Linked Data for Professional Education (LD4PE)

An IMLS funded Project
What Is LD4PE?

- Linked Data for Professional Education (LD4PE) is a project under the jurisdiction of the DCMI Education & Outreach Committee, funded by the Institute of Museum and Library Services (IMLS).
  - The intent is that the LD4PE website will continue to be supported by DCMI and its members as part of DCMI's larger education and outreach activities, and be used in other activities as appropriate once the project is completed.

- The project has developed a Web-based Linked Data platform to support the structured discovery of the learning resources available online by open educational resource (OER) and commercial providers.
  - At the heart of the Linked Data project and website is a competency framework for Linked Data that supports indexing learning resources according to the specific competencies, skills, and acquired abilities they address.
  - To do this, the LD4PE website itself leverages Linked Data technology by assigning global identifiers (URIs) to statements of competency, then citing those URIs in metadata descriptions of learning resources.
Who Is Involved?
Key Project Personnel

• University of Washington
  – Michael Crandall
  – Stuart Sutton
  – David Talley
  – Abi Evans

• Kent State University
  – Marcia Zeng
  – Sean Dolan

• DCMI
  – Stuart Sutton
  – Tom Baker
  – Joseph Chapman

• Content Partners
  – Elsevier
    • Michael Lauruhn
  – Access Innovations
    • Marjorie Hlava
  – Synaptica
    • David Clarke
  – Sungkyunkwan University
    • Sam Oh
  – OCLC
    • Eric Childress
Project Deliverables

• **Competency Framework.** A “Competency Index for Linked Data” based on the Achievement Standards Network Description Language (ASN-DL) for describing formally promulgated competencies and benchmarks.

• **Toolkit.** An openly available, web-based tool set to support the generation of RDF metadata describing: (a) learning resources; and (b) ASN-based competency frameworks and SKOS-based concept schemes.

• **Learning Resource Descriptions.** A set of cataloged learning resources that have been mapped to the competencies and benchmarks of the Competency Index to support competency-based resource discovery by teachers, trainers and learners.

• **LD4PE Website.** A website to be managed by DCMI as part of its educational agenda for open discovery of competency-based learning resources, access to the toolkit, learner trajectory maps, and supporting resources.

• **Best Practices.** Readily accessible best practice documentation for all processes, from community-based competency framework development and learning resource description through learner trajectory creation.
Architecture
Linked Data Competency Index: Mapping the field for teachers and learners

Thomas Baker
Dublin Core Metadata Initiative
The Linked Data Competency Index provides:

• a concise and readable map of concepts and skills
• related to practices and technologies of Linked Data
• for benefit of interested learners (and teachers).
“Competency Index”

A thematic set of competencies organized by

• **Topic**
  – **Competency**: a tweet-length phrase about knowledge or skills that can be learned

• **Benchmark**: an action that demonstrates accomplishment in a given competency
Linked Data Competency Index Example

• **Topic**: Querying RDF Data
  
  – **Competency**: Understands that a SPARQL query matches an RDF graph against a pattern of triples with fixed and variable values
  
  – **Competency**: Understands the basic syntax of a SPARQL query
    
    • **Benchmark**: Uses angle brackets for delimiting URIs.
    • **Benchmark**: Uses question marks for indicating variables.
    • **Benchmark**: Uses PREFIX for base URIs.
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  – **Competency:** Understands that a SPARQL query matches an RDF graph against a pattern of triples with fixed and variable values
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Overview of topics

• **Fundamentals of Resource Description Framework**
  - Identity in RDF
  - RDF data model
  - Related data models
  - RDF serialization

• **Fundamentals of Linked Data**
  - Web technology
  - Linked data principles
  - Linked Data policies and best practices
  - Non-RDF Linked Data

• **RDF vocabularies and application profiles**
  - Finding RDF-based vocabularies
  - Designing RDF-based vocabularies
  - Maintaining RDF vocabularies
  - Versioning RDF vocabularies
  - Publishing RDF vocabularies
  - Mapping RDF vocabularies
  - RDF application profiles

• **Creating and transforming RDF Data**
  - Managing identifiers (URIs)
  - Creating RDF data
  - Versioning RDF data
  - RDF data provenance
  - Cleaning and reconciling RDF data
  - Mapping and enriching RDF data

• **Interacting with RDF Data**
  - Finding RDF Data
  - Processing RDF data using programming languages
  - **Querying RDF Data**
    - Visualizing RDF Data
    - Reasoning over RDF data
    - Assessing RDF data quality
    - RDF Data analytics
    - Manipulating RDF Data

