

The IMS Global Learning Consortium strives to enable the growth and impact of learning technology in the education and corporate learning sectors worldwide. IMS GLC members provide leadership in shaping and growing the learning industry through community development of interoperability and adoption practice standards and recognition of the return on investment from learning and educational technology.

IMS GLC has approved and published some 20 standards of which 17 are the most widely used learning technology standards in the world (see Table 19.5). These IMS GLC standards include Accessibility, Competency Definitions, Content Packaging, Digital Repositories, Enterprise, Enterprise Services, ePortfolio, General Web Services, Learner Information, Learning Design, Meta-data, Question and Test Interoperability, Resource List

Interoperability, Shareable State Persistence, Simple Sequencing, Tools Interoperability, and Vocabulary Definition Exchange. These standards have been used widely in higher education, K-12 education, and corporate training in regions around the globe. All IMS GLC standards are available to be downloaded from its website at http://www.imsglobal.org/specifications.html.

Table 19.5: IMS Standards and their Descriptions

Sr. No.	Specification/ Standards	Description
1.	Accessibility	The Access For All Meta-data specification is intended to make it possible to identify resources that match a user's stated preferences or needs. These preferences or needs would be declared using the IMS Learner Information Package Accessibility for LIP specification. The needs and preferences addressed include the need or preference for alternative presentations of resources, alternative methods of controlling resources, alternative equivalents to the resources themselves and enhancements or supports required by the user. The specification provides a common language for identifying and describing the primary or default resource and equivalent alternatives for that resource.
2.	Competency Definitions	The Reusable Definition of Competency or Educational Objective (RDCEO) specification provides a means to create common understandings of competencies that appear as part of a learning or career plan, as learning pre-requisites, or as learning outcomes. The information model in this specification can be used to exchange these definitions between learning systems, human resource systems, learning content, competency or skills repositories, and other relevant systems.
3.	Content Packaging	The issue with content is how to launch it so that it can access information about the learner and return information about the learner's interaction to the learning management system. This may be, very simply: the learner's name in one direction, and started and finished markers coming back; or it may be complex, providing access to the Learner's Profile, where the content can gain access to the learner's preferences and past performance and receives back detailed performance information.
4.	Digital Repositories	The IMS Digital Repositories purpose is to provide recommendations for the interoperation of the most common repository functions. These recommendations should be implementable across services to enable them to present a common interface. On the broadest level, this specification defines digital repositories as being any collection of resources that are accessible via a network without prior knowledge of the structure of the collection. Repositories may hold actual assets or the meta-data that describe assets. The assets and their meta-data do not need to be held in the same repository.
5.	Enterprise	Its core focus is to integrate learning systems with existing systems within the enterprise. There is now a wide range of systems, including eMail, Personnel, Resource Planning, LDAP, Scheduling and many others.
6.	Enterprise Services	The Enterprise Services specification is the definition of how systems manage the exchange of information that describes people, groups and memberships within the context of learning.
7.	ePortfolio	The IMS ePortfolio specification was created to make ePortfolios interoperable across different systems and institutions. The ePortfolio specification: Supports the advancement of lifelong learning important to many government initiatives, Makes exchanging portfolios from school to work transitions easier, Allows educators and institutions to better track competencies, and enhances the learning experience and improves employee development.
8.	General Web Services	The General Web Services Base Profile promotes interoperability for web service based specification implementations on different software and vendor platforms. The Base Profile focuses on a core set of web service specifications and the most common problems experienced implementing the identified web service specifications.
9.	Learner Information	Learner Information is a collection of information about a Learner (individual or group learners) or a Producer of learning content (creators, providers or vendors). The IMS Learner Information Package (IMS LIP) specification addresses the interoperability of internet-based Learner Information systems with other systems that support the Internet learning environment. The intent of the specification is to define a set of packages that can be used to import data into and extract data from an IMS compliant Learner Information server. The core structures of the IMS LIP are based upon: accessibilities; activities; affiliations; competencies; goals; identifications; interests; qualifications, certifications and licences; relationship; security keys; and transcripts.

Sr. No.	Specification/ Standards	Description
10.	Learning Design	Learning Design specification supports the use of a wide range of pedagogies in online learning. Rather than attempting to capture the specifics of many pedagogies, it does this by providing a generic and flexible language. This language is designed to enable many different pedagogies to be expressed. The approach has the advantage over alternatives in that only one set of learning design and runtime tools then need to be implemented in order to support the desired wide range of pedagogies.
11.	Meta-data	The purpose of metadata is primarily to enable searching and retrieval of learning content. It does this through provision of information about the Content. The task is to define the structure and format of fields for this and their range of values where appropriate.
12.	Question and Test Interoperability	Related to content in use are questions and test which can be used to monitor learners' progress, determine the next activities or formally to assess the learner. The key issue is to separate the content of the question from its presentation, so that it can be easily ported across systems and over time. Formats for different question and presentation types are being agreed, as are types and formats for returning results
13.	Resource List Interoperability	The Resource List Interoperability (RLI) specification details how structured meta-data can be exchanged between systems that store and expose resources for the purpose of creating resource lists and those that gather and organize those Resource Lists for educational or training purposes.
14.	Shareable State Persistence	The Shareable State Persistence specification describes an extension to e-learning runtime systems (e.g., SCORM) that enables the storage of and shared access to state information between content objects.
15.	Simple Sequencing	The IMS Simple Sequencing Specification defines a method for representing the intended behavior of an authored learning experience such that any learning technology system (LTS) can sequence discrete learning activities in a consistent way. The specification defines the required behaviors and functionality that conforming systems must implement.
16.	Tools Interoperability	The IMS Tools Interoperability (TI) approach addresses the growing demand for a reusable mechanism for integrating third-party tools with core LMS platforms. Tools can add specialist functionality to the LMS such as assessment or discipline-specific teaching aids. The reuse of a commonly understood approach across tools will eliminate the need for bilateral solutions, thus focusing investment on adding real value to the learner experience.
17.	Vocabulary Definition Exchange	The IMS Vocabulary Definition Exchange (VDEX) specification defines a grammar for the exchange of value lists of various classes: collections often denoted "vocabulary". Specifically, VDEX defines a grammar for the exchange of simple machine-readable lists of values, or terms, together with information that may aid a human being in understanding the meaning or applicability of the various terms.

