



Competency Framework Specifications

Version: 0.75

Date: December 14, 2011

Authors: Valerie Smothers

Author email: vsmothers@jhmi.edu

Version History

Version No.	Date	Changed By	Changes Made
0.1	2008-07-17	Valerie Smothers	Initial draft
0.2	2009-10-06	Valerie Smothers	Added lom to replace/supplement framework title and identifier, renamed CompetencyDefinitions CompetencyObjects, made category and references subelements fo CompetencyObject, added XtensibleInfo, added CompetencyMap subelements.
0.3	2009-12-23	Valerie Smothers	Removed Competency objects (will be a separate spec) and competency map; put relation at the root.
0.4	2010-03-25	Valerie Smothers	Required elements form lom and eliminated any overlap. Required URI identifier. Changes to non-hierarchical relationships. Changed structure of relations to be 1 to 1 rather than 1 to many.
0.41	2010-05-06	Valerie Smothers	Further simplified relations. Eliminated references.
0.5	2010-07-28	Valerie Smothers	Added SupportingInformation element.

0.6	2011-07-14	Valerie Smothers	<p>Added Includes element. Remove the use of broader/narrower than for relations of framework to top competency objects</p> <p>Allow competency object broader than competency framework.</p> <p>Allow framework includes framework.</p> <p>If using 'broader than', the broader thing must be a competency object</p> <p>Made Relations optional.</p> <p>Updated graphics.</p>
0.61	2011-09-06	Valerie Smothers	<p>Added language forbidding hierarchical conflicts.</p> <p>Changed format, added examples for supporting information. Added XtensibleInfo container.</p>
0.62	2011-10-10	Valerie Smothers	<p>Added note about hierarchical conflicts with examples, modified definition of includes element, added recommended metadata description.</p>
0.7	2011-10-17	Valerie Smothers	<p>Added status, replaces, and replacedBy elements.</p>
0.71	2011-11-6	Valerie Smothers	<p>Removed XtensibleInfo and added namespace qualified extensibility to CompetencyFramework.</p> <p>Allowed multiple replaces and isReplacedBy elements. Changed value of Relations element.</p> <p>Added SKOS and DCMI Terms to references.</p> <p>Changed references to LOM.</p>
0.72	2011-11-14	Valerie Smothers	<p>Added corrections related extensibility. Updated sample XML.</p>
0.73	2011-11-14	Valerie Smothers	<p>Made replaces and IsReplacedBy elements in the MedBiquitous namespace to resolve content model problems.</p>
0.74	2011-12-09	Valerie Smothers	<p>Removed Status element. Added EffectiveDate and RetiredDate as optional elements.</p>
0.75	2011-12-14	Valerie Smothers	<p>Corrected typos. Added lifecycle status as recommended lom element.</p>

MedBiquitous Consortium XML Public License and Terms of Use

MedBiquitous XML (including schemas, specifications, sample documents, Web services description files, and related items) is provided by the copyright holders under the following license. By obtaining, using, and or copying this work, you (the licensee) agree that you have read, understood, and will comply with the following terms and conditions.

The Consortium hereby grants a perpetual, non-exclusive, non-transferable, license to copy, use, display, perform, modify, make derivative works of, and develop the MedBiquitous XML for any use and without any fee or royalty, provided that you include the following on ALL copies of the MedBiquitous XML or portions thereof, including modifications, that you make.

1. Any pre-existing intellectual property disclaimers, notices, or terms and conditions. If none exist, the following notice should be used: "Copyright © [date of XML release] MedBiquitous Consortium. All Rights Reserved. <http://www.medbiq.org>"
2. Notice of any changes or modification to the MedBiquitous XML files.
3. Notice that any user is bound by the terms of this license and reference to the full text of this license in a location viewable to users of the redistributed or derivative work.

In the event that the licensee modifies any part of the MedBiquitous XML, it will not then represent to the public, through any act or omission, that the resulting modification is an official specification of the MedBiquitous Consortium unless and until such modification is officially adopted.

THE CONSORTIUM MAKES NO WARRANTIES OR REPRESENTATIONS, EXPRESS OR IMPLIED, WITH RESPECT TO ANY COMPUTER CODE, INCLUDING SCHEMAS, SPECIFICATIONS, SAMPLE DOCUMENTS, WEB SERVICES DESCRIPTION FILES, AND RELATED ITEMS. WITHOUT LIMITING THE FOREGOING, THE CONSORTIUM DISCLAIMS ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AND ANY WARRANTY, EXPRESS OR IMPLIED, AGAINST INFRINGEMENT BY THE MEDBIQUITOUS XML OF ANY THIRD PARTY PATENTS, TRADEMARKS, COPYRIGHTS OR OTHER RIGHTS. THE LICENSEE AGREES THAT ALL COMPUTER CODES OR RELATED ITEMS PROVIDED SHALL BE ACCEPTED BY LICENSEE "AS IS". THUS, THE ENTIRE RISK OF NON-PERFORMANCE OF THE MEDBIQUITOUS XML RESTS WITH THE LICENSEE WHO SHALL BEAR ALL COSTS OF ANY SERVICE, REPAIR OR CORRECTION.

IN NO EVENT SHALL THE CONSORTIUM OR ITS MEMBERS BE LIABLE TO THE LICENSEE OR ANY OTHER USER FOR DAMAGES OF ANY NATURE, INCLUDING, WITHOUT LIMITATION, ANY GENERAL, DIRECT, INDIRECT, INCIDENTAL, CONSEQUENTIAL, OR SPECIAL DAMAGES, INCLUDING LOST PROFITS, ARISING OUT OF ANY USE OF MEDBIQUITOUS XML.

LICENSEE SHALL INDEMNIFY THE CONSORTIUM AND EACH OF ITS MEMBERS FROM ANY LOSS, CLAIM, DAMAGE OR LIABILITY (INCLUDING, WITHOUT LIMITATION, PAYMENT OF ATTORNEYS' FEES AND COURT COSTS) ARISING OUT OF MODIFICATION OR USE OF THE MEDBIQUITOUS XML OR ANY RELATED CONTENT OR MATERIAL BY LICENSEE.

LICENSEE SHALL NOT OBTAIN OR ATTEMPT TO OBTAIN ANY PATENTS, COPYRIGHTS OR OTHER PROPRIETARY RIGHTS WITH RESPECT TO THE MEDBIQUITOUS XML.

THIS LICENSE SHALL TERMINATE AUTOMATICALLY IF LICENSEE VIOLATES ANY OF ITS TERMS AND CONDITIONS.

