

1 **IEEE 1484.20.1/Draft 4**  
2 **Draft Standard for Learning Technology—**  
3 **Standard for Reusable Competency Definitions**

4 Sponsor  
5 Learning Technology Standards Committee  
6 of the  
7 IEEE Computer Society  
8

9 **Abstract:** This Standard defines a data model for describing, referencing, and shar-  
10 ing competency definitions, primarily in the context of online and distributed learning.  
11 This Standard provides a way to represent formally the key characteristics of a com-  
12 petency, independently of its use in any particular context. It enables interoperability  
13 among learning systems that deal with competency information by providing a means  
14 for them to refer to common definitions with common meanings.

15 **Keywords:** competency, competency definition, reusable competency definition

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38

39 *[NOTE: Information about IEEE LTSC P1484.20 can be found at:*

40 <http://www.ieeeltsc.org/>

41 *This note will be removed upon reaching the final draft of this IEEE document.]*

## 42 **Introduction**

43 (This introduction is not a part of P1484.20.1, Draft Standard for Learning Technology—  
 44 Standard for Reusable Competency Definitions.)

45 This Standard defines a data model for describing, referencing, and sharing competency defi-  
 46 nitions, primarily in the context of online and distributed learning. This Standard provides a  
 47 way to represent formally the key characteristics of a competency, independently of its use in  
 48 any particular context. It enables interoperability among learning systems that deal with com-  
 49 petency information by providing a means for them to refer to common definitions with com-  
 50 mon meanings.

## 51 **Participants**

52 At the time this Standard was completed, the working group had the following membership:

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53 The following persons were on the balloting committee: (To be provided by IEEE editor at  
 54 time of publication.)

## 55 **Acknowledgements**

56 This Standard is based on the “IMS Reusable Definition of Competency or Educational Ob-  
 57 jective Specification,” Version 1.0, published on October 25, 2002 by the IMS Global Learn-  
 58 ing Consortium, Inc.

59	<b>Contents</b>	
60	<b>1. Overview</b> .....	<b>1</b>
61	1.1 Scope .....	1
62	1.2 Purpose .....	1
63	<b>2. Normative references</b> .....	<b>1</b>
64	<b>3. Definitions, acronyms, and abbreviations</b> .....	<b>2</b>
65	3.1 Definitions.....	2
66	3.2 Acronyms and abbreviations.....	3
67	<b>4. Conformance</b> .....	<b>3</b>
68	4.1 Shall and shall not.....	3
69	4.2 RCD instances.....	3
70	4.3 Smallest permitted maximum values.....	4
71	<b>5. Data model</b> .....	<b>4</b>
72	5.1 General information.....	4
73	5.2 Reusable competency definition .....	5
74	5.2.1 Identifier.....	6
75	5.2.2 Title .....	6
76	5.2.3 Description.....	7
77	5.2.4 Definition .....	7
78	5.2.5 Metadata.....	11
79	5.3 Auxiliary data types.....	13
80	5.3.1 Any type.....	13
81	5.3.2 LangString type .....	13
82	5.3.3 Long identifier type .....	15
83	<b>Annex A (informative) Bibliography</b> .....	<b>16</b>
84	<b>Annex B (informative) Conceptual overview</b> .....	<b>17</b>
85	<b>Annex C (informative) Sample XML Binding Schema</b> .....	<b>21</b>
86		

# 87 **Draft Standard for Learning Technology—** 88 **Reusable Competency Definitions**

## 89 **1. Overview**

### 90 **1.1 Scope**

91 This Standard defines a data model for describing, referencing, and sharing competency defini-  
92 tions, primarily in the context of online and distributed learning. This Standard provides a  
93 way to represent formally the key characteristics of a competency, independently of its use in  
94 any particular context. It enables interoperability among learning systems that deal with com-  
95 petency information by providing a means for them to refer to common definitions with com-  
96 mon meanings.

97 This Standard enables information about competencies to be encoded and shared. It does not  
98 define whether a competency is a skill, knowledge, ability, attitude or learning outcome but  
99 can be used to capture information about any of these. This Standard does not specify policies  
100 regarding reusable competency definitions (RCDs), such as the best practice to look for an  
101 existing definition to reuse instead of inventing a new one for the same purpose.

### 102 **1.2 Purpose**

103 The purpose of this Standard is to publish an IEEE standard based on the existing IMS Global  
104 Learning Consortium (IMS) specification for Reusable Definition of Competency or Educa-  
105 tional Objective (RDCEO) [B2]<sup>1</sup>. This Standard is to be defined in such a way that im-  
106 plementations that conform to the IMS specification will be conformant to this Standard.

## 107 **2. Normative references**

108 The following referenced documents are indispensable for the application of this Standard.  
109 For dated references, only the edition cited applies. For undated references, the latest edition  
110 of the referenced document (including any amendments) applies.

---

<sup>1</sup> The numbers in brackets correspond to those of the bibliography in Annex A.

- 111 IEEE 1484.12.1–2002: Standard for Learning Object Metadata.<sup>2</sup>
- 112 IETF RFC 2396:1998, Uniform Resource Identifiers (URI): Generic Syntax.<sup>3</sup>
- 113 ISO 639–1, Code for the representation of names of languages – Part 1: Alpha-2 code.<sup>4</sup>
- 114 ISO 639–2, Codes for the representation of names of languages – Part 2: Alpha-3 code.
- 115 ISO 3166–1, Codes for the representation of names of countries and their subdivisions – Part  
116 1: Country codes.
- 117 ISO/IEC 10646–1:2000, Information technology – Universal Multiple-Octet Coded Character  
118 Set (UCS)—Part 1: Architecture and Basic Multilingual Plane.<sup>5</sup>
- 119 ISO/IEC 11404:1996, Information technology – Programming languages, their environments  
120 and system software interfaces – Language-independent datatypes.
- 121 W3C Recommendation (28 October 2004), XML Schema Part 2: Datatypes, Second Edition.<sup>6</sup>

## 122 **3. Definitions, acronyms, and abbreviations**

### 123 **3.1 Definitions**

124 For purposes of this document, the following terms and definitions apply. *The Authoritative*  
125 *Dictionary of IEEE Standards Terms* [B1] should be referenced for terms not defined in this  
126 Clause.