The scope for IMS specifications, broadly defined as "distributed learning," includes both online and off-line settings, taking place synchronously (real-time) or asynchronously. This means that the learning contexts benefiting from IMS specifications include Internet-specific environments (such as web-based course management systems) as well as learning situations that involve off-line electronic resources (such as a learner accessing learning resources on a CD-ROM).

19.3.4 Institute of Electrical and Electronics Engineers (IEEE) Learning Technology Standards Committee (LTSC)

The IEEE Learning Technology Standards Committee (LTSC) operates under the auspices of the IEEE Standards Association and the IEEE Computer Society Standards Activity Board. The IEEE LTSC is chartered to develop accredited technical standards, recommended practices, and guides for learning technology. "Learning technology" includes software components, tools, technologies, and design methods that facilitate development, deployment, maintenance, and interoperation of computer-based education and training components and systems.

The IEEE-LTSC working groups include:

- 1484.12: Learning Object Metadata (LOM)
- 1484.20: Competencies
- 1484.11: Computer Managed Instruction (CMI)
- 1484.13: Resource Aggregation Models for Learning Education and Training (RAMLET)

Their published Standards include:

- 1484.20.1-2007 IEEE Standard for Learning Technology-Data Model for Reusable Competency Definitions
- 1484.4-2007 IEEE Trial-Use Recommended Practice for Digital Rights Expression Languages (DRELs) Suitable for eLearning Technologies
- 1484.11.3-2005 IEEE Standard for Learning Technology-Extensible Markup Language (XML) Schema Binding for Data Model for Content Object Communication
- 1484.12.3-2005 IEEE Standard for Learning Technology-Extensible Markup Language (XML) Schema Definition Language Binding for Learning Object Metadata
- 1484.11.1-2004 IEEE Standard for Learning Technology-Data Model for Content to Learning Management System Communication
- 1484.11.2-2003 IEEE Standard for Learning Technology-ECMAScript Application Programming Interface for Content to Runtime Services Communication
- 1484.12.1-2002 IEEE Standard for Learning Object Metadata

19.3.5 Sharable Content Object Reference Model (SCORM)

Building on all of the above work, the Advanced Distributed Learning (ADL) initiative of the U.S. Department of Defense has created a unified collection of core specifications, the Sharable Content Object Reference Model (SCORM). SCORM refers specifically to content, technologies, and services for online educational application (e-learning). SCORM is not a standard; it is a detailed implementation reference which, if followed, allows systems, content, and technologies to "talk" to each other. SCORM is still being developed and refined by ADL and other government, academic and corporate groups.

SCORM currently includes specifications for describing, sequencing, and joining learning objects; enabling communication between learning objects and learning management systems; and data tracking. Vendors of products that create and manage learning objects can use the SCORM specifications to ensure interoperability among their products.

SCORM (sharable content object reference model) is a collection of related specifications and standards aimed at the creation of interoperable, accessible, durable, affordable, and re-usable learning content (ADL, 2004). What is particularly important about SCORM is the fact that it does not introduce new specifications or standards, but it coordinates and refers to already established technical standards, specifications, and guidelines introduced by other international organisations committed to e-learning standardization, such as the IMS, the IEEE LTSC, ARIADNE, and AICC. This further justifies the wide acceptance and significant impact of SCORM on the e-learning industry world wide.

To help stimulate industry agreement, SCORM defined the high-level-functional requirements, or 'abilities' for all SCORM-compliant e-learning environments. They are the foundation on which the SCORM is based (Table 19.6).

Table 19.6: SCORM Requirements

Requirement	Explanation
Accessibility	The ability to locate and access instructional components from one remote location and deliver then to many other locations
Interoperability	The ability to take instructional components developed in one location with one set of tools or platforms and use them in another location with a different set of tools or platforms.
Durability	The ability to withstand technology evolution and changes without costly redesign, reconfiguration or recoding
Reusability	The ability to incorporate instructional components in multiple applications and contexts.

***Source**:* SCORM® 2004 4th Edition Overview Version 1.0

In addition to the "abilities," another foundational concept for SCORM is the "Web-enabled assumption," which asserts that the Web provides the best opportunity to maximize access to and reuse of learning content. The Web-based assumption embraces industry's transition to common content and delivery formats. Combining the "abilities" with the Web-based assumption, SCORM's operational principles offer the ability for:

- Web-based learning management systems (LMSs) to launch content that is authored using tools from different vendors and to exchange data with that content.
- Web-based LMS products from different vendors to launch the same content and exchange data with that content during execution.
- Multiple Web-based LMS products/environments to access a common repository of executable content and to launch such content.

SCORM is a collection, integration and harmonization of specifications and standards that have been bundled into a collection of "technical books." These technical books are presently grouped under three main topics: the Content Aggregation Model (CAM), the Run-time Environment (RTE) and Sequencing and Navigation (SN). Table 19.7 gives summary of these books.