The name and trademarks of the MedBiquitous Consortium and its members may NOT be used in advertising or publicity pertaining to MedBiquitous XML without specific, prior written permission. Title to copyright in MedBiquitous XML and any associated documentation will at all times remain with the copyright holders.

Table of Contents

1	Acknowledgements	7
2	Documentation Conventions	9
3	Conformance	10
4	Common Data Types.....	11
4.1	IdentifierType.....	11
5	Introduction	13
6	Other Standards, Specifications, or Schema Referenced	14
7	Terminology	15
8	Competency Framework Schema Grammar.....	16
8.1	CompetencyFramework.....	16
8.2	Lom Required and Recommended Elements	21
8.3	SupportingInformation	28
8.4	Relation	30
8.5	Note about Hierarchical Conflict	34
9	Sample XML Documents	36
10	References	39

1 Acknowledgements

The MedBiquitous Consortium wishes to acknowledge the help of the MedBiquitous Competencies Working Group members, invited experts, and other individuals that contributed to the creation of this document, including:

- Rosalyn Scott, M.D., Department of Veterans Affairs, Co-Chair
- Tim Willett, M.D., MMedEd, Co-Chair

- Susan Albright, Tufts University
- Mary Pat Aust, American Association of Critical-Care Nurses
- Theresa Barrett, New Jersey Academy of Family Physicians
- Chris Candler, M.D., University of Oklahoma
- Matthew Cownie, University of the West of England
- Allan Cumming, M.D., University of Edinburgh
- Tom Doyle, METI
- Rachel Ellaway, Ph.D., Northern Ontario School of Medicine
- Bob Englander, M.D., Association of American Medical Colleges
- Maria Esquela, Advanced Informatics
- Lynne Galiatsatos, American College of Cardiology
- Vladimir Goodkovsky, University of Virginia
- Simon Grant, Ph.D., Jisc Cetis
- Peter Greene, M.D., Johns Hopkins University
- David Hadden, TheraSim
- David Hananel, METI
- Ted Hanss, University of Michigan
- Ronald Harden, M.D., IVIMEDS
- Sean Hilton, M.D., St. George's University of London
- Logan Holt, TheraSim
- David Kiger, Tufts University
- Linda Lewin, M.D., University of Maryland
- Matt Lewis, Outcomes, Inc.
- Chandler Mayfield, University of California, San Francisco
- J.B. McGee, M.D., University of Pittsburgh
- Michael Mintzer, M.D., Department of Veterans Affairs
- Kasem Mohsen, TheraSim

- David Price, M.D., American Board of Family Medicine
- Carla Pugh, M.D, Northwestern University
- Doris Quinn, Vanderbilt University
- Dan Rehak, Ph.D.
- Isarin Sathitruangsak, Tufts University
- Valerie Smothers, MedBiquitous
- Lesley Southgate, M.D., St. George's University of London
- David Stern, M.D., University of Michigan
- Lana Vukovljak, American Association of Diabetes Educators
- Jeff Williamson, American Medical Informatics Association
- Nabil Zary, Karolinska Institute

Specification authors also received technical guidance from members of the MedBiquitous Technical Steering Committee.

- Joel Farrell, IBM, Technical Steering Committee Chair
- James Fiore, American Board of Surgery
- Steve Kenney, American Osteopathic Association
- Andrew Rabin, CECity
- Dan Rehak, Learning Technologies Architect Dan White, American Board of Internal Medicine

This specification would not be possible without the previous work of Claude Ostyn, in particular the Proposal for a Simple Reusable Competency Map. Claude paved the way for this specification and others related to advanced uses of learning technologies. For access to Claude's work, visit:

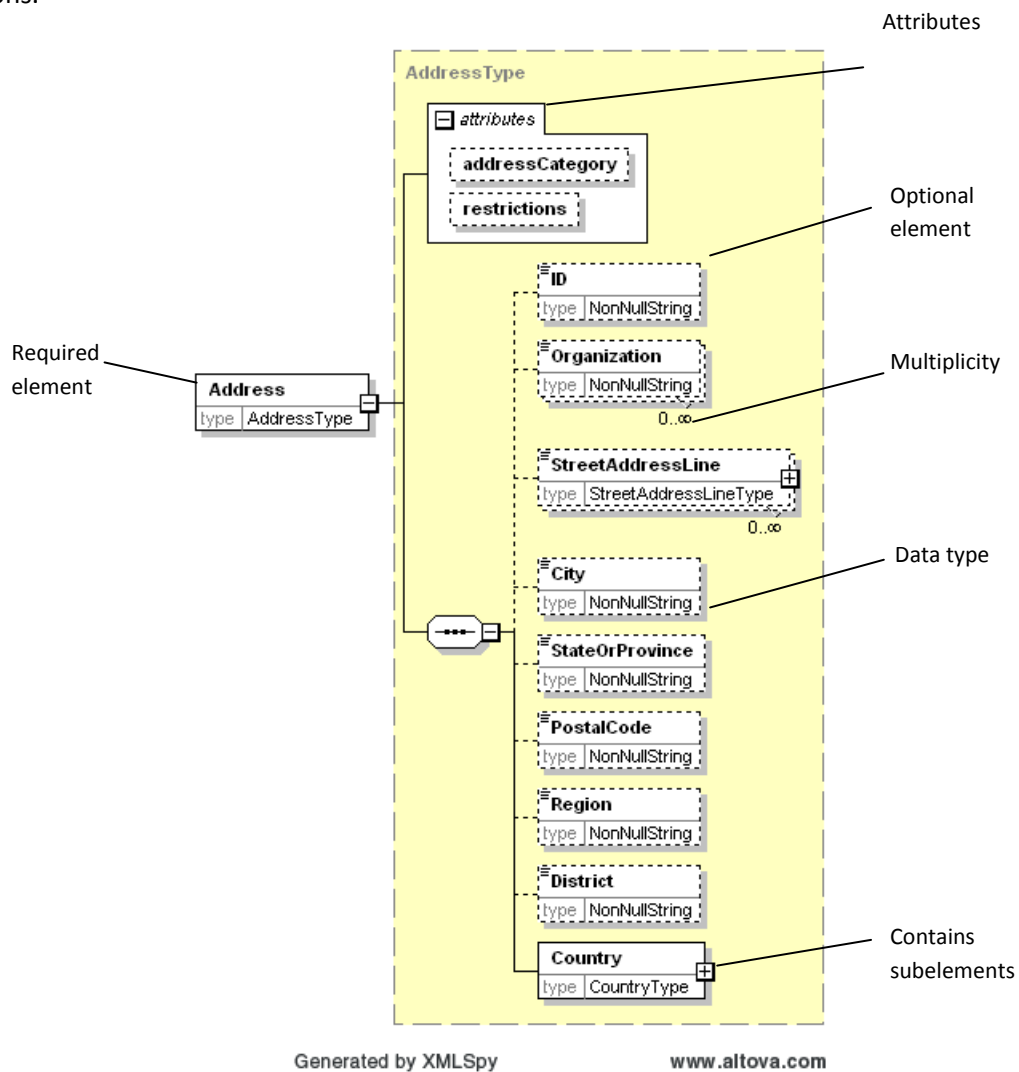
<http://www.ostyn.com/resources.htm>

2 Documentation Conventions

This document uses the following conventions:

Convention	Description
Bold Text	When used with an XML element name, indicates that the element contains sub-elements.
<i>Italics</i>	When used in an XML element description, an attribute of the XML element.
Monospaced type	Sample XML tags, code, schema, or portion thereof.