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<sup>2</sup> IEEE publications are available from the Institute of Electrical and Electronics Engineers, Inc., 445 Hoes Lane, Piscataway, NJ 08854, USA (<http://standards.ieee.org/>).

<sup>3</sup> IETF publications are available from the Internet Engineering Task Force website at <http://ietf.org/rfc.html>.

<sup>4</sup> ISO publications are available from the ISO Central Secretariat, Case Postale 56, 1 rue de Varembe, CH–1211, Genève 20, Switzerland/Suisse (<http://www.iso.ch/>). ISO publications are also available in the United States from the Sales Department, American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, NY 10036, USA (<http://www.ansi.org/>).

<sup>5</sup> ISO/IEC publications are available from the ISO Central Secretariat, Case Postale 56, 1 rue de Varembe, CH–1211, Genève 20, Switzerland/Suisse (<http://www.iso.ch/>). ISO/IEC publications are also available in the United States from Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112, USA (<http://global.ihs.com/>). Electronic copies are available in the United States from American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, NY 10036, USA (<http://www.ansi.org/>).

<sup>6</sup> W3C publications are available from the World Wide Web Consortium, 32 Vassar Street, Room 32–G515, Cambridge, MA 02139, USA (<http://www.w3.org/>).

127 **competency:** Any form of knowledge, skill, attitude, ability, or learning objective that can be  
128 described in a context of learning, education or training.

129 **competency definition record:** An instance of a data structure that represents a reusable com-  
130 petency definition.

131 NOTE—The term “competency” is to be interpreted in the broadest sense to include learning ob-  
132 jectives (those things that are sought) and competency or competencies (those things that are  
133 achieved). The term “competency” is also used to include all classes of things that someone, or  
134 potentially something, can be competent in, although some communities of practice use the term  
135 with nuance, for example limiting its use to skill and excluding knowledge or understanding.

136 **LangString:** A data type that represents one or more character strings. A LangString value  
137 may include multiple semantically equivalent character strings, such as translations or expres-  
138 sions of a description in different languages.

## 139 **3.2 Acronyms and abbreviations**

140 IMS: IMS Global Learning Consortium

141 RCD: reusable competency definition

142 RDCEO: IMS Reusable Definition of Competency or Educational Objective

143 SPM: smallest permitted maximum

144 URI: Uniform Resource Identifier

145 URN: Uniform Resource Name

146 XML: Extensible Markup Language

## 147 **4. Conformance**

### 148 **4.1 Shall and shall not**

149 In this Standard, “shall” is to be interpreted as a requirement on an implementation; “shall not”  
150 is to be interpreted as a prohibition.

### 151 **4.2 RCD instances**

152 A conforming RCD instance shall be an instance of the data model as defined in Clause 5.

## 153 4.3 Smallest permitted maximum values

154 For data elements that have smallest permitted maximum (SPM) values, an implementation  
 155 that conforms to this Standard shall accept and process at least that number of entries or char-  
 156 acters specified by the SPM for the element and may accept and process a larger number.  
 157 SPM values are defined for

- 158 – **Items with multiple values:** All applications that process RCD instances  
 159 shall process at least the SPM number of entries. In other words, an applica-  
 160 tion may impose a maximum on the number of entries it processes for a data  
 161 element with multiple values, but that maximum shall not be lower than the  
 162 SPM value.
- 163 – **Data elements with type `CharacterString` or `LangString`:** All applications  
 164 that process RCD instances shall process at least the SPM length for the  
 165 `CharacterString` value (either directly or contained in the `LangString`) of that  
 166 data element. In other words, an application may impose a maximum on the  
 167 number of characters it processes for the `CharacterString` value of that data  
 168 element, but that maximum shall not be lower than the SPM value for the data  
 169 type of the data element.

170 NOTE 1—The intent is for the SPM values to cover most cases.

171 NOTE 2—The meaning of “process” in this subclause depends on the nature of the application.

172 NOTE 3—This Standard does not define any provision for whether or how a system may process  
 173 more than the SPM value for a particular data element.

## 174 5. Data model

### 175 5.1 General information

176 This Clause defines the data elements of an RCD. Unless otherwise noted, all components of  
 177 records are optional in an RCD instance. (See Annex B for a conceptual overview of RCDs  
 178 and the data model.)

179 NOTE 1—The use of ISO/IEC 11404:1996 notation in the synopses in 5.2 and 5.3 is for descrip-  
 180 tive purposes only. A complete implementation of the operations defined in ISO/IEC 11404:1996  
 181 is not required for conformance.

182 NOTE 2—The ISO/IEC 11404:1996 notation describes the semantics of the language-  
 183 independent data types across all bindings (e.g., implementation of a data type as itself, its sub-  
 184 types, its subclasses, and its specializations). For example, an ISO/IEC 11404:1996 record may  
 185 be implemented as an SQL table row, or as an Extensible Markup Language (XML)  
 186 `complexType`; an ISO/IEC 11404:1996 `characterstring` may be implemented in an encoding  
 187 (ISO/IEC 646, ISO/IEC 8859-1, UTF-8, UTF-16, UTF-32, etc., see [B3], [B4], [B6], [B7], [B8])  
 188 that supports the repertoire specified in the parameter to `characterstring` data type.

189 NOTE 3—All examples in 5.2 and 5.3 are informative and do not endorse any particular binding.

190 NOTE 4—The following language-independent data types used in this Standard are defined in  
191 ISO/IEC 11404:1996: bag, characterstring, and record.

192 NOTE 5—The labels for data elements and data types in the synopses in 5.2 and 5.3 are for refer-  
193 ence, only. An implementation is not required to use the same labels, as long as the data elements  
194 and data types are semantically equivalent.

195 NOTE 6—This Standard does not define a specific extension mechanism for the data model. Im-  
196 plementers may define bindings that allow additional elements, or create additional data models  
197 for competency data. Such models may be used to augment this model to support different com-  
198 munities of practice.

