Metadata Challenges for Situational Properties of Learning Objects

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Abstract

The abstraction of free-standing metadata describing learning objects is typified by an analytical model which primarily focuses on the encoding of discrete properties pertaining to the learning object itself. This process often neglects the contextual properties derived from the situations in which the learning object can be used optimally. We report the derivation of situated properties for learning objects through the use of the CASE framework and explore how these properties are best encoded.

1. Introduction

The creation of free-standing metadata describing learning objects has been the subject of considerable research. Standards for encoding learning object metadata such as IEEE Learning Object Metadata (LOM) [7] and SCORM [1] have emerged, and repositories of learning objects described within these frameworks are now publically available. However, reducing learning object properties to elements in a controlled vocabulary or taxonomy have largely resulted in discrete properties derived from learning object instantiations. In earlier work [6], we proposed the need to focus on the more holistic, socially-informed, and non-deterministic aspects of learning object design. We argued that learning is fundamentally a situated activity and demonstrated that learning objects can imbue these 'situated' characteristics, behaving as instructional descriptors for assisting in the aggregation of learning objects into larger, goal-oriented (or learning outcome) assemblies [5]. We proposed that these situated learning objects properties could be derived via application of the CASE framework [3, 4]. This paper considers the complexity of encoding learning object properties derived from situated learning frameworks, such as CASE, within existing learning object metadata description frameworks.

2. Deriving Descriptors from CASE

The CASE framework provides an integrative approach to the design of learning objects as learning tools. CASE provides a means of capturing salient aspects of cognition and social interaction within a situated learning paradigm [6]. CASE incorporates an iterative and activity-centric design meta-model, consisting of four *concerns*: Cognition, Activity, Social Organisation and Environment. Each concern, or component, represents a level of investigation. Likely influential factors impacting learning activities are situated within and across corresponding components of the framework [6]. Concerns are not mutually exclusive and may be used summatively or productively (depending on the desired analysis) to produce an indication of learner-interface complexity at each level of abstraction. Representative descriptors for each CASE *concern* are shown below. Initially, CASE metadata would be drawn from learner characteristics in Instructional Design [8].

Cognition: task-type, attention, attitude, goals, aptitude, intelligence

Activity: experience, engagement-type, leadership, learning style, motivation, demographics

Social Organization: status, roles, responsibilities, value systems, peer relationships

Environment: materials, colocation, geographical location, affordances, control, perceived context

3. Learning Object Metadata Frameworks

A variety of descriptive frameworks for learning objects are in widespread use, including IEEE LOM, Sharable Courseware Object Reference Model (SCORM), and Dublin Core [2]. Considerable effort has been invested in the development of these standards, and in their adoption by teaching and research communities. This paper considers how these well established standards can encode these new situationally-derived learning object properties.

Learning object metadata standards tend to focus on the minimal set of attributes which are needed to allow learning objects to be managed, located, and evaluated. There is recognition that these standards will likely be insufficient in all cases. As such, nearly all of them incorporate a mechanism for local extension of the basic fields and entity types, including optionality for given fields. These learning object metadata frameworks have as a core value the idea that object manipulation should be supported in the abstract, i.e. without specific inclusion of the object itself in the first instance. Services such as searching, sequencing and aggregation all build on this functionality to leverage resources at the level of metadata descriptions.

4. Encoding CASE properties in IEEE LOM

We have selected a single framework, IEEE LOM, into which we wish to encode these situational properties. We now turn to the actual task of inclusion. There are two main issues to consider: the relevant IEEE LOM element under which to include the properties and the representational data type.

One possibility is to include situational properties as *free text* within *description*. This has the obvious benefit of being human readable and easy to support, but inadequate for automated processing for tasks such as discovery, classification and assembly. Another possibility is to include situational properties as *new values* within *structure*. In this case, the values selected are not likely to be the default *atomic* but rather a qualified selection of *networked*, *hierarchical* or *linear*.

The *education* element offers several possibilities. The first is as an *attribute* under *interactivity* type, selecting *active* rather than *expository* and qualifying it with a new set of values. Another *education* possibility is within *interactivity* level, which for situationally-derived learning object properties is most likely to result in a selection of *medium* or *high*; neither of which without qualification are necessarily indicative of the properties themselves. The final *education* item would be as *description*, as *free text*. Similar points can be made here as were made earlier for *description*.

The next question to examine involves whether or not situationally derived properties should be free standing *new elements*, *attributes* of existing or new elements, or *values* for new or existing attributes. Some aspects of situationally-based descriptors do lend themselves to interpretation simply as sets of values (particularly where there is a singleton choice required to express a particular property). Others are more complex and require more than a single level, ie addition of more than just values, including the addition of elements and/or attributes. Largely the choice between one or another layer of addition is motivated by the complexity

of the properties which need to be encoded; values which are either mutually exclusive, or purely additive are best expressed as controlled vocabularies for values. More complex entities may require the addition of one or more attributes and associated values.

5. Conclusion and Future Work

We have considered the problems of encoding situationally derived properties for learning objects in learning object metadata standards such as IEEE LOM and note that some of these dynamic properties can be accounted for within existing metadata standards. Others, are somewhat more problematic. Future work on how best to reduce learning object properties to attributes which can be expressed in formal metadata is warranted. An obstacle in achieving this goal is that situationally-derived learning object properties do not easily conform to the object models of existing metadata standards.

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