The document uses graphics generated by Altova XML Spy® software, which uses the following graphical conventions.



3 Conformance

To be a **conformant instance of the MedBiquitous Competency Framework specification**, an XML document shall:

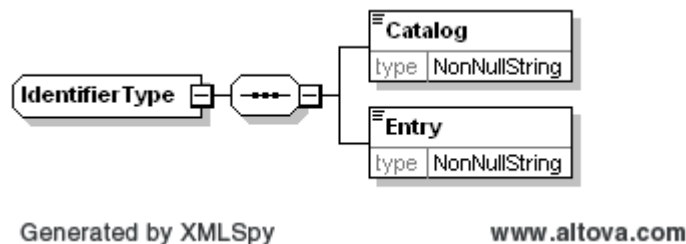
- **Shall** validate against the Competency Framework XML Schema available at:
<http://ns.medbiq.org/competencyframework/v1/competencyframework.xsd>
- Shall conform to any additional requirements stated in this specification.
- **May** include elements not defined in this document only in permitted areas and only if those elements are namespace qualified.

4 Common Data Types

Most of the elements and attributes in MedBiquitous XML documents use the data types defined by the [W3C XML schema definition](#). In some cases MedBiquitous creates its own datatypes as part of its best practices or to meet a specific requirement. Commonly used datatypes are described below.

4.1 IdentifierType

Many of the elements in Competency Framework use the IdentifierType datatype, which allows competency framework developers to indicate the catalog or source of the identifier along with the identifier. This two-part approach facilitates the exchange of competency frameworks across systems by preventing identifier duplication. Competency references may reference MedBiquitous Competency Objects [[Competency Objects](#)], IEEE Reusable Competency Definitions [[IEEE RCD](#)], or external competency frameworks.



Elements using the IdentifierType have Catalog and Entry subelements, which are described in the table that follows.

IdentifierType Subelements

Element	Description	Required	Multiplicity	Datatype
Catalog	Catalog indicates the identification or cataloguing scheme for the entry. URIs may be used in many cases and are required for MedBiquitous Competency Objects and MedBiquitous Competency Frameworks. In others, organizations may wish to use an internal cataloguing scheme.	Required	1	Non-null string
Entry	Entry is the value of the identifier within the cataloguing scheme specified by the Catalog element.	Required	1	Non-null string

The following example shows an identifier for a competency definition that uses a URI cataloging schema.

```
<Identifier>
  <Catalog>URI</Catalog>
  <Entry>http://www.medschool.edu/competencies/kp87t</Entry>
</Identifier>
```

The next example shows an identifier for a competency definition that uses a local cataloging schema.

```
<Identifier>
  <Catalog>Medschool University</Catalog>
  <Entry>2005.10.87</Entry>
</Identifier>
```

5 Introduction

This document describes MedBiquitous Competency Frameworks specification in detail. It is intended for use by anyone who wants to develop tools or implement electronic systems for linking competencies to educational and performance data and resources. The status of the document is indicated at the bottom of the page; draft documents are subject to review and approval through the MedBiquitous and ANSI standards development processes (see http://www.medbig.org/working_groups/consortium_process/MedBiquitousANSIProcess.pdf).

The use of outcome and competency frameworks is a growing part of healthcare education and maintenance of certification. Many nations or states have accreditation frameworks for health professions schools and programs as well as requirements to demonstrate lifelong learning and competency in medical specialties/subspecialties. Currently, there is no standard way to represent these competencies in healthcare, and therefore no easy way to import/export competencies across systems. Once competencies are expressed in a common format, they can be used as the backbone of education and performance management systems, enabling the following:

- Learners and educators able to search for learning resources addressing a particular competency
- Educators able to determine where specific competencies are addressed in a curriculum
- Boards and hospitals able to track and manage competency data for the professional.
- Administrators are able to map one competency framework to another.

The objective of the specification is to provide a consistent format and data structure for defining a competency framework. This, combined with other existing and emerging specifications, enables educational resources and activities to be tied to a competency framework.

The standard allows extensions so that data beyond the core set identified in this document may be communicated to other organizations. This specification is intended to work in concert with other specifications.

6 Other Standards, Specifications, or Schema Referenced

This standard references:

- ANSI/MEDBIQ LO.10.1-2008, Healthcare Learning Object Metadata [[Healthcare LOM](#)]
Healthcare LOM provides the format for identifiers and metadata about the competency framework.
- **Competency Object** [[Competency Object](#)]
Competency Framework may reference individual statements of expectation using a MedBiquitous defined format or the IEEE Reusable Competency Definition.
- DCMI Terms [[DCMITerms](#)]
Competency Framework may indicate is this framework replaces or is replaced by another framework using DCMI Terms.
- 1484.12.3-2005, IEEE Standard for Learning Technology-Extensible Markup Language (XML) Schema Definition Language Binding for Learning Object Metadata [[LOM](#)]
Healthcare LOM extends the IEEE LOM standard.
- 1484.20.1-2007 - IEEE Standard for Learning Technology-Data Model for Reusable Competency Definitions [[IEEE RCD](#)]
Competency Framework may reference individual statements of expectation using a MedBiquitous defined format or the IEEE Reusable Competency Definition.
- Simple Knowledge Organizations System [[SKOS](#)]
The Competency Framework uses select SKOS vocabulary classes for conceptual relationships.
- XHTML™ 1.0 The Extensible HyperText Markup Language (Second Edition) [[XHTML](#)]
XHTML provides the format for supporting information embedded in the competency framework.

