

Chapter 46

Virtual Reality and Education: Overview Across Different Disciplines

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ABSTRACT

Virtual reality (VR) is a technology which combines hardware and software solutions. It permits to create three-dimensional (3D) virtual worlds and virtual objects. This chapter describes how VR technologies find positive application fields in educational environments. VR, combined with multimedia technologies and in support of different learning styles, offers potential help in teaching and in learning paths. This chapter shows a set of examples in the applications of VR at different age levels schools, and in different countries (USA, Italy, Morocco, Romania, and Switzerland). VR, and their applications, are also described here.

INTRODUCTION

In 1987, Yaakov Garb used the term “virtual reality” as title of a paper. For the author, virtual reality is the capability to represent the world with visual symbols (Garb, 1987). Garb’s point of view is far from computer technology.

Two years after, American writer and computer scientist Jaron Zepel Lanier coined the term Virtual Reality (VR). He referred the term to the world of computers: VR exists only as electronic image, without any connection with the real world. As Krueger (1991) stated, “The term therefore typically refers to three-dimensional (3D) realities implemented with stereo viewing goggles and reality gloves” (p. xiii).

VR is a technology which involves information technology, computer graphics and electronics, and it gives its users the illusion of being immersed in a computer generated virtual world with the ability to interact with it. Virtual reality has also been defined as an experience in which the users are immersed in a responsive virtual world. This implies users dynamic control of viewpoints. (Brooks, 1999)

Burdea and Coiffet (2003) describe VR as a simulation in which computer graphics are used to create a realistic-looking world. The synthetic world is dynamic, responding to the user’s input (gesture, verbal command, etc.). This introduces the real-time interactivity which is a key feature of this technology, but computer science evolution requires a new definition of VR.

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Virtual Reality and Education

More recently, the Encyclopædia Britannica (2015) describes VR as “the use of computer modeling and simulation that enables a person to interact with an artificial three-dimensional (3-D) visual or other sensory environment.”

This chapter presents an overview of the use of virtual reality technologies in educational fields, and intends to answer the following question: “Is virtual reality a good educational tool for learning environments?” (Virtual reality, 2015)

To answer to this question, the chapter presents a set of applications of this technology in different schools settings. Such settings may include use in primary schools to create collaborative environments to facilitate the learning, in universities (for example, to create virtual objects and virtual prototypes for training students of industrial design to new digital prototyping systems) and in different countries (for example, in USA, France, Italy, Morocco, Romania, Switzerland). A paragraph is dedicated to the Virtual Worlds and their use in education (Childs, 2010; Duncan, Miller, & Jiang, 2012). All these experiences emphasize that VR has a positive impact in the educational environments. VR presents multiple entry points for personal learning strategies and offers didactic paths that privilege an intuitive approach (McLellan, 1996, 2003; Pantelidis, 1993, 1997, 2010; Pantelidis & Auld, 2002; Sala & Sala, 2005; Sala, 2012).

BACKGROUND

A VR system is a set of hardware and software components which permit to realize virtual reality environments. It has the following three primary requirements (Roseblum & Cross, 1997).

- Immersion refers to a realistic feeling that allows users to have exposure to a virtual environment. The perception is created surrounding the user by the VR technologies and by its devices (e.g., data gloves, head mounted display, sound or other sensorial stimuli), that provide an engrossing total environment (Wu, Liu, Wang, & Zhao, 2015). Immersion requires physically involving the user, both by capturing exclusive visual attention and by transparently responding to 3D input, through use of devices such as a head-tracker, 3D mouse, wand, data glove, or fully instrumented body suit;
- Interaction is a kind of action that occurs as two or more objects have an effect upon one another. In VR what is realized through the 3D control devices to investigate and control the virtual environment; and
- Visual realism (that is an accurate representation of the virtual world using computer graphics tools).

Immersion

Immersion is a feature of virtual reality, and it is an unique experience that is connected with the world of VR. Astheimer et al. (1994) define immersion as the feeling of a VR user, that his virtual environment is real.

In a 2004 work titled *Postmodernism and the Three Types of Immersion*, Adams presents three main categories of immersion: tactical, strategic, and narrative. Tactical immersion gives the users the experi-

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