Table 19.7: SCORM Book Coverage

Book	Concepts Covered	Technologies Covered	Areas of Overlap
Overview	High level conceptual information	Introduction to numerous high-level elements of SCORM terminology	Covers areas of the CAM, RTE and SN books at a high level
Content Aggregation Model (CAM)	Assembling, labeling and packaging of learning content	SCO, Asset, Content Aggregation, Package, Package Interchange File (PIF), Metadata, Sequencing Information, Navigation Information	SCOs and manifests, SCOs communicate with an LMS via the RTE. Manifests contain Sequencing and Navigation Information
Run-Time Environment (RTE)	LMS's management of the RTE, including launch, content to LMS tracking, data transfer and error handling	API. API instance, Launch, Session Methods, Data Transfer, Support Methods, Technical Model, Run-Time Data Model	SCOs are described in the CAM book and are content objects that use the RTE
Sequencing and Navigation (SN)	Sequencing content and navigation	Activity Tree, Learning Activities, Sequencing Information, Navigation Information	Sequencing and Navigation affects how content is assemble in a manifest

***Source**:* SCORM® 2004 4th Edition Overview Version 1.0

Check Your Progress 19.3

Notes: a) *Write your answer in the space given below.*
b) *Compare your answer with those given at the end of this unit.*

1) List at least five basic Dublin Core metadata elements.

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2) Explain competency in the context of IMS.

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3) What is SCORM?

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19.3.6 Alliance of Remote Instructional Authoring and Distribution Networks for Europe (ARIADNE)

This is a European association open to the world, for knowledge sharing and reuse. The core of the ARIADNE infrastructure is a distributed network of learning repositories. The ARIADNE Foundation was created to exploit and further develop the results of the ARIADNE and ARIADNE II European Projects, which created tools and methodologies for producing, managing and reusing computer-based pedagogical elements and telematics supported training curricula.

The goal of the ARIADNE project is to define implement and test suitable methodologies and tools for enabling telematics-based solutions in academic education, open and distance learning and certain types of corporate training. ARIADNE explicitly addresses four aspects of the teaching process:

- Producing computer based teaching material
- Managing this material to permit sharing and reuse
- Assembling courses
- Delivering courses to students

ARIADNE Tools

ARIADNE uses a set of tools to achieve its objectives:

- Search & Index Learning Objects (SILO): Though ARDIANE target integration of their services into third party applications, they offer a query and indexation tool. The ARIADNE Search & Indexation tool allows ARIADNE users to upload, describe and publish learning objects. Silo supports 4 usage rights levels that can be associated to every learning object.
- The Ariadne Web Service: It is a software package that runs on a jakarta tomcat server. This tool offers web services through which external applications can communicate with the ARIADNE knowledge pool system. This tool is thus not intended to be used by end users. The tool however offers a webpage through which an ARIADNE administrator can create ARIADNE account, manage and test an ARIADNE KPS instance.
- Federated Search (GLOBE): Searching beyond the borders of ARIADNE is of great value to this community. This middleware software enables transparent search into various repositories (GLOBE, ProLearn, MACE & MELT). These sites rely on standards such as SQI and LOM for doing federated search. By the addition of new repository to the federated search infrastructure, more heterogeneous content becomes available to the ARIADNE community.
- Integrated Learning Management Systems: At the beginning, ARIADNE provided its members with both a Learning Object Repository (LOR) and a Learning Management System (LMS) that offered learning services while interacting with learning objects stored into the Knowledge Pool. However more recently ARIADNE decided to focus on its LOR and to build API dedicated to specific LMS and providing the opportunity to interoperate with the Knowledge Pool and others LOR included in the Federated Search. These API allow to:
- **query LOR from LMS** and to retrieve learning objects metadata
- **download** the matching **documents** on the local host
- **integrate** the matching **documents** into the dedicated space of the LMS in order to deploy this resource **within a courseware**
- **index new learning objects** into a LOR starting from a LMS.

An API is available for the well-known Moodle LMS. It allows to create, modify, and delete coursewares and to view existing ones which do not require a password.

- **Phoenix**: This authoring tool allows indexing pedagogical material and inserting it into the Knowledge Pool System.
- **Attention Metadata:** In order to create a feedback loop that enables learning from the way people actually use new technologies and tools for learning, it is essential to track the behavior of users and learners. Users usually interact with a wide variety of tools that use learning objects in one way or another. Attention metadata given to learning objects in those tools can be tracked merged and analyzed to facilitate providing users with their relevant objects.
- **The ALOCOM ontology:** is a generic content model that defines a framework for RLOs and their components. The ontology defines concepts representing different RLO component types and their structure. This explicit definition of both content and structure enables the disaggregation of RLOs into their components.

- **Information visualization:** A technique which can enable users to find learning objects in learning object repositories in a more flexible and effective way than filling out electronic forms, which is the way it is currently done in repositories like the Ariadne Knowledge Pool System.
- **Automatic Metadata Generation (AMG):** One of the main concerns in learning technology research is the problem of acquiring the critical mass to establish real reuse. ARIADNE focus on is the creation of metadata. Without appropriate metadata no learning content will be really reusable because it will be difficult or impossible to identify and retrieve it. ARIADNE is currently working on a system to enable automatic creation of learning object metadata. In this way, the users do not have to bother with the metadata if they do not want to. This can be compared with search engines on the web that index web pages in the background without any intervention of the creator or the host of the site.