## 199 5.2 Reusable competency definition

### 200 Synopsis

```

201 reusable_competency_definition :
202 record
203 (
204     identifier :
205         long_identifier_type,
206     title :
207         bag of langstring_type(1000),
208         // SPM: 20 instances of langstring_type in the bag
209         // the parameter value is the SPM for the langstring
210     description :
211         langstring_type(2000),
212         // the parameter value is the SPM
213     definition :
214         record
215         (
216             model_source :
217                 characterstring(iso-10646-1),
218                 // SPM: 1000 characters
219             statements :
220                 bag of statement_type,
221                 // SPM: 10 statement records in the bag
222         ),
223     metadata :
224         record
225         (
226             rcd_schema :
227                 characterstring(iso-10646-1),
228                 // SPM: 4000 characters
229             rcd_schema_version :
230                 characterstring(iso-10646-1),
231                 // SPM: 1000 characters
232             additional_metadata :
```

```

233         bag of any_type,
234         // SPM: 10 of any_type in the bag
235     ),
236 )

```

### 237 **Description**

238 The components of `reusable_competency_definition` are defined in 5.2.1 – 5.2.5.  
 239 Identifier and Title are mandatory and shall be included in RCD instances. Depending on the  
 240 implementation, an instance of `reusable_competency_definition` shall include zero or  
 241 more of the other defined components.

242 All elements in this data model are intrinsically unordered. The order of the elements in the  
 243 data model synopses and the order of the values in a list of values are not significant. For ex-  
 244 ample, if the model includes three statements, their order is not significant. They may appear  
 245 in any order without loss of information.

246 NOTE—A binding may impose a particular ordering on RCD instances that conform to that bind-  
 247 ing.

## 248 **5.2.1 Identifier**

### 249 **Synopsis**

```

250     identifier :
251         long_identifier_type,

```

### 252 **Description**

253 This data element is a globally unique label that identifies the RCD. This data element is suffi-  
 254 cient to reference the RCD in any conforming system.

255 Subclause 5.3.3 defines `long_identifier_type`.

256 NOTE—This data element uses the same subelements as the identifier element defined in IEEE  
 257 1484.12.1–2002 and consists of two subelements, Catalogue and Entry.

## 258 **5.2.2 Title**

### 259 **Synopsis**

```

260     title : bag of langstring_type(1000),
261         // SPM: 20 instances of langstring_type in the bag
262         // the parameter value is the SPM for the langstring

```

### 263 **Description**

264 This data element is a single, mandatory, text label for the RCD. The label is a short, human-  
 265 readable name for the RCD. Because different communities of practice may coincidentally  
 266 define the same title, the identifier, not the title, shall be used to distinguish among RCDs.

267 Subclause 5.3.2 defines `langstring_type`.

268 NOTE 1—This data element may be repeated in multiple languages.

269 NOTE 2—While the Identifier element (see 5.2.1) provides the definitive reference to the defini-  
 270 tion, it is typically unintelligible. The Title element provides a convenient, alternative, readable  
 271 form. Examples: “English proficiency”, “Schmiblick failure diagnostic level 4”, “Demonstrates  
 272 conflict resolution skills”.

### 273 5.2.3 Description

#### 274 Synopsis

```
275     description : bag of langstring_type(2000),
276         // SPM: 20 instances of langstring_type in the bag
277         // the parameter value is the SPM for the langstring
```

#### 278 Description

279 This data element is a human-readable description of the competency. It is an optional, un-  
 280 structured, character string meant to be interpretable only by humans.

281 Subclause 5.3.2 defines `langstring_type`.

282 NOTE 1—This data element may be repeated in multiple languages.

283 NOTE 2—This data element is typically more explicative than the Title element (see 5.2.2). Ex-  
 284 amples: “Proficiency in written and spoken English and use of English for meaningful oral or  
 285 written  
 286 expression”, “Performance of level 4 diagnostic as specified in IETM #SCMBLK007”.

### 287 5.2.4 Definition

#### 288 Synopsis

```
289     definition :
290         record
291         (
292             model_source :
293                 characterstring(iso-10646-1),
294                 // SPM: 1000 characters
295             statements :
296                 bag of statement_type,
297                 // SPM: 10 statement records in the bag
298         ),
```

#### 299 Description

300 This data element is an optional, structured description that provides a more complete defini-  
 301 tion of the competency, usually using attributes taken from a specific model of how a compe-

302 tency should be structured or defined. This data element shall contain zero or more model  
303 sources and at least one statement. It may contain multiple statements.

304 NOTE 1—Typically, the models that underlie this data element define competencies in terms of  
305 “statement, conditions, criteria”, “proficiency, criteria, indicators”, “standards, performance  
306 indicators, outcomes”, “abilities, basic skills, content, process”, and similar sets of statements.

307 NOTE 2—This data element provides a structure for including an arbitrary collection of state-  
308 ments that determine a competency. The author of an RCD is free to use this data element in any  
309 way that best describes the competency.

### 310 5.2.4.1 Model source

#### 311 Synopsis

```
312     model_source :
313         characterstring(iso-10646-1),
314         // SPM: 1000 characters
```

#### 315 Description

316 This data element is the source of the model used for the competency definition. The charac-  
317 ters in the string shall belong to the repertoire of ISO/IEC 10646–1:2000, as allowed by IETF  
318 RFC 2396:1998.

319 NOTE—The value of this data element should be specific enough to avoid conflict with other  
320 source names; therefore, it is recommended that the value be a Uniform Resource Identifier  
321 (URI). If the value of this data element is a URI, it may point to an actual document that defines  
322 the source formally. However, this is not required. Examples: “3-part-learning-objective”,  
323 “http://foo.edu/ref/los.xml”.

