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A Justification for Semantic Training in Data Curation Frameworks Development

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**Background and Motivation**

In the complex data curation activities involving proper data access, data use optimization and data rescue, opportunities exist where underlying skills in semantics may play a crucial role in data curation professionals ranging from data scientists, to informaticists, to librarians. Here, We provide a conceptualization of semantics use in the education data curation framework (EDCF) (Fig. 1) [1] under development by Purdue University and endorsed by the GLOBE program [2] for further development and application. Our work shows that a comprehensive data science training includes both spatial and non-spatial data, where both categories are promoted by standard efforts of organizations such as the Open Geospatial Consortium (OGC) and the World Wide Web Consortium (W3C), as well as organizations such as the Federation of Earth Science Information Partners (ESIP) that share knowledge and propagate best practices in applications.

**A Purdue Approach: conceptual data repository and outcomes diagram**

- Research Data Repository
  - Unfiltered data
  - Utilitarian
  - Complex scientific concepts and principles
- K-39 Data Repository
  - Provides context
  - Simplified models
  - Visualization

**Possible Outcomes for students**

- Ability to make a prediction from data
- Spatio-temporal thinking
- Data management competence

**Educational Data Curation**

- Data Curation Profiling of Educators (needs Assessment)
- Applying Metadata
- Data Lifecycle Management

**Educational Interventions (Activities)**

- Appropriate Use of Data
- Limitations of Data
- Evaluation of learning impacts
- Locating data, interpreting metadata & navigating taxonomies

**Library Services**

- Library Services

**Research Data Repository**

- Research Data Repository

**Possible Outcomes for students**

- Ability to make a prediction from data
- Spatio-temporal thinking
- Data management competence

**Accessing Data Services**

- Data Accessing
- Data Information
- Data Utilization

**Perspective**

Outside the context of EDCF, semantics training may be same critical to such data scientists, informaticists or librarians in other types of data curation activity. Past works by the authors have suggested that such data science should augment an ontological literacy where data science may become sustainable as a discipline. As more datasets are being published as open data [4] and made linked to each other, i.e., in the Resource Description Framework (RDF) format, or at least their metadata are being published in such a way, vocabularies and ontologies of various domains are being created and used in the data management, such as the AGROVOC [5] for agriculture and the GCMD keywords [6] and CLEAN vocabulary [7] for climate sciences. The new generation of data scientist should be aware of those technologies and receive training where appropriate to incorporate those technologies into their reforming daily works.

**References:**


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**Educational Data Curation Framework (EDCF)** - Is defined here as a Higher Education (HE) to K-12 knowledge transfer framework based upon the effective and interdisciplinary data science skills of future librarians working with all disciplines. The librarians conduct data curation properly at the HE level and have an ontological method to share the data in any possible place based or evidence based K-12 or primary education learning environment.

**Fig. 2. Semantically enriched geoscience data services.** With minor modification, semantic technologies can greatly improve the functionality of Earth and environmental science data services, such as the geological map service example shown here. Visualizations, on the other hand, can lower the barrier of domain knowledge to new comers, especially to the students.

**Obtaining an English term ‘Triassic’ from a map layer and retrieving Japanese annotations from Linked Data for the term ‘Triassic’**

* DBpedia and GeoSciML vocabulary are sources for concept annotations

* The functions of map legend and spatial feature filtration are re-developed with the visualization tool

* The geological map service is enriched by semantic technologies

* The processes of semantic web technologies (Fig. 2) [3] . We first developed a geologic time ontology and deployed it to promote online geological map services. Then we used the Linked Data resources (i.e., DBpedia and the GeoSciML vocabulary) for annotating multilingual geologic time terms and visualizations for presenting the results. Behind the user interface the geologic time ontology served as a basic reference for geologic time knowledge, and it controlled the reasoning of relationships between geologic time concepts, which is shown to users through the visualizations.

* An example of semantically enriched data service

* The functions of map legend and spatial feature filtration are re-developed with the visualization tool

* The geological map service is enriched by semantic technologies