# IMS Reusable Definition of Competency or Educational Objective - Information Model

## Version 1.0 Final Specification

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Document Name: IMS Reusable Definition of Competency or Educational Objective - Information Model

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# Table of Contents

# 1. Introduction

## 1.1 Overview

This specification defines an information model for describing, referencing, and exchanging definitions of competencies, primarily in the context of online and distributed learning. In this specification, the word competency is used in a very general sense that includes skills, knowledge, tasks, and learning outcomes. This specification gives a way to formally represent the key characteristics of a competency, independent of its use in any particular context. It enables interoperability among learning systems that deal with competency information by providing a means for them to refer to common definitions with common meanings.

The core information in a Reusable Definition of Competency or Educational Objective (RDCEO) is an unstructured textual definition of the competency that can be referenced through a globally unique identifier. This information may be refined using a user-defined model of the structure of a competency.

The 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. RDCEO provides unique references to descriptions of competencies or objectives for inclusion in other information models.

The RDCEO that conform to this specification are intended for interchange by machines, but the information they contain is currently intended for human interpretation. This specification does not address the aggregation of smaller competencies into larger competencies (e.g., “throws” plus “catches” equals “plays ball”) and does not address how competencies are to be assessed, certified, recorded, or used as part of a process such as instructional design or knowledge management. It also does not specify how records of competencies associated with an individual are structured, stored, or exchanged.

## 1.2 Scope and Context

This document is the IMS Reusable Definition of Competency and Educational Objective Specification version 1.0. As such it forms one of a set that comprise the specification, each with distinct scope:

**Information Model**

Describes the core aspects of the specification and is normative for any binding claiming to use this information model. It contains details of: semantics, structure, data types, value spaces, multiplicity, and obligation (i.e., whether mandatory or optional).

**XML Binding**

Describes a binding of the Information Model to XML version 1.0 and is normative for any XML instance that claims to use this binding, whether by reference to the specification or by declaration of the namespace reserved by the specification. In cases of error or omission, the Information Model takes precedence. The RDCEO XML Binding is released with a control document using W3C Schema Language that should be used in implementations.

**Best Practices and Implementation Guide**

Provides non-normative guidance on application of the Information Model and XML Binding. This includes reference to existing practice in handling information that this specification seeks to support and guidance on practices that will promote interoperability and durability. It also includes examples to illustrate how the conceptual framework maps to practical uses and to identify the relationship between this specification and related IMS specifications. Implementers are encouraged, but not required, to follow guidance in this part of the specification.

## 1.3 Structure of this Document

The structure of this document is:

| | |
|---|---|
| 2. Discussion of the Information Model | Introduces the RDCEO information model, its intent and use. |
| 3. Rdceo Elements | Provides a detailed description of the RDCEO elements in terms of their properties and attributes. |

## 1.4 Nomenclature

| | |
|---|---|
| ADL | Advanced Distributed Learning |
| DTD | Document Type Definition |
| IEEE | Institute of Electronic & Electrical Engineering |
| ISO | International Standards Organization |
| JTC | Joint Technical Committee |
| LTSC | Learning Technology Standards Committee |
| RDCEO | IMS Reusable Definition of Competency or Educational Objective (this specification) |
| SCORM | Shareable Courseware Object Reference Model |
| W3C | World Wide Web Consortium |
| XML | Extensible Mark-up Language |

## 1.5 References


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|---|---|
| (A2A) | http://www.aligntoachieve.org (Align to Achieve) |
| (ACRL) | http://www.ala.org/acrl/ilstandardlo.html (Association of College and Research Libraries. Information Literacy Competency Standards for Higher Education: Standards, Performance Indicators, and Outcomes) |
| (CASAS) | http://www.casas.org/ |
| (CPA) | http://www.cpavision.org/poll/corecomp.cfm (Core Competencies for CPAs) |
| (HR-XML) | http://www.hr-xml.org/ (HR-XML Consortium) |
| (IEEE LOM) | http://ltsc.ieee.org (IEEE 1484-12:2002, Standard for Learning Object Metadata) |
| (IMSBUND) | http://www.imsglobal.org/implementationhandbook/imspack_handv1p0.html (Using IMS Content Packaging to Package Instances of LIP and Other IMS Specifications) |
| (IMSMD) | http://www.imsglobal.org/metadata/ (IMS Meta-Data Specification) |
| (IMSPLID) | http://www.imsglobal.org/implementationhandbook/imsrid_handv1p0.html, IMS Persistent, Location-Independent, Resource Identifier Implementation Handbook version 1.0 |
| (LSDA) | http://www.lsda.org.uk/ (Learning and Skills Development Agency) |
| (Mager) | Robert Mager, 1984. Preparing Instructional Objectives, 2nd Edition. Lake Pub. Co., Belmont, CA. |
| (NOCN) | http://www.nocn.org.uk/ (National Open College Network) |