### 324 5.2.4.2 Statements

#### 325 Synopsis

```
326     statements :
327         bag of statement_type,
328         // SPM: 10 statement records in the bag
329
330     statement_type = record
331         // SPM: 10 statement records in the bag
332     (
333         statement_id :
334             long_identifier_type,
335         statement_name :
336             characterstring(1000),
337         statement_text : bag of langstring_type(1000),
338         // SPM: 20 instances of langstring_type in the bag
339         // the parameter value is the SPM for the langstring
```

```

340     statement_token :
341         vocabulary_type,
342     ),

```

### 343 **Description**

344 Each record in this data element is a description of a single characteristic of a Definition ele-  
 345 ment (see 5.2.4). A record of type `statement_type` shall contain one or more elements.

346 Although no specific component of a statements element is required, the element shall contain  
 347 at least one of these components. For example, a particular learning-objective model might  
 348 require a list of specific statement strings, each of which has a specific name, such as  
 349 “Condition”, “Performance” and “Standard”. A statement element matching this model would  
 350 use the components Statement name and Statement text (see 5.2.4.2.2 and 5.2.4.2.3).

### 351 **5.2.4.2.1 Statement ID**

#### 352 **Synopsis**

```

353     statement_id :
354         long_identifier_type,

```

#### 355 **Description**

356 This data element is a label for the statement. This label shall be unique at least within the  
 357 scope of the definition.

358 Subclause 5.3.3 defines `long_identifier_type`.

359 NOTE—This Standard does not specify how IDs are created, assigned, or resolved.

### 360 **5.2.4.2.2 Statement name**

#### 361 **Synopsis**

```

362     statement_name :
363         characterstring,

```

#### 364 **Description**

365 This data element is a name for the statement. This name shall be unique at least within the  
 366 scope of the definition. Examples: “Condition”, “Action”, “Standard”, “Outcome”, “Criteria”.

367 NOTE—This Standard does not specify how names are created, assigned, or resolved.

### 368 **5.2.4.2.3 Statement text**

#### 369 **Synopsis**

```

370     statement_text : bag of langstring_type(1000),
371         // SPM: 20 instances of langstring_type in the bag

```

372           // the parameter value is the SPM for the langstring

### 373 **Description**

374 This data element is an unstructured, textual description of those aspects of the RCD referred  
375 to by the statement name element. Example: “Given a set of integer numbers in the range 1 to  
376 49.”.

377 NOTE—This data element may be repeated in multiple languages.

### 378 **5.2.4.2.4 Statement token**

#### 379 **Synopsis**

```
380 statement_token :
381     vocabulary_type,
382
383     vocabulary_type = record
384     (
385         source :
386             characterstring(iso-10646-1),
387             // SPM: 1000 characters
388         value :
389             characterstring(iso-10646-1),
390             // SPM: 1000 characters
391     ),
```

#### 392 **Description**

393 This data element consists of a vocabulary token, along with an identifier of its source. This  
394 allows the use of controlled terms (vocabularies) instead of, or along with, free-form statement  
395 text (see 5.2.4.2.3).

396 The source element indicates the source of the token value. The source element may be a URI  
397 that identifies a formal vocabulary definition. Example:  
398 “<http://www.vocabularies.org/OSList>”.

399 The value element is the actual token value from a list of tokens defined in the source. For ex-  
400 ample, the token might be MRS\_15.

401 NOTE 1—This approach to controlled terms (vocabularies) follows that used in metadata stan-  
402 dards such as IEEE 1484.12.1–2002. In this Standard, the token is just a string; it does not have to  
403 be a human-language word and does not have to be meaningful. The source typically defines the  
404 meaning of the token, either by reference to a standard or by the fact that the data in the source  
405 element is a URL to a human- or machine-readable description of the vocabulary tokens.

406 NOTE 2—This Standard does not define what a source is, only that the source has an identifier.  
407 For example, a source may be another standard, a policy document, or a formal vocabulary.

408 NOTE 3—This Standard does not specify how vocabularies are created, assigned, or resolved.

## 409 5.2.5 Metadata

### 410 Synopsis

```

411     metadata :
412         record
413         (
414             rcd_schema :
415                 characterstring(iso-10646-1),
416                 // SPM: 1000 characters
417             rcd_schema_version :
418                 characterstring(iso-10646-1),
419                 // SPM: 1000 characters
420             additional_metadata :
421                 bag of any_type,
422                 // SPM: 10 of any type in the bag
423         ),

```

### 424 Description

425 This data element consists of embedded metadata about the RCD. This data element does not  
 426 preclude the use of external metadata about the RCD. Such external metadata are not defined  
 427 by this Standard.

428 Subclause 5.3.1 defines `any_type`.

429 NOTE—Application profiles may specify additional metadata requirements.

### 430 5.2.5.1 RCD schema

#### 431 Synopsis

```

432     rcd_schema :
433         characterstring(iso-10646-1),
434         // SPM: 1000 characters

```

#### 435 Description

436 This data element is a label for the schema that defines and controls the RCD instance.

437 NOTE 1—If this data element is omitted then a value of “[ieee.org/1484.20.1/2006](http://ieee.org/1484.20.1/2006)” should be  
 438 assumed. Different values may be used to signal application profiles but should not be used to  
 439 replicate the purpose of other elements such as model source (see 5.2.4.1).

440 NOTE 2—This data element is not a label for the schema of the embedded metadata defined in  
 441 5.2.5.3. Every instance of embedded metadata, if any, should include its own schema description  
 442 or identifier.

443 **5.2.5.2 RCD schema version**444 **Synopsis**

```

445     rcd_schema_version :
446         characterstring(iso-10646-1),
447         // SPM: 1000 characters

```

448 **Description**

449 This data element describes the version of the schema described by the Rcd schema element  
 450 (see 5.2.5.1).

451 NOTE—If this element is omitted then a value of “1.0” should be assumed.

452 **5.2.5.3 Additional metadata**453 **Synopsis**

```

454     additional_metadata :
455         bag of any_type,
456         // SPM: 10 of any type in the bag

```

457 **Description**

458 This data element contains optional, additional, embedded metadata describing the RCD. If  
 459 additional metadata are present, the actual type shall be defined by an application profile.