• **Creating Linked Data applications**
  - Storing RDF data
Competency Index

Competencies and benchmarks

- **Topic:** Querying RDF Data
  - **Competency:** **Understands** that a SPARQL query matches an RDF graph against a pattern of triples with fixed and variable values
  - **Competency:** **Knows** the basic syntax of a SPARQL query
    - **Benchmark:** **Uses** angle brackets for delimiting URIs.
    - **Benchmark:** **Uses** question marks for indicating variables.
    - **Benchmark:** **Uses** PREFIX for base URIs.
620 resources described

http://explore.dublincore.net/explore-learning-resources-by-competency/
Example: YouTube video tagged using LDCI

Maximising (Re)Usability Of Library Metadata Using Linked Data

In this video, the speaker explores challenges related to the re-usability of library linked metadata in the field of cultural heritage and for other purposes. She argues that it is crucial that published Linked Data accurately represent core aspects of the original metadata related to language, provenance, license, and dataset metadata. The speaker proposes a "proper representation" of these features using W3C standards, best practices and guidelines for multilingual Linked Open Data.

URL:
https://www.youtube.com/watch?v=IIDXZ-wj4Vs

Keywords: Libraries, Archives, and Museums (LAMs), Lemon (Lexicon Model for Ontologies), Linguistic Linked Open Data, VoID (Vocabulary of Interlinked Datasets), BabelNet

Author: Pérez, Asunción Gómez
Publisher: Technical University of Madrid
Example: YouTube video tagged using LDCI

How to represent in Linked Data...

- Traditional annotation properties to represent language
  
  bne:XX1718747
  rdfs:label "Θερσάντες, Μιγκέλ ντε"@gr.
  "Miguel de Cervantes"@es.
  "Cervantes di Saavedra, Michele"@it.

- Richer models to represent linguistic information for more demanding applications

Association of the vocabulary to an external lexicon model: Is author of (Femenine and Masculine)

```
# LEMON
Bne:OP5001 lemon:isReferenceOf [lemon:isSenseOf :author_of].
:author_of a lemon:LexicalEntry;
lemon:form [lemon:writtenRep "es autor de"@es;
```
https://dcmi.github.io/ldci/D2695955/

LD4PE Competency Index

Version: 2017-06-28 14:34:35
View at: https://dcmi.github.io/ldci/D2695955/

<table>
<thead>
<tr>
<th>Code</th>
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<th>Definition</th>
</tr>
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<tr>
<td>A</td>
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<td></td>
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<td>Tweet-length assertion of knowledge, skill, or habit of mind.</td>
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<td>D</td>
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Note: Hover over a code to see its URI. Click on a code to visit its full definition on the Achievement Standards Network website.

A: Fundamentals of Resource Description Framework

- B: Identity in RDF
  - C: Knows that anything can be named with Uniform Resource Identifiers (URIs), such as agents, places, events, artifacts, and concepts.
Linked Data Competency Index in Chinese

https://dcmi.github.io/ldci-zh/D2695955-zh/

LD4PE Competency Index

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</tbody>
</table>
| C    | 指标 | 知识、技能与思维习惯的主张（140个字符的Tweet长度）。
| D    | 基准 | 达成相关能力的行动。 |

说明: 鼠标暂停在代码上可以看到URI, 点击代码可在一个网页上访问其定义。全文。

A: RDF（资源描述框架）基础

- B: RDF中的标识
  - C: 知道在RDF中所有东西（thing）通过唯一资源识别URI进行命名，例如，代理、地点、事件、物理对象等。
Crowdsourcing LDCI maintenance

**LD4PE Competency Index**

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Users can propose new competencies

- Users can propose new competencies that are real, imagined, or conceptual.
- * [C:]($\text{http://asn.desire2learn.com/resources/S2709298}$) Understands that resources are declared to be members (instances) of classes using the property rdf:type.
- * [C:]($\text{http://asn.desire2learn.com/resources/S2709299}$) Understands the use of datatypes and language tags with literals.
- * [C:]($\text{http://asn.desire2learn.com/resources/S2709997}$) Understands blank nodes and their uses.
- * [C:]($\text{http://asn.desire2learn.com/resources/S2710000}$) Understands that QNames define shorthand prefixes for long URIs.
- * [D:]($\text{http://asn.desire2learn.com/resources/S2710007}$) Uses prefixes for URIs in RDF specifications and data.
- * [C:]($\text{http://asn.desire2learn.com/resources/S2731549}$) Articulates differences between the RDF abstract data model and the XML and relational models.
- * [C:]($\text{http://asn.desire2learn.com/resources/S2731551}$) Understands the RDF abstract data model as a directed labeled graph.
- * [C:]($\text{http://asn.desire2learn.com/resources/S2731552}$) Knows graphic conventions for depicting RDF-based models.
- * [D:]($\text{http://asn.desire2learn.com/resources/S2731553}$) Can use graphing or modeling software to share those models with others.
- * [C:]($\text{http://asn.desire2learn.com/resources/S2709875}$) Understands a named graph as one of the collection of graphs comprising an RDF dataset, with a graph name unique in the context of that dataset.
- * [C:]($\text{http://asn.desire2learn.com/resources/S2731590}$) Understands how a namespace, informally used in the RDF context for a namespace URI or RDF vocabulary, fundamentally differs from the namespace of data attributes and functions (methods) defined for an object-oriented class.
- * [B:]($\text{http://asn.desire2learn.com/resources/S2696012}$) Related data models
  - * [C:]($\text{http://asn.desire2learn.com/resources/S2731554}$) Grasps essential differences between schemas for syntactic validation (e.g., XML) and for inferencing (RDF Schema).
  - * [C:]($\text{http://asn.desire2learn.com/resources/S2731555}$) Differentiates hierarchical document models (e.g., XML) and graph models (RDF).
LD4PE Competency Index

