Chapter 19

INSTRUCTIONAL THEORIES TO MODEL EDUCATIONAL CONTENT: A CASE STUDY

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Abstract: This paper describes an experience to apply instructional design theories using formal specifications to model educational content. Our aim is to extend learning content specifications to cover instructional theories in the current trend of learning technologies standards to provide a formalization framework for templates and instructional patterns. We use LODAS (Learning Object Design and Sequencing Theory) to define the theoretical instructional framework in combination with PALO modelling language. LODAS use Learning Objects and provides instructional methods to create and apply them within sequencing and classification models. PALO is a formal specification to model educational material based on instructional templates and ontology-based repositories of Learning Objects. Our work shows a case study to use PALO formal specification to provide instructional templates based on LODAS methods that could be incorporated into an authoring tool.

Key words: Instructional theory, educational modelling language, learning object, instructional pattern.

1. INTRODUCTION

The study of formal specifications to model educational content is one of the main issues in learning technologies (LT) research. The variety of specifications developed so far strongly facilitate the creation of reusable learning objects providing structure, packaging and sequencing attending to
pedagogical and instructional patterns, including the definition of complex instructional tasks. This complexity includes the development of software interfaces attached to the learning object to achieve software interoperability with the Learning Management Systems (LMS) and Run Time Environments (RTE).

However, in the framework of LT specification development there is currently a need to structure and link with instructional patterns the recent specification paradigms obtained from the LT research (Paquette 1999) (Leo et al., 2004). In this context some of the results in LT -as the notion of Learning Object- have been extrapolated from a variety of well known computational paradigms like reusable component as a software engineering concept, providing structured reusable elements labeled with metadata (Duval et al. 2001), and also from knowledge engineering, allowing content organization using knowledge-based structures like ontologies or semantic web development. On the other hand, from the cognitive sciences perspective, the adoption during the 50s and 60s of some instructional theories based on cognition have obtained useful abstractions to specify appropriate methods and situations in which those are to be applied during learning process. But, instructional theories (IT) have not evolved so far away from the original cognitive scope to the computational environment in which they are applied. Only recently has this need been noticed to combine cognitive sciences and representational mechanisms based in learning technologies (Concannon 2003) (Wiley 2000) or to create explicit instructional patterns for LT specifications.

This paper applies specification patterns in the scope of LT and presents a case study to create templates based on an instructional theory using an educational modelling language. This theoretical framework has been pointed out as one of the three necessary components to model instructional objects along with instructional theory and a taxonomy of learning objects (Wiley 2000).

The aim is to provide instructional meaning to the learning object as a complex content description in the sense of the definition of unit of study, which differs from a simple aggregation of LO (as in a clip-art model). In this sense, EMLs allow not only to overcome that problem but also to define and apply instructional patterns with instructional components such as tasks, sequencing, tools, roles, etc. Additionally, this is a test bed of the expressiveness of PALO to create instructional templates and also in its capacity to represent knowledge domains based on topic maps and explicit conceptualizations.

This paper is structured as follows: section 2 describes formalization issues of instructional theories using EMLs. Section 3 describes LODAS formalization using PALO and proposes a case study and finally section 4 presents the conclusions.