Chapter VII
Managing Cognitive Load in Interactive Multimedia

INTRODUCTION

Most sophisticated multimedia learning environments include various interactivity features. Interactive multimedia learning environments respond dynamically to learner specific actions. Such environments support active, learner-engaged forms of learning that are expected to promote deep cognitive processes and result in active construction and acquisition of new knowledge.

Spector, Christensen, Sioutine, and McCormack (2001) noted that interactivity is the most critical feature of technology-enhanced learning environments. They summarized the relevant conclusions addressed in the research literature in this area as follows:

2. As learning environments provide more and more opportunities for active learner participation, they tend to promote learning; too many opportunities for interaction, however, can lead to confusion and disorientation.
3. Cognitive engagement with the subject material is vital for learning.
4. Opportunities for reflection generally improve learning.
5. Informative feedback is a necessary part of meaningful cognitive engagement; advanced learners may be able to generate their own feedback (a metacognitive skill)” (p. 522).
Hypermedia learning environments represent an online form of interactive multimedia. Hypermedia environments usually involve multiple representations, hyperlinked information networks, and high levels of learner control. In typical hypermedia environments, learner control may include content control, sequencing of information, and the control of representational formats. Research on instructional effectiveness of such environments has produced rather ambiguous results (Chen & Rada, 1996; Dillon & Gabbard, 1998).

Usually interactive (including hypermedia) learning environments are designed by professional computer programmers without applying relevant instructional design guidelines. General cognitively-based design guidelines for such environments could be derived from cognitive theories of multimedia learning and cognitive load theory (e.g., see Mayer, 2005 for a recent comprehensive overview of the field). However, as noted by Scheiter, Gerjets, Vollmann, and Catrambone (2007), these instructional theories have explicitly addressed mostly system-controlled learning environments. In such environments, information is presented to learners in the same predefined order that cannot be skipped and learners cannot choose from different representational formats. On the other hand, different levels of learner prior knowledge have been noted for long time as an important factor influencing the effectiveness of learning in interactive environments (Gay, 1986).

From a cognitive load point of view, observed learner physical activity within an interactive environment may not necessarily result in essential cognitive processes and effective (if any) learning. Instead, it may impose additional processing demands on learner limited cognitive resources and thus hinder learning. Mixed results from research on effectiveness of interactivity and learner control in instruction support this concern. Analyses of associated cognitive processes and structures are required to understand the role of interactivity in learning.

High levels of cognitive load in interactive learning environments could be caused by the large number of variables involved in corresponding cognitive processes; uncertainty and non-linear relationships between these variables; and associated temporal delays. In many situations, individual learners carry the burden of deciding when to use additional learning support (if available) and what forms of support to request. While more advanced learners could handle such a burden, it may be beyond cognitive resources available to less experienced learners.

Thus, a cognitive load framework is potentially capable of providing a suitable conceptualization for the analysis of the conditions and the development of methods for enhancing instructional efficiency of interactive multimedia learning environments. The cognitive load aspects of learning in interactive multimedia learning environments are the main focus of this chapter.
Collaborative Learning in a Web-Based Environment: A Comparison Study
www.igi-global.com/chapter/collaborative-learning-web-based-environment/35970?camid=4v1a