7 Terminology

Much of the terminology in this area is ill-defined or ambiguous, often employed differently (and sometimes interchangeably) by different professionals [[Harden 1](#)]. To ensure clarity and consistency we provide working definitions of the terminology we use in the context of this paper:

- **Competence** – possession of sufficient and necessary knowledge, skill and attitude by an individual to allow her to safely and effectively perform a specific job.
- **Competency** – a statement describing a specific ability, or set of abilities, requiring specific knowledge, skill and/or attitude. Competencies are used to set performance standards that must be met [[Albanese 1](#)].
- **Competency Framework** – an organized and structured representation of a set of interrelated and purposeful competency objects.
- **Competency Object** – an umbrella term used by the **CWG** to describe any abstract statement of learning or performance expectations, and information related to the statement. Statements can be learning outcomes, competencies per se, learning objectives, professional roles, topics, classifications/collections, etc. The Competency Object may include additional data to expand on or support the statement. The Object is abstract in the sense that it does not inherently contain information about connections of the statement to individuals or events or other objects.
- **Learning Objective** – the intended aggregate learner endpoint for an activity, typically directly linked to the means by which it is to be achieved. Learning objectives may be derived from competencies or learning outcomes.
- **Learning Outcome** – the intended aggregate learner endpoint for a program, typically independent of the means by which the outcome is achieved. Used to identify, define and communicate the skills and qualities graduates should have [[Harden 2](#)].
- **Learning Object** – a digital resource used to support learning.
- **Performance** – a demonstration of practice, such as patient care. Can be used as evidence of one or more competencies.

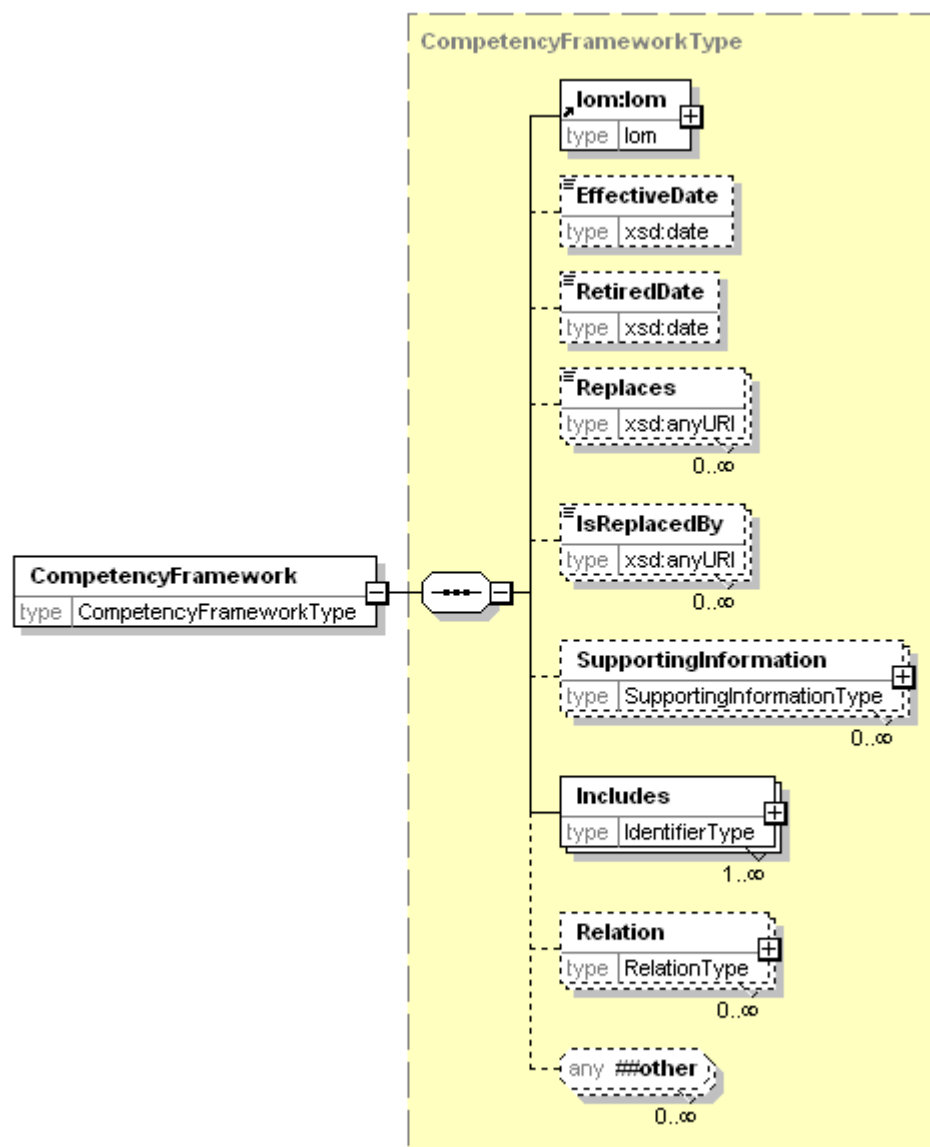
8 Competency Framework Schema Grammar

The following sections explain the Competency Framework Schema grammar. Values in bold under XML Tags column indicate that the element has sub-elements.

All the elements having sub-elements will be defined in separate sections. All elements without sub-elements will be defined within the appropriate element sections that use them.

8.1 CompetencyFramework

CompetencyFramework is the root element. It contains subelements that describe a set of related **competency definitions** as well as the relationships among those competency definitions, if applicable. CompetencyFramework must occur once within a competency framework document.



Generated by XMLSpy

www.altova.com

CompetencyFramework Element Information

Element	Description	Required	Multiplicity	Datatype
CompetencyFramework	CompetencyFramework is the root element. It describes a set of related competency definitions and their relationships.	Required	1	Container
lom	<p>lom is the subelement of CompetencyFramework. It contains subelements that define title, publisher, and other descriptive information about this competency framework.</p> <p>The lom element is defined in the Healthcare Learning Object Metadata standard defined by MedBiquitous. Please see the Healthcare Learning Object Metadata Specifications and Description document for more information on the sub-elements of lom. For information on which subelements of lom are required or recommended for Competency Frameworks, see section Lom Required and Recommended Elements.</p>	Required	1	Container For more information, see [Healthcare LOM] and [LOM] .
EffectiveDate	EffectiveDate is a subelement of CompetencyFramework. It describes the date this competency framework becomes or became effective.	Optional	0 or 1	Date
RetiredDate	RetiredDate is a subelement of CompetencyFramework. It describes the date upon which this competency framework was retired.	Optional	0 or 1	Date