19.4 STRUCTURE AND COMPONENT OF LEARNING OBJECTS

The structure and composite nature of a learning object is still open to interpretation. Content models provide a framework for defining the structure, that is, the level of aggregation/granularity of learning objects. Cisco Systems proposed five aggregation levels for structuring learning content:

1) Subtopic
2) Topic or RIO (reusable information object)
3) Lesson or RLO (reusable learning object)
4) Module
5) Course

A course is comprised of a collection of modules, which in turn include collections of lessons. A lesson can be reusable in multiple courses and learning contexts. A lesson or reusable learning object consists of a single learning objective, an overview, a summary, and a collection of topics (or RIO), as well as practice activities, assessment, and metadata. In particular, five to nine reusable information objects can be combined to form a learning object (Barron, 2002). A topic is a self-contained reusable information object that consists of subtopics (such as small chunks of information of various types such as definitions, examples, tables, guidelines, etc.), assessment, practice activities, and metadata. Topics are grouped into five category types, including concepts, facts, procedures, processes, and principles. Both RLO and RIO components (such as content, activities, and assessment) can be represented in various media formats such as text, audio, animation, videos, Java code, applets, and other delivery media (Cisco Systems, 2003). It is worth mentioning, however, that although Cisco initially treated a single lesson as a learning object, for the purpose of terminological simplicity, Version 4.5 of the strategy regards each aggregation level (from topics to courses) as a learning object (Cisco Systems, 2003). This revision, however, broadens the scope of a learning object and does not specify its exact position in the course hierarchy as it did previously.

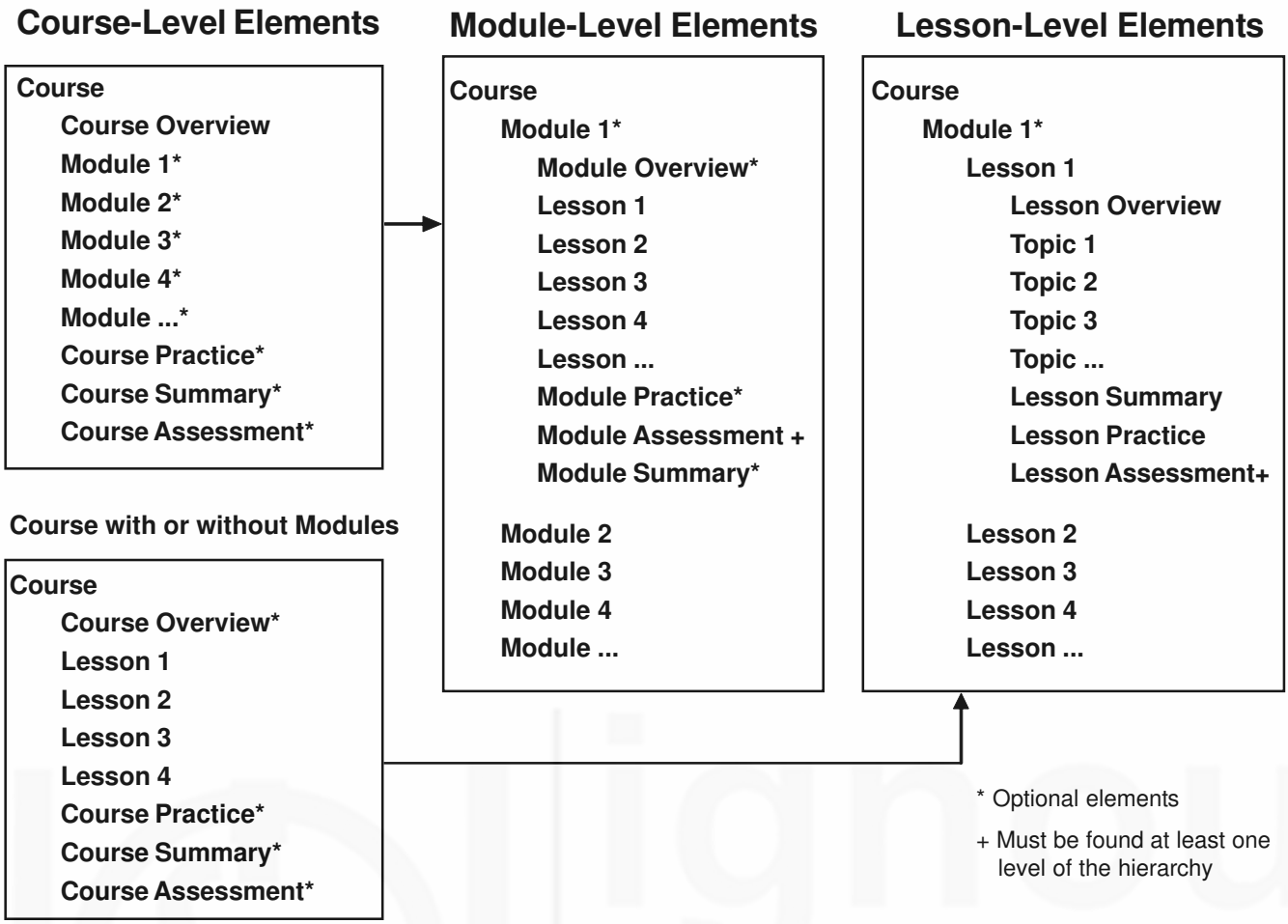

Figure 19.1: Elements of Learning Opbjects (*Source:* CISCO Systems, 2003)

Over the years, Cisco published a strategy for developing and implementing reusable learning objects (RLOs). This is known as Reusable Information Object Strategy (RIO). The RIO Strategy is built upon the Reusable Information Object (RIO). An RIO is granular, reusable chunk of information that is media independent. An RIO can be developed once, and delivered in multiple delivery mediums. Each RIO can stand alone as a collection of content items, practice items and assessment items that are combined based on a single learning objective. RIOs are then combined to form a larger structure called a Reusable Learning Object (RLO).

