INTRODUCTION: THE PARADIGM OF LEARNING OBJECTS

The evolution of Web-based learning has fostered the search for methods and technologies that enable a degree of reuse of learning contents and learning activity designs. Such attempt is intended to facilitate both the reuse of quality resources and the development of automated resource-search tools, and it may eventually reduce the cost of devising learning activities. The concept of learning object is at the center of a new instructional design paradigm for Web-based learning. This new paradigm emphasizes reuse as a quality characteristic of learning contents and activities. For example, the often-cited definition of learning object by Polsani (2003) explicitly includes reuse in his definition: “an independent and self-standing unit of learning content that is predisposed to reuse in multiple instructional contexts.” In one of the most referenced articles on the field, Wiley (2001) also mentions the term reuse in his learning object definition: “any digital resource that can be reused to support learning.” Nevertheless, the concept of learning object reusability as a key quality factor for content design is difficult to characterize and measure, since it encompasses not only the evaluation of the contents themselves (Vargo, Nesbit, Belfer, & Archambault, 2003), but also a balance between their usability in specific contexts and the range of educational contexts it explicitly targets (Sicilia & Garcia, 2003).

In practical terms, a learning object is a piece of Web content of arbitrary type and structure described by a metadata record. This metadata record provides information about the object and its prospective educational usages. Learning object metadata, thus, is the key to reuse.

LEARNING OBJECT STANDARDS AND SPECIFICATIONS

In recent years, a number of specifications and standards that describe or make use of the learning object concept have evolved. However, even though an important effort of cooperation has been made, some confusion still remains, derived from the existence of numerous organizations that create, develop and implement these specifications. The CEN/ISS Learning Technology Standards Observatory (www.cen-ltso.net), a “Web-based repository that acts as a focal access point to projects, results, activities and organizations that are relevant to the development and adoption of e-learning technology standards,” represents one of the most significant clarification efforts in the field.

Regarding metadata, the basic elements associated with learning objects have been described in the IEEE LOM standard (IEEE, 2002). This standard, based on the well-known Dublin Core Metadata Element Set (Dublin Core, 2003), organizes its conceptual metadata schema in nine categories: General, Lifecycle, Meta-Metadata, Technical, Educational, Rights, Relation, Annotation and Classification. General and Annotation cover basic description—title, coverage and so forth—and general-purpose annotations. Lifecycle and Rights, contributors, change control and property matters. The category Technical covers technical characteristics of the Web contents. Meta-metadata covers the description of the metadata record itself. Educational describes the envisioned educational characteristics of the object, including type of interactivity, typical educational context, typical age of the intended learners and the like. The Relation category describes relations between learning objects, which could be seen as a form of “linking” the described learning object to educational characteristics; for example, related learning objects that consti-
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