460 If an additional metadata record is included, the record should conform to IEEE 1484.12.1–  
 461 2002.

462 More than one additional metadata record is allowed in the bag, but if the bag contains more  
 463 than one record, each record should conform to a different metadata specification. An imple-  
 464 mentation shall accept any metadata record that it cannot interpret, but it is not required to in-  
 465 terpret such metadata records.

466 NOTE 1—Useful metadata defined in IEEE 1484.12.1–2002 include additional identification as  
 467 an entry in one or more catalogues, information about the author, the creation date, and so on.  
 468 The IEEE 1484.12.1–2002 Relation element may be used to relate a definition to a prior version  
 469 of the definition, and one or more IEEE 1484.12.1–2002 Classification elements may be used to  
 470 indicate where this particular definition fits in a taxonomy of competencies.

471 NOTE 2—A particular binding specification or application profile may impose additional restric-  
 472 tions or requirements.

473 NOTE 3—Each additional metadata record should contain information about the name and ver-  
 474 sion of its schema. For example, in IEEE 1484.12.1–2002 metadata records, this is specified in  
 475 the meta-metadata element of the metadata record.

## 476 5.3 Auxiliary data types

477 The data types described in 5.3.1 – 5.3.3 are used in conjunction with the data elements de-  
478 scribed in 5.2.

### 479 5.3.1 Any type

#### 480 Synopsis

```
481     type any_type = (unspecified);
```

#### 482 Description

483 This data type represents any type not specified in this Standard. This Standard does not re-  
484 quire an implementation to process data elements of this type when encountered in an RCD  
485 instance.

486 NOTE—If implementations specify or require data elements for which the type is defined in this  
487 Standard as `any_type`, the implementations should provide the means to interpret and validate  
488 the implementation-specific data. For example, an implementation that uses an XML binding  
489 should include a valid XML schema that can be referenced in RCD instances bound in XML  
490 documents, and the schema should be documented.

### 491 5.3.2 LangString type

#### 492 Synopsis

```
493     type langstring_type(length) =
494         record
495         (
496             language :
497                 language_type,
498             string :
499                 characterstring(iso-10646-1),
500                 // SPM: the length parameter
501         );
```

#### 502 Description

503 This data type consists of a language specification for a localized string and the string itself.

#### 504 Examples

505 The following are three examples of localized strings: "Information Technology" in  
506 French, "localization" in British English, and "xxx" in Japanese hiragana.

```
507     "fr", "Technologies de l'information"
508     "en-GB", "localisation"
509     "jp-JP-jisx208", "xxx"
```

### 510 **5.3.2.1 Language**

#### 511 **Synopsis**

```
512     language :
513         characterstring(iso-646) ,
514         // SPM: 250 characters
```

#### 515 **Description**

516 The `language` data element shall be a character string consisting of a required language code  
517 followed by multiple, optional, hyphen-prefixed subcodes.

518 The following constraints apply to the language code part of the character string :

- 519 – Two-letter codes are defined by ISO 639–1.
- 520 – Three-letter codes are defined by ISO 639–2.
- 521 – The value prefix "i" is reserved for registrations defined by the Internet As-  
522 signed Numbers Authority (IANA).
- 523 – The value prefix "x" is reserved for private use.

524 The following constraints apply to the first subcode part of the character string :

- 525 – Two-letter subcodes are ISO 3166–1 alpha-2 country codes.
- 526 – Subcodes of from three to eight letters are registered with IANA.

527 Constraints for additional subcodes are unspecified.

528 The value held by the character string shall be a valid language code as defined by the XML  
529 Schema derived data type `language` (see W3C Recommendation XML Schema, Part 2 [28  
530 October 2004]).

531 ISO 639-2 specifies two code sets, one for bibliographic applications (ISO 639-2/B) and one  
532 for terminology applications (ISO 639-2/T). Either code set may be used.

533 NOTE 1—The language code is normally given in lower case and the subcodes (if any) in upper  
534 case. However, the values are case insensitive.

535 NOTE 2—The XML Schema derived data type `language` does not enforce all constraints on this  
536 language code.

#### 537 **Examples**

```
538     "en-GB"
539     "de"
540     "fr-CA"
541     "it"
542     "i-bnn" (IANA Bunun)
```

543 **5.3.2.2 String**544 **Synopsis**

```

545     string :
546         characterstring(iso-10646-1),
547         // SPM: The length parameter

```

548 **Description**

549 This data element contains the text of the localized string.

550 **5.3.3 Long identifier type**551 **Synopsis**

```

552     type long_identifier_type =
553         record
554         (
555             catalog: characterstring(iso-10646-1),
556             // SPM: 4000 characters
557             entry: characterstring(iso-10646-1),
558             // SPM: 4000 characters
559         );

```

560 **Description**

561 This data type is an identifier (a label) that is intended to be unique within the context of the  
562 RCD. The catalog element is the name or designator of the identification or cataloging scheme  
563 for this entry, in other words, a namespace-scheme. The entry element is the value of the identifier  
564 within the identification or cataloging scheme that designates or identifies this RCD, in  
565 other words, a namespace-specific string.

566 Values for this data type shall conform to the syntax for URIs as defined by IETF RFC  
567 2396:1998. The catalog and entry values may be concatenated as a single character string in  
568 an application profile or binding. If the catalog and entry values are concatenated, the resulting  
569 character string shall conform to the syntax for URIs as defined by IETF RFC 2396:1998.

570 NOTE 1—This Standard recommends that if an application profile or binding specifies a concatenated  
571 format for the identifier, the result be in the form of a globally unique identifier in the  
572 form of a Uniform Resource Name (URN) (see IETF RFC 2141 [B5]).

573 NOTE 2—This Standard recommends that the catalog and entry lengths be limited so that the  
574 total length of a concatenated identifier is never longer than 4000 characters.

575 **Annex A**

576 (informative)

577 **Bibliography**

578 [B1] IEEE 100, The Authoritative Dictionary of IEEE Standards Terms, Seventh Edition.

579 [B2] IMS Specification (25 October 2002), IMS Reusable Definition of Competency or Edu-  
580 cational Objective, Version 1.0.