Element	Description	Required	Multiplicity	Datatype
Replaces	<p>Replaces is a subelement of CompetencyFramework. Replaces indicates a related competency framework that is supplanted, displaced, or superseded by the described framework.</p> <p>Implementers must use a URI to represent the related framework.</p> <p>Replaces is based on the Dublin Core term replaces. For more information, see [DCMITerms].</p>	Optional	0 or more	URI
IsReplacedBy	<p>IsReplacedBy is a subelement of CompetencyFramework. IsReplacedBy indicates a related competency framework that supplants, displaces, or supersedes the described framework.</p> <p>Implementers must use a URI to represent the related framework.</p> <p>IsReplacedBy is based on the Dublin Core term isReplacedBy. For more information, see [DCMITerms].</p>	Optional	0 or more	URI
SupportingInformation	<p>SupportingInformation is the subelement of CompetencyFramework. It contains subelements that include or link to supporting information, such as descriptions of the rationale for developing the framework and its intended use. See section SupportingInformation for more information.</p>	Optional	0 or more	Container
Includes	<p>Includes is the subelement of CompetencyFramework. It contains subelements that uniquely identify competencies included in this competency framework. All competencies included in the framework must be referenced using the Includes element, including any competency object or framework referenced in a relations element.</p>	Required	1 or more	IdentifierType See section IdentifierType for more information.

Element	Description	Required	Multiplicity	Datatype
Relation	Relation is the subelement of CompetencyFramework . It contains subelements that define a relationship between two components of a framework. See section Relation for more information.	Optional	0 or more	Container
Elements from other namespaces	CompetencyFramework may include elements from other namespaces provided those elements are namespace qualified.	Optional	0 or more	Any

Example:

```

<CompetencyFramework>
  <lom:lom>
    . . .
  </lom:lom>
  <EffectiveDate>2011-12-09</EffectiveDate>
  <Replaces>http://www.example.org/competency1</Replaces>
  <SupportingInformation>
    . . .
  </SupportingInformation>
  <Includes>
    . . .
  </Includes>
  <Includes>
    . . .
  </Includes>
  <Includes>
    . . .
  </Includes>
  <Relation>

```

```

. . .
</Relation>
<Relation>
. . .
</Relation>
<Relation>
. . .
</Relation>

```

8.2 Lom Required and Recommended Elements

lom is the subelement of CompetencyFramework. It contains subelements that define title, publisher, and other descriptive information about this competency framework.

Import image

The table that follows indicates which elements of healthcare lom are required or recommended for use in the Competency Framework. Note that additional lom elements may be used.

lom Element Usage Information

Element	Description	Required	Multiplicity	Datatype
lom	lom is the subelement of CompetencyFramework. It contains subelements that define title, publisher, and other descriptive information about this competency framework. For more information on these elements, see [LOM] and [Healthcare LOM]	Required	1	Container For more information on lom and its subelements, see [Healthcare LOM] and [LOM] .

Element	Description	Required	Multiplicity	Datatype
general	A container for general metadata elements.	Required	1	Container
general:identifier	A container for identifier information.	Required	1 or more	Container
general:identifier:catalog	The cataloguing system for the unique identifier. For competency frameworks, the catalog must be URI.	Required	1	Restricted
general:identifier:entry	Defines a unique identifier for the competency framework. For competency frameworks, identifiers must be in the form of a URI.	Required	1	URI
general:title	Defines the title for this competency framework in one or more languages.	Required	1 or more	LanguageString
general: description	A short description of the competency framework.	Recommended	0 or 1	LanguageString
lifecycle	A container for elements relating to the lifecycle of the framework.	Recommended	0 or 1	Container
lifecycle: status	A container for elements describing the status of the competency framework.	Recommended	0 or 1	Container
lifecycle: status: source	The source of the vocabulary for status. Use LOMv1.0.	Recommended	0 or 1	Restricted

Element	Description	Required	Multiplicity	Datatype
lifecycle: status: value	The status of the competency framework. Valid values are: draft, final, revised, unavailable. Use of draft and final values is recommended.	Recommended	0 or 1	Restricted
lifecycle: contribute	A container for elements the people and organizations that have contributed to the competency framework.	Recommended	0 or 1	Container
lifecycle: contribute: role	A container for elements describing the publisher and other entities involved in the development of this framework. Use the role and entity elements within the lifecycle element to indicate the publisher of the competency framework. Role should have a value of publisher and be paired with an entity describing the publisher.	Recommended	0 or more	Container
lifecycle: contribute: role:source	The source of the vocabulary for role. When describing the publisher, use LOMv1.0.	Recommended	0 or 1	Restricted
lifecycle: contribute: role: value	The role being described. To describe the publisher, value should be publisher.	Recommended	0 or 1	Restricted

Element	Description	Required	Multiplicity	Datatype
lifecycle: contribute: entity	Use the role and entity elements within the lifecycle element to indicate the publisher of the competency framework. Entity includes a vcard reference to the publisher and should be paired with a role that has a value of publisher.	Recommended	0 or more	VCARD
educational	A container element for elements related to the educational aspects of the framework.	Recommended	0 or 1	Container
educational: context	A container for elements describing the educational environment for which the competency framework is intended.	Recommended	0 or more	Container
educational: context:source	The source of the vocabulary for educational context. To use the MedBiquitous vocabulary, use HEALTHCARE_LOMv1.	Recommended	0 or 1	Restricted

Element	Description	Required	Multiplicity	Datatype
educational:context:value	<p>The educational context for which the framework is intended. Use a term from the following MedBiquitous vocabulary (described in HealthcareLOM):</p> <ul style="list-style-type: none"> • patient education • caregiver education • primary education • secondary education • vocational training • undergraduate education • undergraduate professional education • graduate professional education • continuing professional development 	Recommended	0 or 1	Restricted
rights	A container element for information on copyright and other restrictions.	Recommended	0 or 1	Container
rights: copyrightAndOtherRestrictions	A container for elements indicating whether or not copyright or other restrictions exist on the competency framework.	Recommended	0 or 1	Container
rights: copyrightAndOtherRestrictions:source	<p>The source of the vocabulary used to describe copyright and other restrictions. To use the lom vocabulary, use LOMv1.0.</p>	Recommended	0 or 1	Restricted

Element	Description	Required	Multiplicity	Datatype
rights: copyrightAndOtherRestrictions:value	Indicates whether or not copyright and other restrictions exist. Valid values are yes and no.	Recommended	0 or 1	Restricted
rights: description	The description element within rights provides a brief description of the copyright or other constraints on the competency framework. The description may include a link to a license.	Recommended	0 or 1	LanguageString
healthcareMetadata	A container element for healthcare related metadata.	Recommended	0 or 1	Container
healthcareMetadata:healthcareEducation	A container element for healthcare education related metadata.	Recommended	0 or 1	Container
healthcareMetadata:healthcareEducation targetAudience	A container element for information about the target audience for whom this framework is intended.	Recommended	0 or 1	Container
healthcareMetadata: healthcareEducation:targetAudience: profession	The health profession for which this competency framework is intended.	Recommended	0 or 1	LanguageString