A Reusable Learning Object is created by combining an overview, summary, assessment and five to nine (7 +2) RIOs and it is shown in the Figure 19.2.

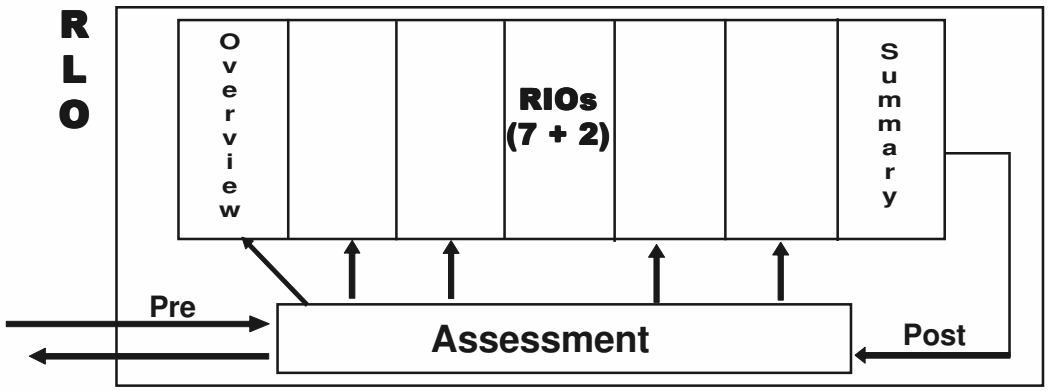

Figure 19.2: Components of Reusable Learning Objects
(*Source*: CISCO Systems, 1999)

An RLO is based on a single objective, derived from a specific job task. Each RIO is built upon an objective that supports the RLO's objective.

Inside RIO

Combining content items, practice items and assessment items creates a Reusable Information Object. Each RIO is built upon a single objective. As defined by Information Mapping, each RIO is classified as either being a Concept, Fact, Process, Principle or Procedure.

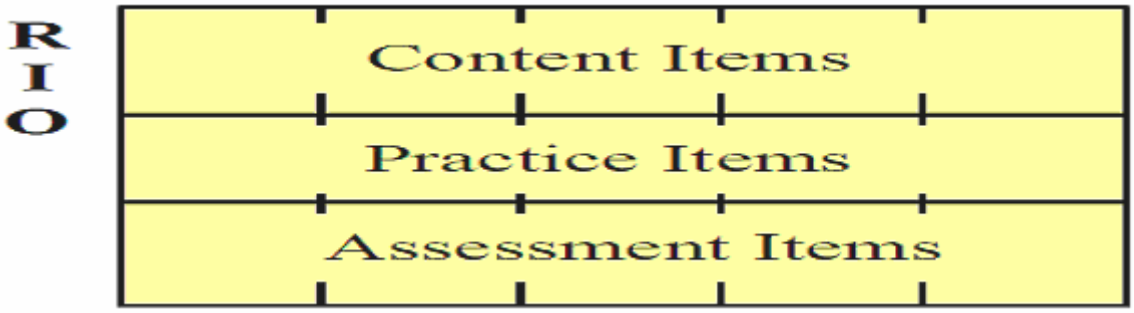

Figure 19.3: Components of Reusable Information Objects (*Source*: CISCO Systems, 1999)

The learner may choose to take the entire RLO, which could be called a "lesson." As in any traditional lesson, the RLO gives the Learner the needed learning context, the knowledge and skills they need to perform the given objective, and a method to assess mastery.

Practice Items: The intent of a practice activity is to assist the learner in encoding and integrating new knowledge, as well as to help the learner get ready for the final assessment. The practice provides instructional feedback and points to topics the learner should review for further study.

Assessment Items: The assessment is intended to be a final experience, associated with a passing or failing grade. Assessment is any activity designed to confirm that a learner has mastered the performance objectives at the course, module, or lesson level.

The following is a list of some of the types of information that may be included in a learning object and its metadata:

- General Course Descriptive Data, including: course identifiers, language of content , subject area , descriptive text, descriptive keywords
- Life Cycle, including: version, status
- Instructional Content, including: text, web pages, images, sound, video
- Glossary of Terms, including: terms, definition, acronyms
- Quizzes and Assessments, including: questions, answers
- Rights, including: cost, copyrights, restrictions on Use
- Relationships to Other Courses, including prerequisite courses
- Educational Level, including: grade level, age range, typical learning time, and difficulty.

Check Your Progress 19.4

Notes: a) *Write your answers in the space given below.*

b) *Compare your answers with those given at the end of this unit.*

1) What are the components of RIO?

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2) What are the aggregation levels of LO?

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19.5 LEARNING OBJECT CREATION PROCESS

The Cisco System Corporation proposed a four phase system for RLO's creation. Each of these phases interacts with each other. This system has built into it a blend of traditional Instructional System Design (ISD) steps as well as newer computer instructional elements (See Figure 19.4).