Who can use it?

- **Students**: help choose courses that cover what you want to learn.
- **Instructors**: design a course, syllabus, homework, quizzes, exams.
- **Employers**: write a job description.
- **Self-learners**: explore technologies and methods related to Linked Data.
LD4PE Competency Index
Learning tailored to the individual

• Since 1800s: “industrial” classroom:
  – instructors lecture ("sage on the stage")
  – students listen and take notes
  – achievement measured by a grade on the exam

• Trend: learning tailored to the individual:
  – students watch the lectures online before class
  – students pursue customized learning objectives
  – instructors give individualized help ("guide at the side")
  – learners learn at own pace
  – life-long learning
  – achievement measured in competencies acquired
LDCI is work in progress!
Follow us on Github!
How Can I Use LD4PE in self-learning, teaching, and training?

Marcia Zeng
Kent State University

1. Learning Maps -- competencies
2. Saved sets – resources
3. OCLC Dataset -- A dataset to try, with sample queries and a guide sheet.
1. Learning Maps

- Logical sequences; Paths or Trajectories to follow
- Competencies targeted to specific audience or theme
- Each item links to a list of resources which teach the competency
Newly Created Map

Competencies for Catalogers
Created: 8/29/2017
Considers the paradigm shift necessary to catalog to an expanded universe
Set Creator: Sean Dolan

Competencies for Data Scientists
Created: 8/11/2017
Recognizing Linked Data as a valuable resource and dealing
Set Creator: Sean Dolan

Competencies for Web Developers
Created: 7/24/2017
Topics include RDF serializations, microdata for HTML markup
Set Creator: Sean Dolan

Competencies for Librarians
Created: 7/22/2017
Deals with the challenges of transitioning from traditional bibliographic systems
Set Creator: Sean Dolan

Competencies for Archivists
Created: 7/15/2017
For quickly getting archivists up-to-speed with Linked Data systems
Set Creator: Sean Dolan

See a list of the learning maps at http://explore.dublincore.net/explore-learning-resources-by-competency/learning-maps/
Example: Individual Learning Map Page
--- a learning map prepared for archivists – what are the key competencies?

- Below each competency, the number of resources tagged to it are listed.
- Clicking this link will take you to these resources.

**Desiderata For An Authoritative Representation Of MeSH In RDF**

Although the Semantic Web provides a framework for the integration of resources on the web, datasets are not always made available in RDF by their [...]  

***** (Please share your rating)

**Semantic Web Misconceptions**

The Semantic Web has been talked about for more than a decade. Over those years, several mistaken or misleading ideas about the Semantic Web have [...]  

***** (Please share your rating)

**The Semantic Web And Linked Data Concepts: A Basic**

**Transforming The Medical Subject Headings Into Linked Data: A New Article In The Journal Of Library Metadata**

This article reviews the pilot project to convert the Medical Subject Headings (MeSH) from XML to Linked Data/RDF. The article examines the collaborative process, the [...]  

***** (Please share your rating)

**Europeana: Moving To Linked Data**

This article describes the pilot project undertaken by Europeana. Its goal was to replace data societies within the cultural heritage domain with "a distributed information [...]  

***** (Please share your rating)

**The Semantic Web And Linked Data Concepts: A Basic**
Learning Map: Competencies for Catalogers

Considers the paradigm shift necessary to catalog to an expanded audience (the Web) as well as technical details involved.

Understands that Linked Data (2006) extended the notion of a web of documents (the Web) to a notion of a web of finer-grained data (the Linked Data cloud).