Example:

```
<lom:lom>
  <lom:general>
```

```
<lom:identifier>
  <lom:catalog>URI</lom:catalog>
  <lom:entry>http://www.example.org/framework1</lom:entry>
</lom:identifier>
<lom:title>
  <lom:string language="en">The Competent Physician</lom:string>
</lom:title>
<lom:description>
  <lom:string language="en">The Competent Physician describes the knowledge, skills, and
abilities a physician should have.</lom:string>
</lom:description>
</lom:general>
<lom:lifeCycle>
  <lom:version>
    <lom:string>1.0</lom:string>
  </lom:version>
  <lom:contribute>
    <lom:entity>Association of Worldwide Physicians</lom:entity>
    <lom:role>
      <lom:source>LOMv1.0</lom:source>
      <lom:value>publisher</lom:value>
    </lom:role>
  </lom:contribute>
</lom:lifeCycle>
<lom:educational>
  <lom:context>
    <lom:source>HEALTHCARE_LOMv1</lom:source>
    <lom:value>undergraduate professional education</lom:value>
  </lom:context>
</lom:educational>
<lom:rights>
  <lom:copyrightAndOtherRestrictions>
    <lom:source>LOMv1.0</lom:source>
    <lom:value>yes</lom:value>
  </lom:copyrightAndOtherRestrictions>
```

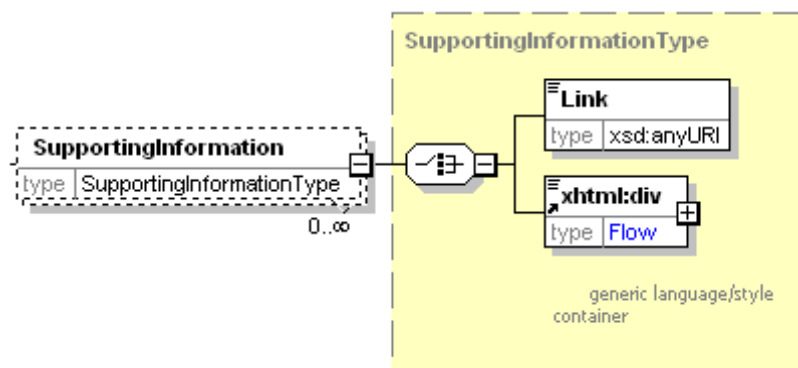
```

    <lom:description>
      <lom:string language="en">Creative Commons Attribution 3.0 Unported license,
      http://creativecommons.org/licenses/by/3.0/</lom:string>
    </lom:description>
  </lom:rights>
  <hx:healthcareMetadata>
    <hx:healthcareEducation>
      <hx:targetAudience>
        <hx:profession>
          <lom:string language="en">physician</lom:string>
        </hx:profession>
      </hx:targetAudience>
    </hx:healthcareEducation>
  </hx:healthcareMetadata>
</lom:lom>

```

8.3 SupportingInformation

SupportingInformation includes or links to supporting information, such as descriptions of the rationale for developing the framework and its intended use.



SupportingInformation Element Information

Element	Description	Required	Multiplicity	Datatype
SupportingInformation	SupportingInformation is the subelement of CompetencyFramework. It contains subelements that include or link to supporting information, such as descriptions of the rationale for developing the framework and its intended use.	Optional	0 or more	Container
Link	Link is the subelement of SupportingInformation. It provides a URL or URI reference to a supporting resource, such as a pdf or html file describing the purpose of the framework in detail. Link must contain a valid URI.	Either Link or xhtml:div is required	0 or 1	Restricted
xhtml:div	A div element is a mixed type element referenced from XHTML. The div element can include a mix of text and XHTML tags as specified by the XHTML schema.	Either Link or xhtml:div is required	0 or 1	Container For more information, see [XHTML] .

The following example provides a link:

```
<SupportingInformation>
  <Link>http://www.scottishdoctor.org/resources/scottishdoctor3.doc</Link>
</SupportingInformation>
```

The following example shows the use of XHTML:

```
<SupportingInformation>
  <xhtml:div>
    <xhtml:h2>The Scottish Deans Medical Curriculum Group (SDMCG)</xhtml:h2>
    <xhtml:p>Following the publication of ‘Tomorrow’s Doctors’ by the UK General
    Medical Council (GMC) in 1993, the five Scottish Medical Schools (Universities of Aberdeen,
    Dundee, Edinburgh, Glasgow and St Andrews) had a series of meetings to discuss the implications
```

of the recommendations. As a result of these discussions, the Scottish Deans' Medical Curriculum Group (SDMCG) was set up in 1999. The purpose of the SDMCG is to discuss and where necessary coordinate the development, delivery and evaluation of their undergraduate curricula and to ensure that the graduates from each school are of an equivalent standard.

The Group comprises two members from each School, one of whom is the Teaching Dean or equivalent. The Group also has as members a medical education IT expert, an educationalist, who also acts as the Project Officer, a Post Graduate Dean and an administrator. The activities of the Group are funded by the five Schools, with earlier support coming from NHS Education for Scotland. The SDMCG reports to the Board for Academic Medicine in Scotland.

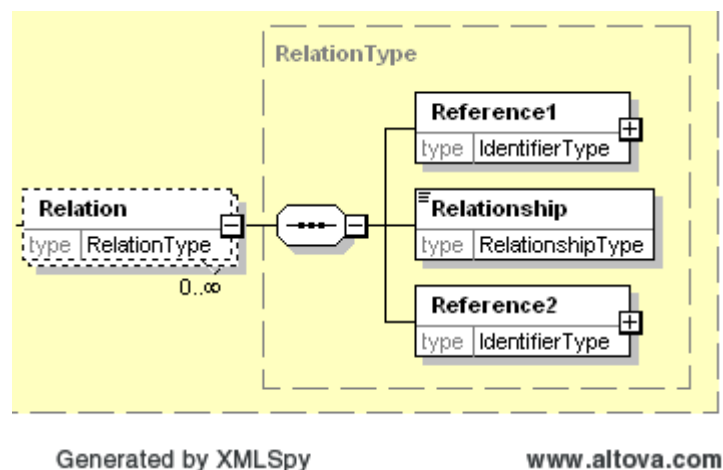
The Scottish Doctor publications have been the most visible results of the SDMCG's activities. Other projects include ones on standard setting, student portfolios, learning in acute care, communication skills and anatomy and some of these projects are ongoing. There is also a standing IT/informatics subgroup (The Medical Education Informatics Group). The SDMCG has proved a valuable forum for the Schools to discuss national issues such as Government or NHS consultation documents or guidance from specialty groupings about undergraduate medical curricular content. The Group has recently appointed a Senior University Teacher in Law, Ethics and Risk Management. The holder of this post, which is funded by the Medical and Dental Defence Union of Scotland, works with all five Schools on their continuing development of this important curricular theme.