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|---|---|
| (NOICC) | http://www.academicinnovations.com/noicc.html (National Occupational Information Coordinating Committee: High School Student Competencies and Indicators) |
| (O*NET) | http://online.onetcenter.org/ (or http://www.access.gpo.gov/o_net/datadict/datadict.pdf) |
| (Ostyn) | http://ltsc.ieee.org/doc/wg20/CompDefInit.doc (Base document from P1484.20) |
| (PASS) | http://www.ous.edu/pass/standards/admission.html (Oregon Proficiency-based Admissions Standards System) |
| (RFC 2396) | http://www.ietf.org/rfc/rfc2396.txt (Uniform Resource Identifiers) |
| (SCANS) | http://www.tier.net/tcenters/scans.htm (Secretary's Commission on Achieving Necessary Skills: Competencies) |
| (SCORM) | http://www.adlnet.org (ADL SCORM) |
| (TATS) | http://www.adtdl.army.mil/atdls.htm (Total Army Training System) |
| (XPOINTER) | http://www.w3.org/TR/xptr-framework/ (XPointer Framework, Working Draft 10 July 2002) |

# 2. Discussion of the Information Model

The RDCEO data model is minimalist and extensible. It is purposely neutral with regard to models of competencies and the use of competencies. Competencies are defined and structured in many ways in different communities of practice (ACRL, CASAS, CPA, Mager, NOICC, O*Net, PASS, SCANS, TATS). This specification allows communities of practice to exchange information according to the model they use.

Extensibility can be achieved by defining the structure of the Definition of Competency or Educational Objective or by including Learning Object Metadata (LOM) elements in the Metadata portion.

The information model contains the following elements:

1) **Identifier:** A globally unique label that identifies this Definition of Competency or Educational Objective. This identifier uses the same data elements as the Identifier element defined in the IEEE LOM standard, and consists of two sub-elements: Catalogue and Entry. The Identifier is sufficient to reference the competency in any other system.

2) **Title:** A single mandatory text label for the competency or objective. This is a short human-readable name for the competency. While the Identifier provides the definitive reference to the definition, it is typically unintelligible. The Title provides a convenient alternative readable form, but one which is not the definitive label. The Title may be repeated in multiple languages.

3) **Description:** A human readable description of the competency. This is an optional unstructured (opaque) “text blob” meant to be interpretable only by humans. The Description may be repeated in multiple languages.

4) **Definition:** An optional structured description that provides a more complete definition of the competency or educational objective, usually using attributes taken from a specific model of how a competency or educational objective should be structured or defined. Typically, such models define a competency or educational objective in terms of a “statement, conditions, criteria”, “proficiency, criteria, indicators”, “standards, performance indicators, outcomes”, “abilities, basic skills, content, process”, and similar sets of statements.

   The Definition element provides a structure for including an arbitrary collection of statements that determine a competency or educational objective. The author of a RDCEO is free to use the Definition element in the way that best describes the competency or objective. The accompanying best practices guide and examples will illustrate potential ways to express different types of competencies, objectives, and competency or objective models using the Definition element.

   The Definition element contains the following sub-elements:
   **Model Source:** An identifier of the model or structure upon which the definition is based. The model defines which statements are used to define the competency; it defines the namespace and value-set of content for “Statement Name” below.
   **Note:** The value of Model Source should be specific enough to avoid conflict with other source names; therefore it is recommended that this value be a URI. If the value of Model Source is a URI, it may point to an actual document that defines the source formally. However, this is not required.

   **Statement:** A Statement is a description of a single characteristic of a definition. A definition must contain at least one and generally contains multiple statements. A statement has the following parts:

   **Statement Id:** An optional string that is a local identifier for the statement within the model.

   **Statement Name:** An optional name that is a token used to label the statement. The token is taken from a sourced vocabulary defined in the model identified by the Source element.

   **Statement Text:** An optional unstructured textual description of those aspects of the competency referred to by the StatementName. The StatementText may be repeated in multiple languages.