581 [B3] ISO/IEC 646, Information technology – ISO 7-bit coded character set for information  
582 interchange.

583 [B4] ISO/IEC 8859–1, Information Technology — 8-bit single-byte coded graphic character  
584 sets — Part 1: Latin alphabet No. 1

585 [B5] Network Working Group (May 1997) RFC 2141, URN Syntax.

586 [B6] The Internet Society (November 2003) [RFC 3629](#), UTF-8, a transformation format of  
587 [ISO 10646](#).

588 [B7] The Internet Society (February 2000) RFC 2781, UTF-16, an encoding of ISO 10646.

589 [B8] The Unicode Consortium, [The Unicode Standard, Version 4.0](#) Boston, MA, Addison-  
590 Wesley Developers Press, 2003.

591 *This book describes UTF-32.*

## 592 **Annex B**

593 (informative)

### 594 **Conceptual overview**

#### 595 **B.1 Objectives**

596 This Standard is intended to satisfy the following objectives:

- 597 – Provide a data model for competency definition records that can be shared or  
598 reused in one or more compatible systems.
- 599 – Reconcile various existing and emerging data models into a widely acceptable  
600 model.
- 601 – Provide a way to identify the type and precision of a competency definition.
- 602 – Provide a unique identifier as the means to unambiguously reference an RCD  
603 regardless of the setting in which the competency definition is stored, found,  
604 retrieved, or used. For example, metadata that describe learning content may  
605 contain references to one or more competency definition records that describe  
606 learning objectives for the content.
- 607 – Provide a data model for additional information about a competency defini-  
608 tion, such as a title, description, and source, compatible with other emerging  
609 learning asset metadata standards.
- 610 – Recommend metadata as one of the methods that may be used to express how  
611 competency definitions are semantically related.

612 This Standard also addresses the following needs:

- 613 – A common data model that allows the building of various competency mod-  
614 els, hierarchies, and maps. However, the definitions of such competency mod-  
615 els, hierarchies, and maps are outside of the scope of this Standard
- 616 – A standard method that allows persistent, long-lived competency definitions  
617 to be created, shared among systems, and maintained
- 618 – A standard method by which competency definitions can be identified as  
619 globally unique among conforming systems and repositories
- 620 – A common data model for the metadata that give an RCD its value in a reuse  
621 environment, such as the source of the competency definition, validation in-  
622 formation, and other meta information useful to locate an RCD in a repository  
623 or collection

#### 624 **B.2 Functional overview**

625 This Standard defines a data model for describing, referencing, and sharing competency defi-  
626 nitions, primarily in the context of online and distributed learning. The data model provides a

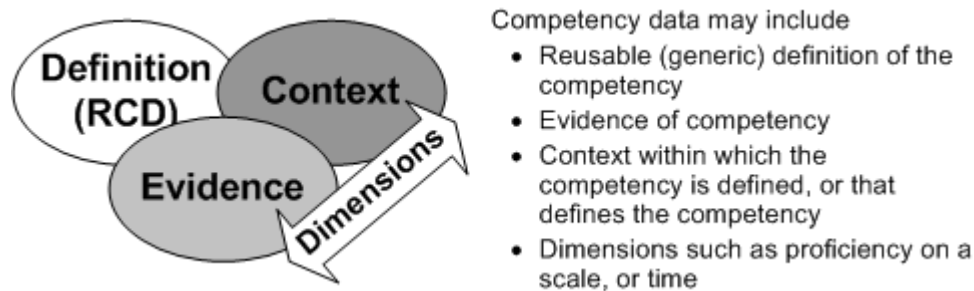
627 formal representation of the key characteristics of a competency, independently of its use in  
 628 any particular context. It enables interoperability among learning systems that deal with com-  
 629 petency information by providing a means for them to refer to common definitions with com-  
 630 mon meanings.

631 The core information in an RCD is an unstructured textual definition of the competency that  
 632 can be referenced through a globally unique identifier. This definition may be refined using a  
 633 user-defined model of the structure of a competency.

634 This Standard provides a means to capture common understandings of competencies that ap-  
 635 pear as part of learning or career plan, as learning prerequisites, or as learning outcomes. The  
 636 data model in this Standard can be used to share these definitions between learning systems,  
 637 human resource systems, learning content, competency or skills repositories, and other rele-  
 638 vant systems. This Standard provides unique references to competency definitions for inclu-  
 639 sion in other data models, such as personal competency profiles.

640 RCD instances that conform to this Standard are intended for interchange by machines, but the  
 641 information they contain is intended for human interpretation.

642 This Standard does not address the aggregation of smaller competencies into larger competen-  
 643 cies (e.g., “throws” plus “catches” equals “plays ball”) nor does it address how competencies  
 644 are to be assessed, validated, certified, recorded, or used as part of a process, such as instruc-  
 645 tional design or knowledge management. It also does not specify how records of competencies  
 646 associated with an individual are structured, stored, or shared. Figure B.1 shows how an RCD  
 647 integrates with competency data.



649 **Figure B.1—RCDs cover only a part of the competency data**

### 650 **B.3 Data model overview**

651 The data model is minimalist and extensible. It is neutral with regard to models of and uses of  
 652 competencies. Competencies are defined and structured in many ways in different communi-  
 653 ties of practice. This Standard allows communities of practice to share information according  
 654 to the models they use. Semantics can be “tightened” or “loosened” in the data itself, while  
 655 conserving the same data model regardless of how strictly a particular organization or institu-  
 656 tion requires the data to be formulated.

657 The data model contains the following mandatory elements:

- 658 – **Identifier:** A globally unique label that identifies the RCD. This identifier  
659 uses the same data elements as the identifier element defined in IEEE  
660 1484.12.1–2002, “Standard for Learning Object Metadata,”<sup>7</sup> and consists of  
661 two subelements, Catalog and Entry. The identifier is sufficient to reference  
662 the competency in any other system.
- 663 – **Title:** A text label for the RCD. This is a short, human-readable name. While  
664 the identifier provides the definitive reference to the RCD, it is typically unin-  
665 telligible. The title provides a convenient, readable alternative. The title may  
666 be repeated in multiple languages.

