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Reshaping the Structure of Learning Objects in the Light of Metacognition

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ABSTRACT

This paper is aimed to re-discuss the organization of learning objects in the realm of current research on metacognition. After a discussion on the structure of learning objects in the light of current standardization initiatives, a new model is proposed that explicitly introduces the representation of the learning design, expressed in terms of a metacognitive framework and of navigational aids. Then, an example of the proposed structure put in practice is discussed by showing the metacognitive framework for a learning object devoted to the fan-plate system (a basic experiment in a course on automatic controls). In the last section, a learning content management system currently under development, which natively implements our model of a learning object, is presented.

Keywords: learning design; learning objects; metacognition; metacognitive framework; LIMEFRAME

INTRODUCTION

Although the term Learning Object (LO) is largely referenced by researchers and practitioners in the field of e-learning and is widely used in current applications, it is rather surprising that there does not exist a common agreement on its associated semantic. This paper provides a working definition of learning object that partially complies with existing standards in the field.

The organization of multimedia content within technology-enhanced learning systems is often described by using four

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levels of granularity: atoms, content units, composite units and courses. Content units, composite units and courses are also known as "learning objects" (CEN/ISSS, 2000). According to Kooper (2001), examples of LOs are courses, study tasks, study programs, textbooks, exercises, and even persons. Reusability represents the main reason underlying the definition of LO as "any entity, digital or non-digital that may be used or referenced in a technology-supported learning system" (IEEE-LOM, 2002). The previous definition is shared by the ARIADNE Foundation for the European Knowledge Pool, by the Sharable Content Object Reference Model (SCORM) developed by the Advanced Distributed Learning Consortium and by the Aviation Industry CBT Committee (Duval, 2004). Reuse is of fundamental importance in a field where the design of learning material is so human and capital-intensive to involve both fixed and marginal costs (Bassi, 2000) depending on many factors, including technical complexity and learning objectives (Brahler, Peterson, & Johnson, 1999). According to Golas (1993), the development of one hour of material (i.e., just one of the cost elements concurrent in the development of distance learning material) may range from 30 to 600 hours of human effort. The same idea of encapsulating learning objects within metadata (IEEE-LOM, 2002) is based on the requirement of allowing both the sharing and the exchanging of LO across any technology-supported learning system to reduce development costs.

The broadness of the definition of LO as provided by the Learning Technology Standard Committee has led many researchers to create different terms that generally narrow its scope down to something more specific (Wiley, 2000). At the same time, other researchers have refined the definition while continuing to use the term LO.

The problem is that "confusingly, these additional terms and differently defined LO are all Learning Technology Standard Committee LO in the strict sense" (Wiley, 2000). In addition, other terms that imply the general intention to take an object-oriented approach to computer-based instruction have been forged, as for instance "knowledge objects" (Merrill & Jones, 1991), "components of instruction" (Merrill, 2001), "educational software components" (ESCOT, 2000), "resources" (ALI, 2000), "units of study" (Kooper, 2001) and "Units of Learning" (IMS-LDIM, 2003).

Although different terms have been adopted, a sort of informal agreement has been achieved among researchers on the fact that learning does not come from the provision of knowledge solely, but stems from the activities of the learners solving problems, operating with real devices, and interacting with each other in the learning environment (Kooper, 2001). Therefore, it has been suggested that learning objects must explicitly include specifications regarding their learning design (Brennan, Funke, & Anderson, 2001). Unfortunately, Brennan and co-workers fail to tell what is expected to be found in the learning design of a LO, and in which way, it should be described. In fact, according to the IDC, "the [learning] object is assembled

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