

Chapter 12

Competency Equilibrium and Instructional Scenarios' Quality¹

Julien Contamines

LICEF Research Center, Canada

Gilbert Paquette

LICEF Research Center, Canada

ABSTRACT

- State of the Art on Instructional Scenarios's Quality
- Competency-Driven Scenario Validation
 - Competency Ontologies
 - Associating Competencies to Resources
 - The Concept of Competency Equilibrium
- Scenario Validation Process
 - From Atomic to Complex Scenarios
 - Tools for Scenario Validation

This chapter focuses on the quality of instructional scenarios. An instructional scenario is a particular kind of aggregated resources composed of learning objects (LO) or resources, actors and activities according to an *Educational Modeling Language* (EML) such as the *IMS Learning Design* or the *TELOS Scenarios Language* (TSL) both presented in Chapter 8.

Among the factors which permit the production of “good” scenarios, one of the most important is the use of Instructional Engineering methods. The case of the MISA method was presented in Chapter 8. Another alternative was presented in Chapter 9 where the elaboration of the scenarios is based on the use of patterns directly in link with the type of cognitive skill aimed by the scenario. Another working example to improve scenario quality was conducted by Psyche, Bourdeau,

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Nkambou & Mizoguchi (2005) where learning and instructional theories guide the use of *IMS Learning Design* educational modeling language. In the present chapter, another alternative for quality scenarios is developed: scenario validation driven by the competencies which are associated with the scenario and its components.

The principles, techniques and methods developed in the field of Instructional Engineering should be further exploited, in order to frame the realization of scenarios, assure their coherence and guide the interconnection of tools, languages and resources that populate the Web and learning objects repositories.

This vision is shared by some researchers in the field. Wiley (2002) advocated that the composition of training with learning objects should fit into an approach of Instructional Engineering. The juxtaposition of learning objects is not sufficient. Baron & Paquette (2007), Devedzic (2006), Knolmayer (2003), Mohan, Greer & McCalla (2003), Karampiperis & Sampson (2004) all advocate that the result of the aggregation of learning objects must “*make sense*” on the educational level.

Baron & Paquette (2007) emphasize the need of a new Instructional Engineering methodology that must take “*account of the standardization of the educational components, the use of the learning objects repositories and the development of ontologies*” (p. 333). They add that this new methodology should be directed by Ontological Engineering in order to define the contents of the activities, the structure of the scenarios, the management of learning material, as well as the course delivery processes.

We begin by summarizing some research projects about the validation of learning objects aggregates and instructional scenarios. Next, the approach of validation by competency equilibrium is introduced and illustrated. We will discuss how a scenario is validated. We shall further discuss the role of *ontological engineering*; how does a *competency ontology* can be used for the validation of scenario equilibrium. Finally, from a technical

point of view, we shall discuss the implementation of a set of tools and a process to assure the validation of process-based scenarios.

12.1 RESEARCH ON INSTRUCTIONAL SCENARIOS'S QUALITY

Although there is some work on the quality of scenarios in an instructional engineering context (Paquette 2003,; Caeiro-Rodriguez, 2008; Psyché *et al.*, 2005), to our knowledge, there is still limited work on scenario validation.

Melia & Pahl (2007a, 2007b) discuss the following research questions: how can aggregates be validated? How can the invalid aggregates be corrected? These authors propose an architecture named CAVAM (*Courseware Authoring Validation Model*) that integrates four models:

- *Domain Model*: formalization of the domain in the form of a *concept graph*.
- *Goal and Constraints Model*: specification of the objectives of the course and the pedagogical constraints for the domain. The prerequisite relations between concepts are a part of these constraints. The course objectives correspond to a subset of the concepts contained in the domain model. The pedagogical constraints are directly expressed in the domain model by labelled relations between concepts.
- *Learner Model*: the knowledge that the learner possess at the beginning of the course is a subset of the concepts contained in the domain model.
- *Course Model*: it's a formalization of sequences between learning objects. In practical terms, this model is a graph where every learning object is associated to at least one concept of the Domain Model.
- *Validation Model*: specification of what is

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