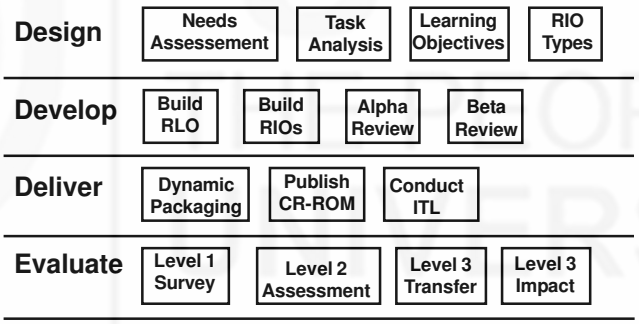

Figure 19.4: Instructional System Design for Learning Objects

As depicted in the Figure 19.4, the phases are:

- **Design** - The design phase is where the foundation of the learning event is created. There are four stages included in this phase: Needs Assessment, Task Analysis, Learning Objectives, and RLO Types. When designing learning objects, it is pertinent to consider how many objectives should be included. If too many are included, the object may become large, which will limit its ability to be reused by other individuals.
- **Develop** - Now that the Design phase has been completed, the RIOs can be developed. At this phase, text, graphics, video, and other content are built. Content items, practice items and assessment items are created based on the learning objects defined in the Design phase.
- **Deliver** - At the beginning of this phase, the RLO's are complete and produced. The RLO would be stored in a database and are ready of use. Packaging of the RLO for delivery to the user must be decided. Three common types of delivery are: Dynamic Web Packages, CD-ROM's, and Instructor-Led Training Materials.

- **Evaluate** - The evaluation phase is built off of Kirkpatrick's four levels of evaluation. According to Cisco using these four levels will allow the author or organization to be able to make judgements about the effectiveness of the RLO.

The details of all the phases are given in a Table 19.8:

Table 19.8: Steps in Creation and Use of Learning Objects

Design	Develop	Deliver	Evaluate
Need Assessment An RLO and each RIO must be created to solve a real need in the organization. The need must be measurable and quantifiable in order for the training intervention, or RIOs in this case, to be successfully implemented. **Task Analysis** In this step the Author relates the needs to specific job tasks. At this stage the Author identify the knowledge and skills that are critical to meet the training needs identified in Stage 1. With a specific job task identified, the Author adds other "need-to-know" information that helps the Learner learn the job task (such as a definition of a fact, or an explanation of a concept or process). The combination of these elements forms a hierarchy of RIOs, which are nested into RLOs. **Learning Objectives** Once the job tasks have been analyzed, the Author creates learning objectives for each RLO and for each RIO. Objectives tell the Learner what they must do in order to achieve mastery. For the Author, they identify what type of practice and assessment should be included in the RIO in order to assure mastery. Each objective consists of an action statement, a performance condition and a performance criterion. **RIO Types** The Author uses the learning objective to categorize each RIO as a concept, fact process, principle, and procedure.	**Build RLO** Using published guidelines and templates, the Author builds an RLO to meet the design requirements specified in the Design phase. Each RLO is constructed out of overview, RIOs (7 ± 2), summary, and assessment **Build RIOs** Using published guidelines and templates for each type of RIO (concept, fact, process, principle, and procedure), the Author builds an RIO to meet the requirements specified in the Design phase. Regardless of the type of RIO, each is built out these three elements: ▪ Content items ▪ Practice items ▪ Assessment items Media production for each item would also begin at this stage. This includes graphics, video clips, simulations and so on. **Alpha Review** An alpha version of a program is also known as a "pilot" version, which can be tested for overall usability and training effectiveness. **Beta Review** An important function of quality control and one of the last steps before release of a RLO. Beta testing involves the use of a RLO by selected users to create a formal documentation of content errors, software bugs, usability, level of engagement, and other factors.	**Dynamic Web Packages** In this case, Web pages are built as needed and delivered to the Learner through a Web browser. When the Learner wants to take a "lesson" or reference a "job aid" they simply request the raw items that make up the RLO and RIO from the database. Format and style sheets are then applied to the objects as they are packaged and delivered to the Learner's Web browser. **CD-ROM's** In cases where the Learner is separated from a network connection, due to travel, or other physical constraints, RLO-RIOs can be packaged onto a physical medium such as a CD-ROM. **ITL** The need for live, instructor led training will not diminish because of the availability of Web based training. The RIO Strategy supports the creation of instructor-led training materials such as student workbooks, instructor guides, learning activities and presentation materials. Because RIOs are stored free of format and style, they can be packaged using style sheets and templates specific for instructor-led training delivery.	**Level I Survey** Measures the Learner's reaction to the event (Did Learners like it?). Sometimes called "smile sheets," Level 1 measures if the Learner liked the training. It is all opinion based and does not test actual learning. However, the data collected at this level is important for business and development considerations. **Level II Assessment** Measures if the learning objectives have been met immediately following the event (Did Learners learn?). The Level 2 assessment should match the objective found in the RIO, and therefore must be job-task focused. **Level III Transfer** Measures the transfer of skills back to the job (Are they using it?). This level determines if the Learners actually are using what the RIO taught them when back on the job. Usually, transfer is measured through some type of 360 degree peer/manager review and by observation. Simply re-testing the Learner can indicate only if they still have the knowledge and skills, not if they are actually using them on the job. Ideally, the same instrument used during the needs would be used to test if job transfer occurred as a result of the RIO. **Level IV Impact** Measures the impact on the business (Did it matter?). Level 4 measures how the organization's bottom line was affected as a result of the RIO. Examples include increase in profitability, increase in customer satisfaction, increase in sales, and decrease in returns. Correlating business impact, productivity and return on investment (ROI) to any training intervention can be a laborious process.

19.6 TYPES OF LEARNING OBJECTS

CISCO has specified five types of learning objects: concept, fact, procedure, process, and principle.