</xhtml:div>

</SupportingInformation>

8.4 Relation

Relation defines a relationship between two components of a framework.



Relation Element Information

Element	Description	Required	Multiplicity	Datatype
Relation	<p>Relation is the subelement of Competency Framework. It contains subelements that define a relationship between two components of a framework. The following types of relationships are allowed:</p> <ul style="list-style-type: none"> • A competency may have a broader competency. • Conversely, a competency may have a narrower competency. • A competency may have a narrower external framework. • Conversely, an external framework may have a broader competency. • A competency may be related to another competency. • A competency may be related to an external framework. <p>No other relationships may be defined. Cyclical references are forbidden as are any references that result in a hierarchical conflict. For more information, see the note about hierarchical conflict following this section.</p>	Optional	0 or more	Container

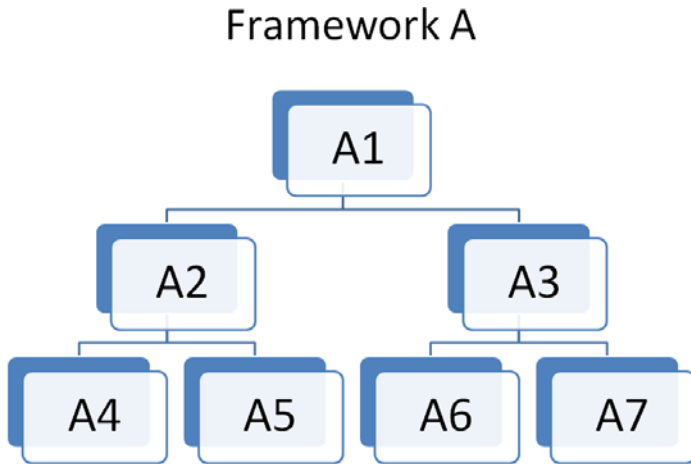
Reference1	Reference1 is the subelement of Relation. It identifies a single competency with a relationship to the components specified in Reference2.	Required	1	Container
Relationship	<p>Relationship is a subelement of Relation. It defines the nature of the relationship between the components of the framework specified in Reference1 and Reference2.</p> <p>Valid values are:</p> <p>http://www.w3.org/2004/02/skos/core#broader which means has broader concept</p> <p>http://www.w3.org/2004/02/skos/core#narrower which means has narrower concept</p> <p>http://www.w3.org/2004/02/skos/core#related which means has related concept.</p> <p>Has broader concept and has narrower concept, indicated by http://www.w3.org/2004/02/skos/core#broader and http://www.w3.org/2004/02/skos/core#narrower, are converse relationships. If Component1 has broader concept Component2, Component2 must have narrower concept Component1. The converse relationship does not need to be explicitly encoded; it should be understood based on the nature of the relationship between the two components.</p> <p>Has related concept, http://www.w3.org/2004/02/skos/core#related, may be used for any relationship that is non-hierarchical.</p> <p>The valid values of the relation element are taken from the Simple Knowledge Organizations System [SKOS].</p>	Required	1	Restricted
Reference2	Reference2 is the subelement of Relation. It identifies the component that has a relationship to the component specified in Reference1.	Required	1	Container

Example:

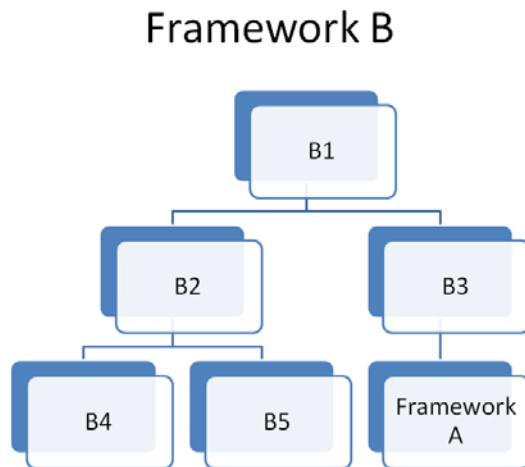
```
<Relation>
  <Reference1>
    <Catalog>URI</Catalog>
    <Entry>http://www.example.org/competency123</Entry>
  </Reference1>
  <Relationship>broader than</Relationship>
  <Reference2>
    <Catalog>URI</Catalog>
    <Entry>http://www.example.org/competency234</Entry>
  </Reference2>
</Relation>
```

8.5 Note about Hierarchical Conflict

The ability to define relations to external competency objects and frameworks provides a great deal of flexibility in defining a competency framework, but it also has the potential to lead to confusion. This standard explicitly forbids any relations that result in a hierarchical conflict, as in the example below.

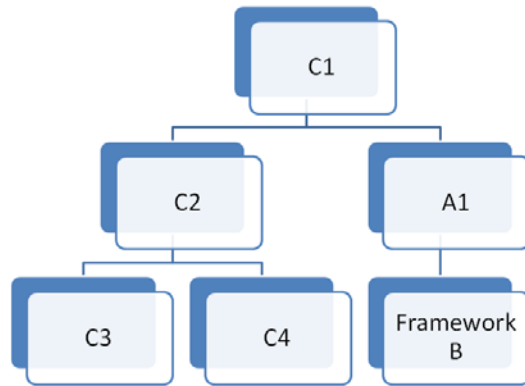


Framework A has no external references.

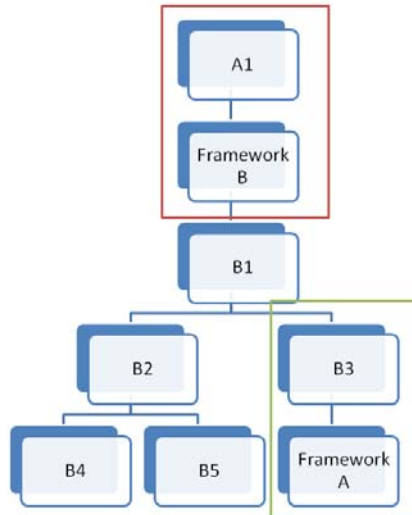


Framework B incorporates Framework A. Competency object B3 is broader than Framework A.