   **Statement Token:** An optional vocabulary token, along with an identifier of the source of the vocabulary.
   **Note:** Although all elements are optional, in practice a statement should contain at least one or more of these elements in order to be useful. For example, a particular learning objective model requires a list of

specific statement strings, each of which has a specific name, such as “Condition”, “Performance” and “Standard”; a Definition matching this model would use the elements Statement Name and Statement Text.

5) **Metadata:** Optional meta-data record that further describe the RDCEO.

If a meta-data record is included, it is recommended that this record conform to IEEE 1484-12.1-2002: Standard for Learning Object Metadata (IEEE LOM). In such conforming records, the version of the Metadata Specification standard is given in the meta-metadata element of the meta-data record.

**Note:** Useful meta-data defined in the IEEE LOM include additional identification as an entry in one or more catalogues, information about the author, the creation date, and the coverage (in the sense of the Dublin Core as adopted by the IEEE LOM.) The Relation element may be used to relate a definition to a prior version of the definition, and one or more Classification elements may be used to indicate where this particular definition fits in a taxonomy of competencies or educational objectives.

More than one meta-data record is allowed, but if there is more than one record each record should conform to a different meta-data specification. An implementation must accept any meta-data record that it cannot interpret, but it is not required to interpret such meta-data records.
**Note:** A particular binding specification or application profile may impose additional restrictions or requirements.

## 2.1 Data Types, Multiplicities, and Obligations

The only data types used in this specification, other than those used by the <metadata> element, are strings LangStrings and sourced vocabularies. All strings that represent human-interpretable information are of data type LangString, which includes a language attribute. All human-readable strings may be represented in multiple languages. Any element with a value space of the LOM LangString data type may have multiple lingual instances of strings that are values for that element. The method of expressing LangStrings in the XML binding will be harmonized with other IMS bindings. The information model is not concerned with encoding of strings but bindings should permit 32-bit character encoding as defined by ISO 10646-1:2000.

Sourced vocabularies are tokens represented as strings. The tokens are represented in only one language. The token encoding should permit 32-bit characters.

The identifier, title, and definition are mandatory. All other top-level elements are optional. Each Statement element must contain at least one StatementText element.

The <metadata> element may be repeated. All other top-level elements must appear at most once or at most once per language.

## 2.2 Ordering of Data Elements

All elements in this data model are intrinsically unordered. The order of the elements in the data model summary and the order of the values in a list of values bear no meaning. For example, if the model includes three statements, then the order of these statements is not significant. They may appear in any order without loss of information.

**Note:** A binding may impose a particular ordering on RDCEO data instances that conform to that binding. Other than conformance to the binding, no significance is associated or should be inferred from that ordering requirement. In particular, the ordering of Statement elements in a Definition is undefined.

## 2.3 Taxonomies of Competency or Objective Definitions

There are various ways to classify competencies or educational objectives. This specification is intended to meet the simple need of referencing and cataloguing a competency or objective, not classifying it. Nonetheless, an implementation might want to include relation and classification information, which can be done through the embedding of optional meta-data as specified in the information model.

# 3. RDCEO Elements

## 3.1 Summary

| No | Name | Explanation | Reqd | Mult | Value Space | Datatype | Notes |
|---|---|---|---|---|---|---|---|
| 1 | Identifier | A globally unique label that identifies this Definition of Competency or Objective | M | Single | | | |
| 1.1 | Catalog | The name or designator of the identification or cataloguing scheme for this entry. A cataloguing scheme. | M | Single | Repertoire of ISO/IEC 10646-1:2000, as allowed by RFC 2396 | Character String (smallest permitted maximum: 1000 characters) | Examples: "ISBN", "ARIADNE", "URI", "http://acme.org/compmodcat" |
| 1.2 | Entry | The value of the identifier within the identification or cataloguing scheme that designates or identifies this Definition of Competency or Educational Objective. A namespace specific string | M | Single | Repertoire of ISO/IEC 10646-1:2000, as allowed by RFC 2396 | Character String (smallest permitted maximum: 1000 characters) | Examples: "2-7342-0318", "LEAO875", "http://imsglobal.org/dco/1234" |
| 2 | Title | Text label of this RCEOD | M | Single * | | LangString(smallest permitted maximum: 1000 characters) | Examples: "English proficiency", "Schmiblick failure diagnostic level 4", "Demonstrates conflict resolution skills" |
| 3 | Description | Description of the Competency or Educational Objective | O | Single * | | LangString(smallest permitted maximum: 2000 characters) | Examples: "Proficiency in written and spoken English and use of English for meaningful oral or written expression.", "Performance of level 4 diagnostic as specified in IETM #SCMBLK007" |
| 4 | Definition | A list of statements according to a particular definition model | O | Multiple | | | |
| 4.1 | Model Source | Source of the Model being used | O | Single | Repertoire of ISO/IEC 10646-1:2000, as allowed by RFC 2396 | Character String (smallest permitted maximum: 1000 characters) | Examples: "3-part-learning-objective", "http://foo.edu/ref/los.xml" |
| 4.2 | Statement | | O | Multiple | | | |
| 4.2.1 | Statement ID | A local identifying label for the Statement | O | Single | | Character String (smallest permitted maximum: 4096 characters) | |