Concept: A Concept RLO is used when you need to teach a group of objects, symbols, ideas, or events which:

- Are designated by a single word or term
- Share a common feature
- Vary on irrelevant features

A Concept RLO is made of content items (Introduction, Definition, Facts, Examples, Non-Examples, Analogy, and Instructor Notes), Practice items, and Assessment items

Fact: A fact RLO is unique in that it can be taught as either a standalone RLO or a link from another RLO. Facts are presented as statements, data, or pictures of specific objects. Use a fact topic when you need teach unique, specific, one-of-a-kind pieces of information. Ideally, a fact would have a link to the concept, procedure, process, or principle that it is referencing (or vice versa). Sequence facts so that they flow logically within the lesson, or better yet, link a fact to the other topics that reference that fact.

Procedure: A procedure is a sequential set of steps to be followed by one individual to accomplish a task or make decisions. It lists directions for procedural tasks. Actions within a procedure must be done the same way each time (within a given situation). Use a procedure RLO when you need to teach a procedure performed on the job. For the learner to be successful, the procedures must be clear. In addition, the RLO must provide job-based practice for transfer to the job. Typically, a procedure RLO will come after a concept or process RLO. For example, if you are creating a lesson to teach the configuration of a router, the concept topic titled "What is a Router?" may be taught first.

Process: Use a process RLO when you need to teach how a system works. A process RLO is helpful in supporting underlying job tasks, providing motivation, and ensuring the overall quality of job performance. A process can be defined as:

- A flow of events that describes how something works
- A task that involves many persons or organizations, not a task to be done by one person
- Mechanical, business, or scientific

You can place a process RLO at any point within a lesson. If the goal of the lesson is to teach the process, then multiple processes may be included with concept topics. If a process topic is being presented to establish the context of a procedure, then it should come before the procedure topic within the lesson.

Principle: Use a principle RLO when you need to create a job task that requires judgment or when guidelines must be applied to a job situation. Typically, a principle RLO will come after a concept or process RLO. For example, if you are creating a lesson to teach the guidelines for handling employee conflicts, the concept topic titled "What Is a Conflict?" may be taught first.

Here are some examples of things you would teach using a principle RLO:

- Guidelines for handling employees with personal problems
- Guidelines for designing effective visual aids
- Responding appropriately to an angry customer
- Designing learner-centered training

Table 19.9 gives a comparison of all five types with example.

Table 19.9: Types of Learning Objects

Item	Definition	Examples	Sample Titles
Concept	A group of objects, symbols, ideas, or events that are defined by a single word or term, share common features, and vary only in irrelevant features.	Look for multiple examples of the class or group that share common features and that are designated by a single word or term; for example: user, forms, router, needs, requirements, or PSTN.	• "What Is the PSTN?" • "What Is a Router?"
Fact	Unique, specific information in the form of a statement or data or pictures of specific objects.	Look for unique specific information in the form of a statement or data or picture of specific objects; for example, the setup script on the Cisco 2500 router, or the number of card slots on a Catalyst 5500 switch.	• "About the Cisco 2500 Router Setup Script" • "About Cisco Catalyst 5500 Switch Slots" • "About the Footprint Size of the Cisco 7600 Router"
Procedure	A sequence of steps to be followed by one individual to accomplish a task or make a decision. A procedure contains directions or procedural tasks and contains actions that are done the same way each time.	Look for directive steps, second person language, and active voice; for example, how to log on to a computer.	• "How to Log on to a Computer" • "How to Access the Learning Content Development Pack"
Process	A flow of events that describes how something works. It is not necessarily a task done by one person; many people or an organization may be involved.	Look for descriptive stages, third person language, and passive voice; for example, identifying data link layer problems.	• "Identifying Common Physical and Data Link Layer Problem • Resolutions" • "Routing Messages" • "Implementing the Course Development Process"
Principle	Directions for tasks that provide employees with guidelines for action. Employees must adapt the guidelines to various job situations. Principles require employees to use judgment and discretion when they apply them. Ask yourself these questions: Is the task completed in a different way each time? Does the outcome of the task rely on the circumstances and on the learner's judgment?	Look for guidelines and judgment calls; for example, designing a multilayer switched network.	• "Guidelines for Designing a Multilayer Switched Network" • "Positioning the Cisco Catalyst • 5500 to IT Managers" • "Handling Customer Objections"

(***Source***: CISCO Systems, 2003)

Check Your Progress 19.5

Notes: a) *Write your answer in the space given below.*

b) *Compare your answer with the one given at the end of this unit.*

What are the five types of LOs? Give example of each of them.

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19.7 LET US SUM UP

In this unit we discussed the concept of reusable learning objects, and associated industry standards to develop learning objects. We discussed that learning objects mean many things to many people, and therefore, a common understanding is important. We defined learning objects as digital object/resource that is adaptable, reusable, independent, granular, and interoperable in nature. We discussed the characteristics and advantages of learning objects (LOs). LO being reusable, can save resources and also save development time of online courses. However, there are also criticisms for the learning object strategy, as it has its origin in the Army, and at a very simple level, learning is contextual, and objects cannot carry the context with them.

We also described the learning object metadata standards and specifications including Dublin Core, Instructional Management Specifications, AICC standards, and the IEEE-LTSC standards. We described the structure and components of learning objects using the CISCO framework. Learning objects includes a set of 7±2 reusable information objects, and they can be aggregated at the level of course, lesson and topic. While the instructional system design model is applicable to development of learning objects, we also should develop these considering the type applicable to different subject areas. There are five types of learning objects: concept, fact, procedure, process, and principle. We hope the discussion in this unit would give you an overview of the world of learning objects, as we have not gone into the practical aspects developing standard compliant learning objects.

19.8 KEYWORDS

AICC: Aviation Industry CBT Committee. An emerging set of standards The AICC sets guidelines in the development, delivery, and evaluation of e-learning programs. These guidelines are developed specifically for the aviation industry, but are being widely adopted in a variety of other industries.