Framework C



Framework C incorporates a competency from framework A and all of Framework B, saying that competency object A1 is broader than Framework B. This is a hierarchical conflict since Framework B explicitly defines Framework A, and therefore all of its competency objects, including A1, as narrower than competency object B3, which is a part of framework B. The resulting string of relations look like this:



The hierarchical relation shown in red clearly conflicts with the hierarchical relation shown in green.

9 Sample XML Documents

```

<?xml version="1.0" encoding="UTF-8"?>
<CompetencyFramework xmlns="http://ns.medbiq.org/competencyframework/v1/"
xmlns:lom="http://ltsc.ieee.org/xsd/LOM"
xmlns:hx="http://ns.medbiq.org/lom/extend/v1/"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://ns.medbiq.org/competencyframework/v1/
competencyframework.xsd http://ltsc.ieee.org/xsd/LOM
http://ns.medbiq.org/lom/healthcarelom.xsd
http://ns.medbiq.org/lom/extend/v1/
http://ns.medbiq.org/lom/healthcare/healthcaremetadata.xsd">
  <lom:lom>
    <lom:general>
      <lom:identifier>
        <lom:catalog>URI</lom:catalog>
        <lom:entry>http://www.example.org/framework1</lom:entry>
      </lom:identifier>
      <lom:title>
        <lom:string language="en">The Competent Physician</lom:string>
      </lom:title>
      <lom:description>
        <lom:string language="en">The Competent Physician describes
the knowledge, skills, and abilities a physician should have.</lom:string>
      </lom:description>
    </lom:general>
    <lom:lifeCycle>
      <lom:version>
        <lom:string>1.0</lom:string>
      </lom:version>
      <lom:contribute>
        <lom:entity>Association of Worldwide Physicians</lom:entity>
        <lom:role>
          <lom:source>LOMv1.0</lom:source>
          <lom:value>publisher</lom:value>
        </lom:role>
      </lom:contribute>
    </lom:lifeCycle>
    <lom:educational>
      <lom:context>
        <lom:source>HEALTHCARE_LOMv1</lom:source>
        <lom:value>undergraduate professional education</lom:value>
      </lom:context>
    </lom:educational>
    <lom:rights>
      <lom:copyrightAndOtherRestrictions>
        <lom:source>LOMv1.0</lom:source>

```

```

        <lom:value>yes</lom:value>
      </lom:copyrightAndOtherRestrictions>
      <lom:description>
        <lom:string language="en">Creative Commons Attribution 3.0
Unported license, http://creativecommons.org/licenses/by/3.0/</lom:string>
      </lom:description>
    </lom:rights>
    <hx:healthcareMetadata>
      <hx:healthcareEducation>
        <hx:targetAudience>
          <hx:profession>
            <lom:string language="en">physician</lom:string>
          </hx:profession>
        </hx:targetAudience>
      </hx:healthcareEducation>
    </hx:healthcareMetadata>
  </lom:lom>
  <EffectiveDate>2011-12-09</EffectiveDate>
  <Includes>
    <Catalog>URI</Catalog>
    <Entry>http://www.example.org/competency1</Entry>
  </Includes>
  <Includes>
    <Catalog>URI</Catalog>
    <Entry>http://www.example.org/competency2</Entry>
  </Includes>
  <Includes>
    <Catalog>URI</Catalog>
    <Entry>http://www.example.org/competency3</Entry>
  </Includes>
  <Relation>
    <Referencel>
      <Catalog>URI</Catalog>
      <Entry>http://www.example.org/competency1</Entry>
    </Referencel>

    <Relationship>http://www.w3.org/2004/02/skos/core#narrower</Relationshi
p>
    <Reference2>
      <Catalog>URI</Catalog>
      <Entry>http://www.example.org/competency3</Entry>
    </Reference2>
  </Relation>
  <Relation>
    <Referencel>
      <Catalog>URI</Catalog>
      <Entry>http://www.example.org/competency1</Entry>
    </Referencel>

```

```
<Relationship>http://www.w3.org/2004/02/skos/core#narrower</Relationshi  
p>  
  <Reference2>  
    <Catalog>URI</Catalog>  
    <Entry>http://www.example.org/competency2</Entry>  
  </Reference2>  
</Relation>  
</CompetencyFramework>
```

10 References

Albanese 1

Albanese MA, Mejicano G, Mullan P, Kokotailo P and Gruppen L. Defining characteristics of educational competencies. *Medical Education* 2008; 42(3):248-55.

Competency Object

MedBiquitous Competency Object Specifications and description Document. MedBiquitous Website. <http://www.medbiq.org/sites/default/files/CompetencyObjectSpecification.pdf>. Accessed June 16, 2011.

DCMI Terms

DCMI Metadata Terms. Dublin Core Metadata Initiative Website. <http://dublincore.org/documents/dcmi-terms>. Accessed October 17, 2011.

Harden 1

Harden RM. Learning outcomes and instructional objectives: is there a difference? *Medical Teacher* 2002; 24(2):151-5.

Harden 2

Harden RM, Crosby JR, Davis MH and Friedman M. AMEE Guide No. 14: Outcome-based education: Part 5 – From competency to meta-competency: a model for the specification of learning outcomes. *Medical Teacher* 1999; 21(6):546-52.

Healthcare LOM

ANSI/MEDBIQ LO.10.1-2008, Healthcare Learning Object Metadata, MedBiquitous Website. http://www.medbiq.org/std_specs/standards/index.html#HCLOM. Accessed June 1, 2011.

IEEE RCD

1484.20.1-2007 - IEEE Standard for Learning Technology-Data Model for Reusable Competency Definitions, IEEE Standards Association Website. <http://standards.ieee.org/findstds/standard/1484.20.1-2007.html>. Downloaded October 21, 2009.

LOM

"IEEE Standard for Learning Technology-Extensible Markup Language (XML) Schema Definition Language Binding for Learning Object Metadata," *IEEE Std 1484.12.3-2005*, vol., no., pp.0_1-46, 2005
doi: 10.1109/IEEESTD.2005.97889

URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=1532505&isnumber=32693>

SKOS

SKOS Simple Knowledge Organizations System Namespace Document – HTML Variant, 18 August 2009

Recommendation Edition, W3C website. <http://www.w3.org/2009/08/skos-reference/skos.html>.
Accessed November 10, 2011.

XHTML

XHTML™ 1.0 The Extensible HyperText Markup Language (Second Edition), W3C website.
<http://www.w3.org/TR/2002/REC-xhtml1-20020801>. Accessed September 6, 2011.