

## **Chapter VI**

# **ICT Developments: Learning Design and Teaching**

### **Introduction**

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This chapter is the second of two chapters that explore developments in information and communications technology (ICT). This chapter discusses ICT tools and standards developed to support learning design and teaching. Such developments greatly affect the learning media and modes available for deployment by learning designers. These may enable existing learning designs to be delivered in different ways. However, they may also enable the development of new learning designs.

The chapter begins by reviewing developments relating to computer-assisted learning (CAL), with particular emphasis on intelligent and adaptive tutoring systems that incorporate aspects of artificial intelligence and the use of reasoning mechanisms and knowledge representations to support learning. It goes on to discuss learning environments and management systems, and the move to interoperability, sharing, and reuse, which closely interrelates with resource discovery as discussed in the previous chapter.

This chapter also explores a number of more general ICT developments, while not developed specifically for educational purposes, nevertheless offer new educational opportunities for learning. The chapter goes on to discuss these opportunities, and concludes by further developing the on-going model of learning to integrate the educational affordances provided by the ICT developments introduced in both this and the previous chapter.

## **Intelligent and Adaptive Tutoring Systems**

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Within education, there is a long history of attempts to devise CAL systems designed to provide a level of *personalised* learning in order to respond to what is a key theme in this book, namely: individual differences. CAL systems were created in the 1960s, and worked implicitly with a behaviourist/acquisition-based model of learning. These systems essentially presented learners with problems and recorded their responses. Drill and practice systems followed, and these were the first to move away from the *one presentation for all* mode—although the sophistication of their adaptivity was low.

The 1980s saw the development of intelligent tutoring systems (ITS), when attention began to be paid to the development of more complex models of the learner for use in the system (Chabay & Larkin, 1992; Urban-Lurain, 1996). These developments have continued with the more recent emergence of adaptive hypermedia systems (AHS) (Brusilovsky, 2001; Conlan, Hockemeyer, Wade, & Albert, 2003; De Bra, Aroyo, & Chepegin, 2004).

In terms of media and delivery modes, the late 1980s and early 1990s saw the rapid rise of multimedia and CD ROM-based training, largely superseded in the 1990s by Internet-based training, which matured into the e-learning boom of the early 2000s. The convergence of work on intelligent systems; standards for discovering, sharing, and reusing Web-based learning resources; and technologies supporting the emerging Semantic Web are taken up in Chapters VII and VIII, which focus on the development of *educational informatics* systems.

The essence of intelligent adaptive systems has been the creation of (1) a model of the subject domain in terms of parameters relevant to the presentation and sequencing of information (e.g., a representation denoting *prerequisite* concept relationships); (2) a learner model including details of the learner's existing knowledge, history of learning behaviour within the learning session, and so forth; (3) a pedagogical model specifying some interaction between learner and system (e.g., the type of information that should be presented in relation to particular learner responses and/or characteristics); and (4) some reasoning, or inferencing mechanism that will operationalise the pedagogical model. These elements are shown in Figure 70.

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