| No | Name | Explanation | Reqd | Mult | Value Space | Datatype | Notes |
|---|---|---|---|---|---|---|---|
| 4.2.2 | Statement Name | Name of the Statement | O | Single | String | | Examples: "Condition", "Action", "Standard", "Outcome", "Criteria" |
| 4.2.3 | Statement Text | Text of the statement | O | Single * | LangString | | Example: "Given a set of integer numbers in the range 1 to 49" |
| 4.2.4 | Statement Token | Token value for the statement | O | Single | Vocabulary defined in definition model | Vocabulary (state) | |
| 5 | Metadata | Embedded Metadata about this RDCEO | O | Single | | | |
| 5.1 | RDCEO Schema | Describes the schema that defines and controls this RDCEO | O | Single | Repertoire of ISO/IEC 10646-1:2000, as allowed by RFC 2396 | Character String (smallest permitted maximum: 100 characters) | If no schema element is present in a RDCEO instance, its value is assumed to be "IMS RDCEO" |
| 5.2 | RDCEO Schema Version | Describes the version of the above schema. | O | Single | Repertoire of ISO/IEC 10646-1:2000, as allowed by RFC 2396 | Character String (smallest permitted maximum: 20 characters) | If no schema version element is present in a RDCEO instance, its value is assumed to be "1.0" |
| 5.3 | {Additional Metadata} | Additional embedded Metadata describing this RDCEO | O | Multiple | The information contained in this section is defined by the IMS Metadata specification. | Smallest permitted maximum 10 | See Best Practice document guidance for Metadata records |

* Elements with type “LangString” and multiplicity “single” must appear at most once per language but may appear multiple times with different language attributes. The smallest permitted maximum of such expressions of a LangStrings is 10.

## 3.2 Datatypes

LangString is as defined in IEEE 1484-12.1-2002: Standard for Learning Object Metadata (IEEE LOM). A LangString is a composite datatype that includes a character string and information that identifies the language of the string.

Vocabulary is as defined in IEEE LOM. A Vocabulary data element type is a composite datatype that includes an identifier of the source vocabulary and a token value.

## 3.3 Smallest Permitted Maximum Values

In the Information Model, smallest permitted maximum values are defined for:

- Items with multiple values: All applications that process RDCEO instances shall process at least that number of entries stated. In other words: an application may impose a maximum on the number of entries it processes for a data element with multiple values, but that maximum shall not be lower than the smallest permitted maximum value.
- Data elements with type CharacterString or LangString: All applications that process RCD instances shall process at least that length for the CharacterString value (either directly or contained in the LangString) of that data element. In other words: an application may impose a maximum on the number of characters it processes for the CharacterString value of that data element, but that maximum shall not be lower than the smallest permitted maximum value for the data type of the data element.

  **Note 1:** The intent is for the smallest permitted maximum values to cover most cases.

  **Note 2:** What “processing” means in the above depends on the nature of the application.

# About This Document

| | |
|---|---|
| **Title** | IMS Reusable Definition of Competency or Educational Objective - Information Model |
| **Editors** | Adam Cooper, Claude Ostyn |
| **Team Leads** | Dan Rehak, Claude Ostyn, Robby Robson |
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| **Document Location** | http://www.imsglobal.org/competencies/rdceov1p0/imsrdceo_infov1p0.html |

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# Revision History

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| Base Document | 3 November 2000 | Document first proposed to the IMS Technical Board. |
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| Final Version 1.0 | 25 October 2002 | The first formal release of the IMS Reusable Definition of Competency or Educational Objective - Information Model. |