Chapter 2.23
Building an Instructional Framework to Support Learner Control in Adaptive Educational Systems

Kyparisia A. Papanikolaou
University of Athens, Greece[*]

Maria Grigoriadou
University of Athens, Greece

ABSTRACT

Recently there has been a growing appreciation concerning learner control over the learning/instructional process, leading to the development of mixed-initiative systems where learners are allowed to take varying levels of control. The design of Adaptive Educational Systems (AES) that provide such learner control opportunities through their adaptive and adaptable dimensions, is a challenging research goal that requires a certain understanding of the learning and instructional processes. To this aim, in this chapter we focus on the educational background that should underlie the design of adaptation and learner-system interaction in the context of AES used for Web-based education. We propose an instructional framework that supports a variety of instructional approaches and provides guidelines that unify several processes underlying adaptation such as structuring the domain knowledge, developing the content, and planning individualised support—assessment—learner control opportunities. This framework incorporates a variety of approaches over instruction and assessment, in order to accommodate the diversity of learners' needs and preferences, and enable them to choose when, what, and how to learn. The theoretical background underlying the design of the framework and the implications for Web-based AES design are also discussed.

INTRODUCTION

In Web-based education, centrally available systems are used to deliver instruction, allowing a user to learn transcending typical time and space barriers. In this context, the challenge posed for both the education and the computer science research communities is the exploitation of the innovative characteristics of the Internet for the development of educational systems, flexible enough to accommodate learners' individual differences and promote learners to take control over the instructional process. Instruction for learning is, and has always been, a complex and multifaceted challenge. Especially in Web-based education where tutors are mainly facilitators rather than the main agents, the instructional approach adopted to guide the interactions taking place among the educational system, the learners and the educational content should aim to: (i) provide learners with the appropriate resources and guidance towards the accomplishment of their goals accommodating their individual approach to learning, and (ii) stimulate and actively engage learners in learning providing them opportunities to take control over the instructional process. However, the sharing of control between the learner and the system is a critical issue as there is always the possibility that unrestricted control and lack of learning goals can dampen the power of learning (Lawless & Brown, 1997). Thus, issues of learning and didactics become more prominent for the development of Web-based learning environments, and several critical questions are emerging, such as: (i) which instructional approaches are appropriate for incorporation in a Web-based environment where learners are usually adults and where the variety of learners taking the same course is large, and (ii) how to design learner control opportunities that allow learners to decide when and how to take control over instruction, in a way that enhances learning, builds positive attitudes and heightens self-efficacy.

In the context of Web-based education, Adaptive Educational Systems (AES) (Brusilovsky, 1996, 1999, 2001; Brusilovsky & Peylo, 2003) emerged as an alternative to the traditional "one-size-fits-all" approach in the delivery of instruction. AES possess the ability to make intelligent decisions about the interactions that take place during learning and aim to support learners without being directive. Taking into account that, learners will be able to achieve their learning goals more efficiently when pedagogical procedures accommodate their individual differences (Federico, 1991), and that learners appear to benefit from learner control opportunities (Federico, 1999; Jonassen, Mayes, & McAleese, 1993), research in the area of AES has been focused on methods and techniques that integrate such functionalities in real systems.

Critical issues that affect the educational perspective of AES are the instructional approach guiding system-learner interaction, and the type of adaptation, which depends on the amount of control a learner has over the adaptation (for a taxonomy of different types of adaptation see Kobsa, Koenemann, & Pohl, 2001). As far as the latter is concerned, lately there is a growing appreciation concerning the learner control over the learning process (Kay, 2001), leading to systems where learners are allowed to take varying levels of initiative. The development of Web-based AES in which learners are individually supported in accomplishing their personal learning goals (adaptive dimension of AES) and at the same time they are allowed to control when, what, and how to learn (adaptable dimension of AES), requires a certain understanding of the learning and instructional processes. In this direction, the design of a coherent instructional framework, which integrates instructional decisions that lead to the adaptation, is a challenging research goal motivated by the expected learning benefits.

In this chapter we focus on the educational background that should underlie the development of AES used for Web-based education. We pro-

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