Abstract. This poster presents the learning objects project of the Documenting the American South digital library. It explains the rationale behind the development of the content and the underlying architecture. By maintaining a high level of granularity and using semantic tools that support concept-based teaching, we hope to develop a collection of learning objects capable of serving teachers at any grade level, from elementary to secondary, to higher education. We describe the content of the learning objects, how they are contextualized for teachers, and our method of annotating and indexing the learning objects with ontology-based metadata.

The deployment of ontologies in digital libraries has not been fully explored or evaluated. We believe that by advancing the use of emerging knowledge systems such as web ontologies for logical organization and formal representation of learning objects within a digital library, we will help bring these valuable educational resources to a broader audience and support a wider variety of instructional settings. The project offers perspectives on virtual learning environments within a digital library, the application of semantic web technologies, and the use of standards to facilitate interoperability.

Introduction

Documenting the American South (DocSouth) is a digital library (http://docsouth.unc.edu/) sponsored by the University Library of the University of North Carolina at Chapel Hill. The site provides access to digitized primary materials that offer Southern perspectives on American history, literature, and culture. These materials, including letters, diaries, photographs, artifacts, and more, enable students of all ages to explore firsthand evidence of and different perspectives on historical and personal events, time periods, and places.

A recent usability study conducted on the site (not yet published) revealed that while educators were enthusiastic about using primary sources in the classroom, they found the typical presentation of educational materials for digital libraries limiting and not
always useful. In regard to the DocSouth site, they noted that the size of the material was often unwieldy or overwhelming and therefore difficult to adapt for use in the classroom.

Purpose

The purpose of this project is to repackage the DocSouth primary source materials to make them more accessible to teachers and more conducive to classroom teaching. Reusable learning objects appear to be a promising alternative to traditional lesson plans and activities. The definition of learning objects adopted as for this project is that set forth by Polsani: “A Learning Object is an independent and self-standing unit of learning content that is predisposed to reuse in multiple instructional contexts”. (Polsani, 2002) According to Artacho in an interview with Joost van Kasteren, “Learning is a process between teacher and students, and teachers tend to have their own view of learning and the way they use learning materials in class”. (van Kasteren, 2003) Therefore, our intent was not to prescribe how these materials should be introduced or used in the classroom, but to make the learning materials accessible, reusable, and interoperable to complement traditional classroom teaching.

Learning Object Content

At the heart of each learning object is a part, a whole, or an aggregate of the primary source materials from the DocSouth digital library. For instance, the focal point of one learning object may be an 5 page excerpt from a 300 page slave narrative; another may consist of a single letter from a civil war soldier; yet another might contain 10 propaganda posters from the larger collection of 100 available on the DocSouth site. This process of breaking up larger digital library collections into smaller pieces is often referred to as “content chunking”. (Yaron, Milton, & Freeland, 2001) Content chunking makes the materials more accessible for educators at all levels. Relating the chunks to the various levels of granularity further enables teachers to decide what level of content is most appropriate for their unique instructional circumstances.

While the primary source material is the central element of the learning object, on its own, it is not sufficient and would not qualify as a learning object. “…the problem is that many teachers and learners do not have the skill to use raw resources for learning.” (van Kasteren, 2003) To assist teachers in the contextualization of these primary source materials they are accompanied by a set of learning objectives, and a variety of explanatory or background material, suggested discussion questions, sample activities.

Figure 1: screen capture of a learning object prototype

Ontology-Based Metadata

One area of investigation is which metadata schema is most appropriate for describing these learning objects, given our unique instructional objectives. Half of the learning objects will be described using the “Learning Objects Metadata Standard” (LOM) [cit. Draft 2002]. LOM was developed by the Learning Technology Standard Committee
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(LTSC) of the IEEE as an extension of the Dublin Core which is too general for the specific descriptive needs required by learning objects. The other half of the learning objects will be described with Dublin Core metadata from DocSouth primary materials, extended with additional elements in order to specify important and distinctive aspects of our resources, including educational level, rights management and so on. The effectiveness of these metadata schemas will be tested through a series of usability tests with actual educators. Based on the results of the tests, we will decide whether to use one of the metadata standards or create a new application profile.

The metadata annotations will be based on a domain ontology (Brase & Nejdl, 2004). The ontology will be developed to provide a knowledge model of the DocSouth digital library collections, that is, the American South. In other words, the ontology will identify and define the relevant concepts and the relationships among those concepts within the domain and formalize their semantics for machine-processing. This semantic layer will be able to support various functions including resource description, browsing, search and retrieval. It will also drive the design of the user interface in an attempt to improve search results.

The ontology grounds the metadata into a conceptual framework which provides a set of formal and explicit relationships (e.g., is-a, part-whole, etc.). Leveraging those relationships may help to produce more accurate search results. We know teachers often have difficulty constructing search queries within digital libraries (Recker, Dorward, and Nelson, 2004). For example, if a teacher searches for materials having to do with “blacks who fought in the U.S. Civil War”, but if the metadata uses terms such as African American and soldier, the keyword search may not retrieve the desired results. The ontology aids in this effort by conceptual linking terms, such as “black” to African American” and “war” to “soldier”. The matching is semantically-driven rather than relying on choosing the right keywords.

Figure 2: Prototype Ontology

Semantic Search Interface

The search interface will be driven by the underlying knowledge architecture provided by the ontology. In addition to the keyword search, the interface will also include a browsable list of facets. These facets will be taken from the ontology-based metadata and will include such things as historical event, personal event, time period, and so on. By offering this alternative means of access to the learning objects, users will have a better understanding of the terminology and concepts related to the collection, as well as its scope. Each category in the faceted classification will indicate the number of items included. Users can quickly determine which queries will prove most successful and which will lead to limited or no results. The ability to browse as well as search for objects is something instructors find highly desirable (Recker, Dorward, and Nelson, 2004).

Figure 3: Screen capture of prototype search interface

System Architecture and Deployment
The learning objects will be marked up using XML. An RDF Schema (Brickley & Guha, 2004) will be used as the formalism for representing the ontology. An RDF Schema is a flexible and extensible framework originally developed for metadata interchange. RDF Schema provides a suitable data model for representing a light-weight ontology such as the proposed here. An RDF Schema also facilitates interoperability between resources annotated with different metadata standards (e.g., Dublin Core, MARC). Semantic web technologies such as web ontologies and RDF Schema provide a means to formalize and represent the knowledge of our specific domain in a way that is sharable and reusable among different application systems in the spirit of the semantic web initiative and a collaborative learning environment.

Figure 4: Image of XML Schema

Figure 5: Image of RDF Schema

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