Authoring tool: Software application used to produce interactive learning materials that bring together all components of a course, such as text presentation, graphics, tracking, and links.

Courseware: Software designed specifically for use in a classroom or other educational setting, containing instructional material, educational software, or audiovisual materials. “Courseware” is a term used to describe software resources which are used for Computer-Assisted Learning (CAL). to mediate or support a course or module.

Learning Content Management System (LCMS): A web-based administration program that facilitates the creation, storage and delivery of unique learning objects, as well the management of students, rosters, and assessments.

Learning Management System (LMS): A program that manages the administration of training. Typically includes functionality for course catalogs, launching courses, registering students, tracking student progress and assessments.

Metadata: Information about content that allows it to be stored in and retrieved from a database.

Reusable information objects (RIO): A collection of content, practice, and assessment items based on a learning objective.

Reusable learning objects (RLO): Information, based on RIOs, overviews, summaries, and assessments that supports a specific learning objective.

SCORM: The Sharable Content Object Reference Model (SCORM) integrates a set of related technical standards, specifications, and guidelines designed to meet SCORM's high-level requirements—accessible, interoperable, durable, and reusable content and systems. It is a series of e-learning standards that specify ways to catalog, launch and track course objects

19.9 REFERENCES AND FURTHER READINGS

Barritt, C., & Alderman, F.J., Jr, (2004). *Creating a Reusable Learning Object Strategy*, San Francisco: Pfeiffer

Cisco Systems (199). Reusable Information Object Strategy: Definition, Creation Overview, and Guidelines Version 3, 1999 http://www.cisco.com/warp/public/779/ibs/solutions/learning/whitepapers/el_cisco_rio.pdf

Cisco Systems (2003). Reusable Information Object Strategy: Definition, Creation Overview, and Guidelines Version 4.5 at http://www.e-novalia.com/materiales/RLOW__07_03.pdf

Friesen, N. (2003). Three Objections to Learning Objects and E-learning Standards. Available online at http://learningspaces.org/n/papers/objections.html

Harman, K., & Koohang, A. Eds. (2007). *Learning Objects and Instructional Design*, Santa Rosa: Information Science Press.

Harman, K., & Koohang, A. Eds. (2007). *Learning Objects: Standards, Metadata, Repositories & LCMS*, Santa Rosa: Information Science Press.

L'Allier, J. J. (1998). *NETg's precision skilling: The linking of occupational skills descriptors to training interventions* [On-line]. Available: http://www.netg.com/research/pskillpaper.htm

Littlejohn, A. Ed. (2003). *Reusing Online Resources: A sustainable approach to e-learning*, London: Kogan Page

McGreal, R (2009). Learning Objects: A Practical Definition. Available at http://itdl.org/Journal/Sep_04/article02.htm

McGreal, R. Ed. (2004). *Online Education Using Learning Objects*, Abingdon: RoutledgeFalmer

Rogers, P., Howard, C.(Ed.)(2007) Encyclopedia of Distance Learning(2nd Ed.). Google Books. Available online at http://books.google.com/books?id=sC9Le3jIwzIC&printsec=frontcover&source=gbs_navlinks_s

Smith, R.S. (2004). Guidelines for Writers of Learning Objects. The New Media Consortium: Austin, Texas

Wiley, A.D. (2001). Connecting learning objects to instructional design theory: A definition, a metaphor, and a taxonomy [On-line]. Available at http://www.elearning-reviews.org/topics/technology/learning-objects/2001-wiley-learning-objects-instructional-design-theory.pdf

Wisher, R. (2009). Sharable Content Object Reference Model (SCORM)® 2004 4th Edition: Overview, Version 1 by ADL Initiatives. Retrieved from http://www.adlnet.gov

19.10 FEEDBACK TO CHECK YOUR PROGRESS QUESTIONS

Check Your Progress 19.1

1) Your definition of learning object should include the characteristics such as reusable, digital, adaptable, interoperable, granular, independent nature of learning resource.

2) Your answer may include any five of the listed characteristics such as: usability, adaptability, reusability, contextual neutrality, interactivity, independent, and interoperable.

Check Your Progress 19.2

1) Three advantages of learning objects are: it saves financial resources, its saves time and effort to build the LO, and high quality of interactive resource.

2) The major objections to learning object strategy are: the definition of LO is too simple to be accepted as such, and learning being contextual, and LOs being context independent their utility is questionable, and since the concept emerged in the Army, it may not be applied in education.

Check Your Progress 19.3

1) Five basic Dublin Core metadata elements are: creator, format, language, date and publisher. However there are 1o other elements, and if you have written any of those, you are in correct path.

2) In the context of IMS, the competency standard gives specifications for common understanding of competencies as part of career plan as learning pre-requisites or as learning outcomes. The information model in this specification can be used to exchange information between learning systems, content repositories, and other human resource performance systems.

3) SCORM is the short form of Sharable Content Object Reference Model. It is an initiative of the Advanced Distributes Learning (ADL) of US Department of Defense. It is a collection of specifications and standards for creation of interoperable, accessible, durable, affordable, and re-usable learning objects.

Check Your Progress 19.4

1) The components of RIO are: Content items, Practice items, and Assessment Items.

2) The learning objects can be aggregated at the course level, lesson level and topic level.

Check Your Progress 19.5

The five types of Learning Objects are: conceptual, factual, procedural, process-orientated and principle-based. Example of each one is as follows:

Concept	What is an Open University?
Fact	A description about IGNOU as Open University
Procedure	How to log on to the Internet using an ISP
Process	Steps in instructional design model such as ADDIE
Principle	The principles of multimedia design