

# Chapter 37

## Recent Advances in Intelligent Tutoring Systems: A Case Study

**Joel J. P. C. Rodrigues**

*Instituto de Telecomunicações, University of Beira Interior, Portugal*

**Pedro F. N. João**

*Instituto de Telecomunicações, University of Beira Interior, Portugal*

**Isabel de la Torre Díez**

*University of Valladolid, Spain*

### ABSTRACT

*Intelligent Tutoring Systems (ITS) include interactive applications with some intelligence that supports the learning process. Some of ITS have had a very large impact on educational outcomes in field tests, and they have provided an important ground for artificial intelligence research. This chapter elaborates on recent advances in ITS and includes a case study presenting an ITS called EduTutor. This system was created for the Web-Based Aulanet Learning Management System (LMS). It focuses on subjects for the first cycle of studies of the Portuguese primary education system, between the first and the fourth year. It facilitates the perception of the learning process of each student, individually, in a virtual environment, as a study guide. Moreover, EduTutor has been designed and its architecture prepared for being easily integrated into higher levels of studies, different subjects, and several languages. Currently, it is used in the Aulanet LMS platform.*

### INTRODUCTION

Distance learning is based on an educational model in which teachers and students are physically present at the same place. In this context, the different agents exchange learning contents

using Information and Communication Technologies (ICT). In the past few decades, distance learning started to be important by the policies defined by the governments of the most developed countries. Furthermore, both companies and other organizations paid more attention to these

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technologies because they allow easy information access in asynchronous way (Woo, et al., 2006). Older examples of this kind of learning were the tele-school and teaching by mail. With the fast spreading of the Internet, these methods have been discarded and are being replaced by e-learning. The teaching-learning process is being more supported by technological resources that offer different ways of communication between persons, using sophisticated educational software applications.

E-learning term is usually understood as electronic learning or learning through computer assistance. Amaral and Leal (2006) define e-learning as: "The process, by which the student learns through the content placed in the Internet and/or CD-Rom. The teachers at distance, using the Internet to communicate with the students, possibly intermediated with some face-to-face moments".

It is important to assure that e-learning is not just one more tool for non-organized information delivery. From this perspective the importance of the distance learning methodologies and existence of systems that monitor the progress of learning of individual students in virtual learning environments is essential. According to Amaral and Leal (2007) we should consider five types of e-learning,): (1) asynchronous online teaching, (2) on-line teaching with synchronous moments, (3) mixed on-line teaching, (4) on-line teaching, and (5) computer based teaching.

Asynchronous on-line teaching is characterized by a teacher-student interaction with asynchronous moments, such as electronic mail exchange or discussion fora. Whereas in the online teaching with synchronous moments, teacher-student interaction needs synchronous moments, such as Internet relay chat IRC and videoconference. Mixed online teaching involves real-time and face-to-face interaction, and it is also known as blended learning (b-learning). In the pure online teaching, contents are available on the Internet without the

teacher's figure and it is not dependent on the time and space. Finally, in the computer based teaching, contents are available on CD-Rom and, similarly to the latter, with teacher support. In this kind of e-learning, the contents are independent of time and space.

Under e-learning, the following two main concepts or technological systems may be considered (Yuuichi *et al.*, 2006): learning management systems (LMS) and Course Management System (CMS). But, what is the real difference between CMS (such as Blackboard (Blackboard Inc., 2008), and LMS (for example: NetDimensions EKP (NetDimensions, 2008), Saba (Saba, 2008), or SumTotal (SumTotal Systems, 2008))?" The answer to this question is the basis to understand the difference between the concepts CMS and LMS.

A CMS is characterized by online systems that were originally designed to support academic learning, such as universities or secondary schools. Traditionally, a CMS is defined as Web-based software that creates and distributes course content, manages student enrollment and tracks student performance. In this sense, the CMS enables instructors to extend the classroom beyond its traditional boundaries of time and space. With the advent of digital libraries and Web 2.0 technologies, the term CMS is being replaced by LMS. This term extends the previous CMS concept to include tools that allow easy access to digital resources and enable a wide range of collaborative activities. So, LMS is a software application or Web-based technology used to plan, implement, and assess a specific learning process. Typically, a LMS provides an instructor with a way to create and deliver content, monitor student participation, and assess student performance (Freedman *et al.*, 2000). It may also confer students the ability to use interactive features such as threaded discussions, videoconferencing, and discussion *fora*.

EduTutor was created for a Portuguese LMS, called Aulanet (Aulanet, 2008), that supports the *Escola da Malta* portal, from EduWeb (EduWeb,

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