69 resources

Knows Tim Berners-Lee's use HTTP URIs that can be independent identifiers.

18 resources

Knows that Uniform Resource Locators (URIs) are distinct from the URI itself.

0 resources

Understands that a "resource" is distinct from the URI.

0 resources

Knows the subject-prefixing namespaces.

46 resources

Understands the difference between SQL query language (which operates on database tables) and SPARQL (which operates on RDF graphs).

24 resources

Understands the use of datatypes and language tags with literals.

15 resources

Knows graphic conventions for depicting RDF-based models.

10 resources

Distinguishes the RDF abstract data model and concrete serializations of RDF data.

41 resources

Recognizes that owl:sameAs, while popular, can create unintended formal semantics that can entail unintended properties.

13 resources

Identifies resource attributes and relationship-holding data that can be candidates for RDF properties.

9 resources

Uses RDF Schema to express semantic restrictions on properties.

53 resources

Coins namespace URIs, as needed, for any attached properties.

14 resources

Knows Simple Knowledge Organization System (SKOS) for representing knowledge that is organized into informal hierarchies, and inherits.

43 resources

Knows SKOS eXtension for Labels, or SKOS-XL (2009), a small set of additional properties for describing and linking lexical labels as instances of the class Label.

4 resources

Managing identifiers (URI)

19 resources

Creating RDF data

44 resources

Cleaning and reconciling RDF data

17 resources

Mapping and enriching RDF data

32 resources

Knows the SPARQL 1.1 Update language for updating, creating, and removing RDF graphs in a Graph Store

32 resources
Making new maps

Learning Maps

List Learning Maps Created By
All users

Create a New Learning Map
Enter new map name
Enter new map description

Authenticated users can assemble nodes from the Competency Index into structures or as personalized pathways created by instructors or learners as resources of the Explore Linked Data site and opened for public access by them. Use the Learning Map Builder to compile your own personalized map.

More about Learning Maps

LOD Basics
Created: 3/11/2017
Basic concepts of LOD for beginners.
Set Creator: sophy
1. Select the competency and benchmarks you need

2. Click on “Add to map”, now it is added to your map.
2. Saved Sets

- Curated collection of learning resources
- Targeted to specific audience or theme
- Each item links to resource’s description page

http://explore.dublincore.net/explore-learning-resources-by-competency/all-saved-sets
Authenticated users can save Sets as either Public or Private
Any user can view Public Sets
3. The OCLC Dataset

- Static data to test skills on or to use in creating new learning resources
- Ensures that consistent results can be obtained from queries and that access will not suddenly disappear

- Identifies and describes bibliographic resources gleaned from library, archives, and museum data from around the world.
- Extracted from the original MARC records based on:
  - FAST headings
  - DDC classes
  - LCC subclasses

Access the static dataset at: http://purl.org/dataset/WorldCat/LibraryScienceSubset
DOWNLOAD as:
N-TRIPLES
MARC/XML

License:
ODC-BY

AVAILABILITY:
through December 2027

ACCESS THE DATASET AT: http://purl.org/dataset/WorldCat/LibraryScienceSubset
TUTORIAL:

• DOWNLOAD DATASET
  • N-Triples

• STORE PERSISTENTLY
  • Apache Jena’s TDB (Triple Store)

• Query using SPARQL
  • Command Line using TDBQUERY (similar to ARQ)
  • Interpreting and Storing Results

PDFs AVAILABLE:

• Simple Query 1: Union and Shared Subjects
• Simple Query 2: Optional and Turning an Object into a Subject
• Simple Query 3: Negation Using Not Exists and Minus

• Additional SPARQL Exercises
• Answers and Walkthrough

Figure 12: SPARQL query to retrieve all books written in French

Figure 15: Result set for triple statements sharing subject variable (truncated)
The Future of LD4PE

Stuart Sutton
University of Washington
The Future of LD4PE

• DCMI participation in the LD4PE project
  – From IMLS planning grant to its current realization
  – Why? Opportunity!
    • Opportunity for DCMI to help frame the substance behind metadata best practices—to help identify and describe what it takes for a professional to engage in those practices.
    • Opportunity to pioneer a mechanism to shift development of competency frameworks from a traditional top down, highly structured process to a more dynamic, bottom up, stakeholder-driven process.
The Future of LD4PE

• Engagement beyond Linked Data
  – For DCMI, the Linked Data index has served as a training ground
  – A point of departure for development of competency indexes defining knowledge, skills and acquired abilities in other areas of metadata interest:
    • *Knowledge Organization Systems* development and application
    • *Application Profiles* design and implementation
    • Etc.
QUESTIONS?

HTTP://EXPLORE.DUBLINCORE.NET/

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