Chapter 10
Designing Web-Based Educational Virtual Reality Environments

Kosmas Dimitropoulos
University of Macedonia, Greece

Athanasios Manitsaris
University of Macedonia, Greece

ABSTRACT

This chapter aims to study the benefits that arise from the use of virtual reality technology and the World Wide Web in the field of distance education, as well as to further explore the role of instructors and learners in such a network-centric mode of education. Within this framework, special emphasis is given on the design and development of web-based virtual learning environments so as to successfully fulfil their educational objectives. In particular, the chapter includes research on distance education on the Web and the role of virtual reality, as well as study on basic pedagogical methods focusing mainly on the efficient preparation, approach and presentation of the learning content. Moreover, specific designing rules are presented considering the hypermedia, virtual and educational nature of this kind of applications. Finally, an innovative virtual reality environment for distance education in medicine, which reproduces conditions of the real learning process and enhances learning through a real-time interactive simulator, is demonstrated.

INTRODUCTION

Virtual reality has been widely recognized as a significant technological breakthrough, which can be used in the field of education in order to enhance learning. In contrast with the conventional two-dimensional presentation of educational material, virtual reality technology allows the visualization of data in three dimensions and provides interactive functionalities that reinforce the feeling of immersion into a computer-generated virtual world. According to many researchers and educational practitioners this alternative form of education facilitates learning due to the ability of human brain to perceive better and assimilate easier a 3D computer-graphics representation than a simple text. It is also widely recognized that VR technology engages students' attention and

DOI: 10.4018/978-1-61692-822-3.ch010

turns education into an entertaining procedure contributing thereby to the active participation of students in learning process.

One of the most beneficial uses of VR technology is the development of virtual reality environments on the Web. This capability provides a novel framework for distance learning and life-long education shifting the centre of education from physical classroom to network. Hence, students can approach knowledge from any place, even from their own home, having as much time as they really need to study the educational material adapting so the learning process to their personal needs. However, in order to support and enhance learning through Web-based virtual environments, specific pedagogical methods should be applied and well-defined rules should be followed. Web-based virtual learning environments play a multilateral educational role providing not only a platform for the presentation of educational material, but also a communication means among the members of a learning community. These capabilities allow the creation of a virtual classroom, i.e. a virtual learning environment in which educators and learners are able to perform classroom-like tasks (Grigoriadou & Papanikolaou, 2000). To ensure the educational effectiveness of the learning environment, appropriate pedagogical methods should be considered, especially in the designing phase of the system. Basic pedagogical methods such as behaviourism, cognitivism, constructivism and collaborative learning are studied focusing mainly on the efficient preparation, approach and presentation of learning content to fulfil its educational objectives.

A web-based virtual learning environment (the term hypermedia virtual learning environment can be alternatively used) is not just a conventional website used for disseminating educational content or a web page containing 3D graphics. It is a combination of virtual reality and web technologies centralized on the fulfilment of specific educational objectives. For the effectiveness of the final application, specific designing rules should be followed to ensure its usability, i.e. an efficient, understandable and pleasant communication between user and system. The designing rules presented in this chapter are classified in three categories according to the triple nature of these applications: hypermedia, virtual and educational nature. Each of these categories contains a number of requirements that should be taken into account by a designer to ensure the usability and effectiveness of the final application. In the next section a study on various virtual reality educational environments on the web is presented.

This chapter is organized into five distinct parts. First of all, a historical overview is provided, which cover some of the most significant milestones in the area of web-based virtual reality environments. This is followed by a designing analysis, in which the basic designing rules for web-based educational virtual reality environments are described. Thereafter, a prototype environment is presented for the distance education of medical students. Finally, future research directions as well as the conclusions of this study are presented.

BACKGROUND

The vast majority of these applications involve predeveloped virtual environments in which students can interact to learn some basic concepts. A case of a virtual reality distance learning system was VRLAB (VRLAB, 2005). Within the VRLAB system, students are able, via the Internet, to conduct experiments, which are located in a remote laboratory. This guarantees safety and does not include any financial or time restrictions. Special emphasis is given to the students' interaction with the experiment (i.e. control of the experiment, camera control etc.), which is realized via a user-friendly interface based on virtual reality and 3-D visualization techniques using 3D graphics so as to stimulate the students' interest. Virtual reality equipment, such as a Head Mounted Display could also be used, if available, in order to im-