667 The data model contains the following optional elements:

- 668 – **Description:** A human-readable description of the RCD. This is an unstruc-  
669 tured character string meant to be interpretable by humans, only. The descrip-  
670 tion may be repeated in multiple languages.
- 671 – **Definition:** A structured description that provides a more complete definition  
672 of the RCD than the free-form description expressed in the title and descrip-  
673 tion, usually using attributes taken from a specific model of how a compe-  
674 tency should be structured or defined. Typically, such models define a  
675 competency in terms of “statement, conditions, criteria,” “proficiency, criteria,  
676 indicators,” “standards, performance indicators, outcomes,” “abilities, basic  
677 skills, content, process,” and similar sets of statements.
- 678 – **Metadata:** Embedded metadata that further describe the RCD by, for exam-  
679 ple, identifying the author and publication date of the RCD or by specifying  
680 known relations to other RCDs.

681 Extensibility can be achieved by defining a specific model structure within the Definition ele-  
682 ment (5.2.4) or by including elements defined by IEEE 1484.12.1–2002, Clause 6 in the  
683 Metadata element (5.2.5). In addition, implementers may create additional data models that  
684 include or reference the RCD data model or RCD instances. Such implementation-specific  
685 data models may be used to augment the data model in this Standard to support different ap-  
686 plications and communities of practice.

687 NOTE—The identifier, not the title, is used to distinguish between RCDs, because different  
688 communities of practice may coincidentally define the same title.

## 689 **B.4 Taxonomies of reusable competency definitions**

690 This Standard is intended to meet the simple need of referencing and cataloguing a compe-  
691 tency, not classifying it. Nonetheless, an implementation might want to include relation and  
692 classification information, which can be done by embedding additional metadata as specified

---

<sup>7</sup> For information on normative references, see Clause 2.

693 in 5.2.5.3. Instances of RCDs also can be referenced by the nodes in a tree or other graph rep-  
694 resenting a taxonomy or ontology of competencies.

## 695 Annex C

696 (informative)

### 697 Sample XML binding schema

698 This Standard does not define any specific binding for the data model. However, related stan-  
699 dards may reference this Standard and define bindings.

700 The example in Figure C.1 illustrates existing practice using an XML schema defined by the  
701 IMS Global Learning Consortium [B2].

702 NOTE—The sample schema uses “rdceo, n ” as the label for the root data element. It is not re-  
703 quired that an implementation of this Standard use the same labels for data-element or type labels  
704 as those used in the example below, as long as the elements and types themselves are semanti-  
705 cally equivalent.

706

```

707 <?xml version="1.0" encoding="UTF-8"?>
708 <xs:schema targetName-
709 space="http://www.imsglobal.org/xsd/imsrdceo_rootv1p0"
710 xmlns:xs="http://www.w3.org/2001/XMLSchema"
711 xmlns="http://www.imsglobal.org/xsd/imsrdceo_rootv1p0"
712 elementFormDefault="qualified" attributeFormDefault="unqualified">
713   <xs:group name="extelement">
714     <xs:annotation>
715       <xs:documentation>extension mechanism for ele-
716 ments</xs:documentation>
717     </xs:annotation>
718     <xs:sequence>
719       <xs:any namespace="##other" processContents="strict" maxOc-
720 curs="unbounded"/>
721     </xs:sequence>
722   </xs:group>
723   <xs:element name="rdceo">
724     <xs:annotation>
725       <xs:documentation>A single definition of a competence, educa-
726 tional objective etc</xs:documentation>
727     </xs:annotation>
728     <xs:complexType>
729       <xs:sequence>
730         <xs:element ref="identifier" minOccurs="1" maxOccurs="1"/>
731         <xs:element ref="title"/>
732         <xs:element ref="description" minOccurs="0"/>
733         <xs:element ref="definition" minOccurs="0" maxOc-
734 curs="unbounded"/>
735         <xs:element ref="metadata" minOccurs="0"/>
736       <xs:sequence minOccurs="0">
737         <xs:group ref="extelement"/>
738       </xs:sequence>

```

```

739         </xs:sequence>
740         <xs:anyAttribute namespace="##other" processCon-
741 tents="strict"/>
742     </xs:complexType>
743 </xs:element>
744 <xs:element name="langstring">
745     <xs:annotation>
746         <xs:documentation>A string in a human lan-
747 guage</xs:documentation>
748     </xs:annotation>
749     <xs:complexType>
750         <xs:simpleContent>
751             <xs:extension base="xs:string">
752                 <xs:anyAttribute namespace="##other" processCon-
753 tents="strict"/>
754             </xs:extension>
755         </xs:simpleContent>
756     </xs:complexType>
757 </xs:element>
758 <xs:element name="title">
759     <xs:annotation>
760         <xs:documentation>A title for the defini-
761 tion</xs:documentation>
762     </xs:annotation>
763     <xs:complexType>
764         <xs:sequence>
765             <xs:element ref="langstring" maxOccurs="unbounded"/>
766             <xs:sequence minOccurs="0">
767                 <xs:group ref="extelement"/>
768             </xs:sequence>
769         </xs:sequence>
770         <xs:anyAttribute namespace="##other" processCon-
771 tents="strict"/>
772     </xs:complexType>
773 </xs:element>
774 <xs:element name="identifier">
775     <xs:annotation>
776         <xs:documentation>Catenated form of the identifier of an
777 RDCEO</xs:documentation>
778     </xs:annotation>
779     <xs:complexType>
780         <xs:simpleContent>
781             <xs:extension base="xs:anyURI">
782                 <xs:anyAttribute namespace="##other" processCon-
783 tents="strict"/>
784             </xs:extension>
785         </xs:simpleContent>
786     </xs:complexType>
787 </xs:element>
788 <xs:element name="description">
789     <xs:annotation>
790         <xs:documentation>A description for the defini-
791 tion</xs:documentation>
792     </xs:annotation>
793     <xs:complexType>
794         <xs:sequence>

