

Chapter 10

Virtual Reality, 3D Recreations and 3D Printing in Social Sciences Education: Creating and Interacting With Virtual Worlds

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ABSTRACT

Virtual reality is a technology for the relocation and interaction of users with a digital environment created by computers through an interface that recognizes actions carried out in the real world. It allows users a multimodal experience, making possible immersion in a digital world. On the other hand, 3D modeling is a process of design and representation of an object (3D model) in three dimensions with specialized software, a model that could become tangible through 3D printing. Virtual reality, 3D modeling, and 3D printing technologies, with appropriate teaching proposals and appropriate tools for process monitoring, offer students new ways of interacting with contents of social sciences, geography, and history. There are more resources for the management of classes with VR devices and specific VR applications for teaching. In general, virtual reality and 3D modeling/painting in class allows both interaction and several opportunities for learning adapted to the needs of students.

INTRODUCTION

In recent years, Virtual Reality (VR) is one of the main emerging tools in educational environments (Freeman, Becker, Cummins, Davis, and Hall Giesinger, 2017). According to previous chapters and based on Milgran, Takemura, Utsumi and Kishino (1994) approach, mixed reality and continuous reality-virtuality were basic aspects when differentiating between Real Environment (RE), Augmented Reality (AR), Augmented Virtuality (AV) and Virtual Environment (VE), understanding AR as the incorpora-

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tion of computer-generated objects in a 3D real-world scene and AV as the incorporation of real objects in a virtual world. One of the specific features of VR is related to the immersion level of experiences.

VR allows immersion in digital world, from different senses, involving sight and hearing. It allows the user to immerse themselves in a digitally created world (Díaz, 2016). VR is not just a technology at the service of entertainment. As Everson, McDermott, Kain, Fernández & Horan, (2017), Johnston, Rae, Ariotti, Bailey, Lija, Webb & McGhee, (2017) or Toca (2017) indicate, this technology has been used in science, medicine, architecture, psychology, engineering, military training, astronaut training, etc. With this technology, new devices for domestic use have emerged with relatively low prices; VR devices such as Oculus Rift, Play Station VR, Daydream, or VR Sky. It is possible to buy a VR Headset / Head-mounted display (HMD) adapted to include smartphones to VR experiences. Besides, users can manually build it with a cardboard template at a very low price. Lower price options to use this technology are driving the creation of VR experiences (Aznar, Romero & Rodríguez, 2018; Piscitelli, 2017) and services of companies that offer packs for these experiences (Díaz, Rodríguez & García, 2018; Brown & Green, 2012). 3D modeling is the process of developing a representation of an object (3D model) in three dimensions with specialized software. There is a connection between 3D modeling and 3D printing; regarding this, 3D model can also be physically created using 3D printing devices. 3D printing is technology that allows build a 3D object with successive layers of material.

In this chapter, we will review the conceptualization of VR, virtual recreation and 3D printing, as well as, the strategies for using them in the teaching of Social Sciences, Geography and History. Finally, we will review some of the resources for the inclusion of VR experiences, 3D modeling and 3D recreations in the classroom, including their usefulness for 3D printing. Regarding VR, a selection has been carried out considering the maintenance by developers and the flexibility of the resource to adapt it to the classroom needs: *View Master*, *ClassVR*, *ENGAGE* (communicate / teach / learn), *CoSpaces Edu*, *Google Expeditions*, *Google Street View*, *Google Earth VR* and *YouTube (360/180)*. Regarding 3D modeling software, we have selected some integrated platforms and programs for 3D design, customize, sculpt, draw on 3D models, etc. That programs are: *Tinkercad*, *SketchUp*, *Blender*, *Sculptris* and *Pixexix*. Regarding 3D recreation software, we have selected the following repositories: *Thingiverse* and *Smithsonian X 3D*. Some of the 3D model design tools are enriched by 3D repositories and almost all 3D software allow the printing by 3D printer.

CONCEPTUALIZATION OF VIRTUAL REALITY

In 1962, Heilig materialized his immersion ideas in a mechanical projection device called *Sensorama* where visual experience, 3D stereoscopic vision, stereo sound and aromas were offered; becoming the first example of multimodal immersion. The first virtual reality (VR) head-mounted display (HMD) system, “The Sword of Damocles”, was created by Ivan Sutherland and his team in 1968 and allowed the visualization of virtual environments in wireframe (although it was so heavy that it should be hooked from the ceiling). In 1981, Thomas Furnes boosted the “virtual cockpit” and, subsequently, presented the “Visually Coupled Airborne Systems Simulator”, a helmet that offered American war pilots additional flight information (Chain, 2008). In the 80’s, several devices emerged, devices as, for example, *DataGlove*, a glove that allows the recognition of real moving in virtual environment (López, 2013). Other alternative was *PowerGlove*, a peripheral of Nintendo to play NES through a system of recognition of hand movements that although it did not work satisfactorily enough, it was revolutionary. In the second half of the

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