

Chapter 16

Modeling for Learning¹

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ABSTRACT

- External Representations and Cognitive Tools
- Knowledge Modeling as an Individual Learning strategy
- Collaborative Knowledge Modeling as a Learning Strategy for Distance Education
- Collaborative Knowledge Modeling in Face-to-Face Learning Situations

Some years ago, we have introduced in the pedagogical scenario of a distance university course a learning activity consisting at having students create their own knowledge models with the

knowledge modeling software MOT developed by Paquette (2002).

At the same time, was initiated a series of studies¹ aiming at evaluating the learning benefits and exploring the meditating effect of the use of this tool in the learning process, both in individual or collaborative conditions, as well as in face-to-face or distance educational settings. In our research, MOT is mainly used as a mean to support students' text comprehension, but we also proposed this tool to professionals engaged in a vocational university program to help them reflect on how the curriculum knowledge domain is instantiated in their own professional practice. In addition, we provided training sessions to faculties and produced some documentation (available on the web) on the educational uses of knowledge model-

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ing software in higher education (Pudelko & Basque, 2005).

In this chapter, we will first situate the MOT tool among other node-link visual knowledge representation tools used in educational settings. Next, we will describe how we used MOT to support learning in three different learning contexts at the postsecondary level (individual learning by distance learners; collaborative learning in dyads at a distance; collaborative learning in large group in a face-to-face setting) and report some of the results of our studies.

16.1. EXTERNAL REPRESENTATIONS AND COGNITIVE TOOLS

External representations (text, graphic, table, picture, etc.) play a significant role in the teaching/learning process. Learners can be invited either to study external representations elaborated by the teacher or by other authors, or they can be invited to elaborate some themselves. Constructivist and generative learning theories (Duffy & Cunningham, 1996; Grabowski, 1996) tend to favor the second option because students have then to identify the knowledge units to be represented and to provide a substantial effort in searching for how they are related (O'Donnell, Dansereau, & Hall, 2002). This active and deep mental process would help the learner in constructing more elaborate internal structures of knowledge.

To construct any external representation, a representational notation system must be used. Each representational notation system manifests a particular “representational guidance” (Suthers, 2003) in two major ways: (1) it constrains the expressiveness of how the knowledge units can be expressed and (2), it makes some of that knowledge more salient. Hence, representational notation systems structure provide a specific approach how to reason about knowledge domains.

Node-link diagrams constitute a family of external representations which is more and more used for educational purposes. In fact, the construction of node-link diagrams such as concept maps (Novak, 1998; Novak & Gowin, 1984); mind maps (Buzan & Buzan, 1996) or knowledge maps (Holley & Dansereau, 1984) by learners has been proposed as a learning strategy for nearly three decades in the educational field. Since the mid-eighties, much research has been conducted on this issue with students of all educational levels and in several disciplines. In general, research shows that this activity leads to beneficial effects on learning (Horton *et al.*, 1993; Nesbit & Adesope, 2006).

The most popular representational technique explored in these studies is the concept mapping technique proposed by Novak and Gowin in their seminal book *Learning how to learn* published in 1984. A concept map is defined by these authors as “a schematic device for representing a set of concept meanings embedded in a framework of propositions” (p. 15). A proposition is a semantic unit formed by two or more concept linked by words. Then, a concept map is a node-link representation, where nodes denote concepts of a certain knowledge domain, and links denote the relationships among concepts. Concepts are specified by textual labels, which could be a noun, or a noun complemented with one or more adjectives or adverbs for denoting a more specific concept (for example, *living things* instead of *things*). Links are specified by lines, usually arrowed, on which textual labels are also put, more specifically verbs (such as *contain*, *involve*, *change*, *are in*, *can be*, etc.) or “linking phrases” (such as *then*, *by*, *as in*, *with*, *that*, etc.). The general spatial layout and the directions of the links aim to express the idea of a hierarchy of concepts, going from the most general to the most specific ones.

The emergence of computer-based concept mapping software in the nineties has provoked a renewed interest in the construction of concept maps by students as a learning activity. Compared

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