```

```

795         <xs:element ref="langstring" maxOccurs="unbounded"/>
796         <xs:sequence minOccurs="0">
797             <xs:group ref="extelement"/>
798         </xs:sequence>
799     </xs:sequence>
800     <xs:anyAttribute namespace="##other" processCon-
801 tents="strict"/>
802 </xs:complexType>
803 </xs:element>
804 <xs:element name="definition">
805     <xs:annotation>
806         <xs:documentation>A structured form of the defini-
807 tion</xs:documentation>
808     </xs:annotation>
809     <xs:complexType>
810         <xs:sequence>
811             <xs:element ref="model" minOccurs="0"/>
812             <xs:element ref="statement" maxOccurs="unbounded"/>
813             <xs:sequence minOccurs="0">
814                 <xs:group ref="extelement"/>
815             </xs:sequence>
816         </xs:sequence>
817         <xs:anyAttribute namespace="##other" processCon-
818 tents="strict"/>
819     </xs:complexType>
820 </xs:element>
821 <xs:element name="model">
822     <xs:annotation>
823         <xs:documentation>The model identification for the structured
824 definition</xs:documentation>
825     </xs:annotation>
826     <xs:complexType>
827         <xs:simpleContent>
828             <xs:extension base="xs:string">
829                 <xs:anyAttribute namespace="##other" processCon-
830 tents="strict"/>
831             </xs:extension>
832         </xs:simpleContent>
833     </xs:complexType>
834 </xs:element>
835 <xs:element name="statement">
836     <xs:annotation>
837         <xs:documentation>A component part of a structured defini-
838 tion</xs:documentation>
839     </xs:annotation>
840     <xs:complexType>
841         <xs:sequence>
842             <xs:choice>
843                 <xs:element ref="statementtext"/>
844                 <xs:element ref="statementtoken"/>
845             </xs:choice>
846             <xs:sequence minOccurs="0">
847                 <xs:group ref="extelement"/>
848             </xs:sequence>
849         </xs:sequence>
850         <xs:attribute name="statementid" type="xs:ID"/>

```

```

851         <xs:attribute name="statementname" type="xs:string"/>
852         <xs:anyAttribute namespace="##other" processCon-
853 tents="strict"/>
854     </xs:complexType>
855 </xs:element>
856 <xs:element name="statementtext">
857     <xs:annotation>
858         <xs:documentation>Used for statements with free-form
859 text</xs:documentation>
860     </xs:annotation>
861     <xs:complexType>
862         <xs:sequence>
863             <xs:element ref="langstring" maxOccurs="unbounded"/>
864             <xs:sequence minOccurs="0">
865                 <xs:group ref="extelement"/>
866             </xs:sequence>
867         </xs:sequence>
868     </xs:complexType>
869 </xs:element>
870 <xs:element name="source">
871     <xs:annotation>
872         <xs:documentation>Source identification for a vocabulary to-
873 ken</xs:documentation>
874     </xs:annotation>
875     <xs:complexType>
876         <xs:simpleContent>
877             <xs:extension base="xs:string">
878                 <xs:anyAttribute namespace="##other" processCon-
879 tents="strict"/>
880             </xs:extension>
881         </xs:simpleContent>
882     </xs:complexType>
883 </xs:element>
884 <xs:element name="value">
885     <xs:annotation>
886         <xs:documentation>A vocabulary token</xs:documentation>
887     </xs:annotation>
888     <xs:complexType>
889         <xs:simpleContent>
890             <xs:extension base="xs:string">
891                 <xs:anyAttribute namespace="##other" processCon-
892 tents="strict"/>
893             </xs:extension>
894         </xs:simpleContent>
895     </xs:complexType>
896 </xs:element>
897 <xs:element name="metadata">
898     <xs:annotation>
899         <xs:documentation>A container for metadata</xs:documentation>
900     </xs:annotation>
901     <xs:complexType>
902         <xs:sequence>
903             <xs:element ref="rdceoschema" minOccurs="0"/>
904             <xs:element ref="rdceoschemaversion" minOccurs="0"/>
905             <xs:sequence minOccurs="0">
906                 <xs:group ref="extelement"/>

```

```

907         </xs:sequence>
908     </xs:sequence>
909     <xs:anyAttribute namespace="##other" processCon-
910 tents="strict"/>
911 </xs:complexType>
912 </xs:element>
913 <xs:element name="statementtoken">
914     <xs:annotation>
915         <xs:documentation>Used for statements with token values (vo-
916 cabulary use)</xs:documentation>
917     </xs:annotation>
918     <xs:complexType>
919         <xs:sequence>
920             <xs:element ref="source"/>
921             <xs:element ref="value"/>
922             <xs:sequence minOccurs="0">
923                 <xs:group ref="extelement"/>
924             </xs:sequence>
925         </xs:sequence>
926         <xs:anyAttribute namespace="##other" processCon-
927 tents="strict"/>
928     </xs:complexType>
929 </xs:element>
930 <xs:element name="rdceoschema">
931     <xs:annotation>
932         <xs:documentation>The identity of the RDCEO schema - assumed
933 to be IMS RDCEO if absent.</xs:documentation>
934     </xs:annotation>
935     <xs:complexType>
936         <xs:simpleContent>
937             <xs:extension base="xs:string">
938                 <xs:anyAttribute namespace="##other" processCon-
939 tents="strict"/>
940             </xs:extension>
941         </xs:simpleContent>
942     </xs:complexType>
943 </xs:element>
944 <xs:element name="rdceoschemaversion">
945     <xs:annotation>
946         <xs:documentation>The version of the RDCEO schema - assumed to
947 be 1.0 if absent</xs:documentation>
948     </xs:annotation>
949     <xs:complexType>
950         <xs:simpleContent>
951             <xs:extension base="xs:string">
952                 <xs:anyAttribute namespace="##other" processCon-
953 tents="strict"/>
954             </xs:extension>
955         </xs:simpleContent>
956     </xs:complexType>
957 </xs:element>
958 </xs:schema>

```

959

**Figure C.1—An example schema**