SUMMARY OF SECTION I

This section of the book presented an overview of major theoretical issues and empirical evidence that are essential for understanding main implications of a cognitive load theoretical framework for the design of multimedia learning. Implementing cognitive design principles in multimedia learning environments involves reducing extraneous cognitive load by avoiding diversion of cognitive resources on activities and tasks that are not directly related to learning, for example, on searching and locating appropriate components in pictures and/or text, or attending to unnecessary details. It is also important to prevent uncontrolled reduction of essential (intrinsic and germane) cognitive load in learning. An essential part of enhancing learners’ self-regulation abilities is developing their skills in managing cognitive resources.

Substantial empirical evidence has been obtained for interactions between different instructional methods and levels of learner task-specific expertise (the expertise reversal effect or prior knowledge effect). It was found that many techniques for reducing extraneous non-essential cognitive load (such as integrating sources of information or using dual-modality formats in a split-attention situation, using worked examples instead of conventional problem solving) were effective for relatively novice learners. For more knowledgeable learners, such instructional techniques may become ineffective. In many situations, these techniques resulted in negative rather than positive or neutral effects when used with more experienced learners. This effect has been consistently replicated in many studies with a large range of instructional materials and participants. A theoretical interpretation of the effect within a cognitive load framework was presented in this part of the book.

The most important implication of the expertise reversal effect is that the design of effective and cognitively efficient multimedia environments needs to be tailored to changing levels of learner task-specific expertise. Such adaptive learning environments may optimize cognitive resources available for comprehending multimedia messages and constructing appropriate organized knowledge base. For example, multimedia systems may include several different interaction modes that present the same information differently to different learners or to the same learners at different stages of development of their expertise in the domain.

Dynamic adaptive instructional systems require rapid online methods for evaluating levels of learner expertise. A rapid diagnostic approach has been developed for real-time monitoring of levels of learner task-specific expertise in a domain by capturing authentic domain-specific knowledge structures involved in processing presented information. This diagnostic approach has the potential for developing more rapid and sensitive knowledge tracing techniques than traditional measures.
It could be used to increase the accuracy of information about levels of learner knowledge and expertise contained in instructional systems’ student models.

The new rapid diagnostic methods together with techniques for evaluating levels of cognitive load will be applied in the following sections of the book as means of tailoring multimedia environments to levels of learner expertise.