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3.3 MAKING 3D OBJECTS IN VIRTUAL LEARNING ENVIRONMENTS

1. INTRODUCTION

This chapter reviews the software tools that are used in the field of virtual education and which, thanks to Internet, facilitate teaching and learning processes. The programs associated with the learning environments and the tools that work with augmented reality (in 3D environments) are described. What is more, it also explains how to make 3D objects for learning activities using Sloodle, which links to a multi-user virtual environment (MUVE) such as OpenSim with a learning management system (LMS), in this case Moodle.

2. VIRTUAL LEARNING ENVIRONMENTS (VLES)

VLEs are computer applications that have been developed to manage and administer learning processes through Internet. They aim to provide the tools required to manage the various e-learning initiatives designed to develop the attitudes and aptitudes of the participants of an educational process. A VLE must be designed, constructed and integrated into the educational process from a pedagogical point of view to guarantee not only that it incorporates technology but also a mediating interface that facilitates learning (Suárez, 2003).

2.1. Learning Management Systems (LMSs)

LMSs are computer applications that integrate management- and administration-oriented functions for users, virtual classrooms, content and learning activities. An LMS is not only a software application: it is designed and constructed on a sound pedagogical basis that makes learning possible by displaying content, and managing and administering the educational process. LMSs must provide and integrate a set of web tools that facilitate learning and course management. What makes LMSs different is the pedagogical orientation that they give to these tools so that they can be more useful (Malikowski, Thompson, & Theis, 2006).

An LMS is structured in such a way that it shows students how to learn. It provides an environment that makes it possible to organise information and the architecture to display it; a set of tools that facilitate interaction between the actors in the process, and between the

actors and the content; and a set of interfaces that facilitate the integration, participation, action, communication and collaboration of the students engaged in educational activities and research. It also contains a wide variety of tools that enable students to find different ways of doing, thinking and feeling (Dillenbourg, 2000).

According to Sánchez (2009), the most widely used term to refer to this sort of software application is learning management system. Nevertheless, there are other related terms: virtual learning environments (VLE), course management systems (CMS), mediated learning environments (MLE), integrated learning systems (ILS), learning support systems (LSS) and learning platforms (LP).

The first of these tools to emerge was the course management system (CMS), designed to manage learning-oriented content and which is not necessarily a software application limited to the web. They were used to provide support to distance education. CMSs also facilitated the generation of dynamic websites for some types of content (Boneu 2007).

After CMSs came LMSs, software applications that can work on both intranet and extranet levels: that is to say, they were developed for internet and make it possible to update and accumulate dynamic content, and also improve the possibilities of collaboration, interaction and communication of the platform users.

Learning and content management systems (LCMS) have a repository of learning objects, which are stored as a database of the digital content and information and learning objects that make up the lessons, teaching units and courses generated from the learning objects. The LCMS can be defined as a web-based system that uses the web to create, approve, publish, administer and store educational resources and on-line courses (Rengarajan, 2001).

2.1.1. Moodle

Moodle is an LMS based on the philosophy of free and open source software and it is one that is in widespread use by teaching staff and students all over the world, as can be seen in the statistics that are available on its website. It enables courses to be managed and distributed on Internet and it is based on a "social constructivist pedagogy" (SCOPEO, 2011).

3. VIRTUAL REALITY

Virtual reality (VR) is the science that studies and develops the various components of both hardware and software that aims to simulate reality and the sensation of presence through a medium of communication. "Virtual reality is a three-dimensional simulation, commonly computer-generated or assisted, of some aspect of the real or fictional world, in which the user has the feeling of belonging to the synthetic environment or of interacting with it. Virtual reality makes it possible to interact with three-dimensional worlds in a more natural way: for example, a user can perform actions within a virtual model, travel, move, walk through it or lift things and thus experience situations that resemble the real world." (ISEA, 2008).

In the context of VR, virtual worlds simulate real worlds, or not, in three dimensions (3D) using software platforms installed in a computer (Grané, Frigola, & Muras, 2007)

3.1. Multi-user virtual environments (MUVEs)

On-line virtual worlds known as MUVEs integrate resources that enable users to communicate, interact and collaborate from a new perspective (ISEA, 2008).

For Camacho, Esteve & Gisbert (2011), a virtual world is a simulation of a space, a three-dimensional representation of geographical features, cities and digital simulation of the real environment. Second Life, for example, is a 3D environment that enables users to interact by means of a graphical representation that is known as an avatar.

MUVE applications are classified in two large groups depending on the functions available to users and the administration options available to organizers. Client MUVEs are platforms that are available and which are administrated by a company or organization. MUVE servers are platforms that can be downloaded or purchased to be installed and configured in other servers.

3.1.1. OpenSimulator

OpenSimulator (OpenSim) is an open-source, cross-platform, multi-user software application. It is a 3D-applications server. It can be used to create a virtual environment that can be accessed by various clients using different protocols (http://opensimulator.org/wiki/Main_Page). The development of OpenSim is closely connected to the platform SecondLife owned by Linden Labs. It has two main components:

- The ***client,*** which is a software application consisting of a window or interface by which the user navigates through a three-dimensional space. This interface also enables the user to make searches, view maps, manage the inventory, communicate by chat, configure and personalize the interface, and administer clients.
- The ***server***, which is the software application that communicates with the client by accepting requests and sending responses. The server application is connected to one or more databases in which all the user's assets and the inventory articles are stored

It has three operation modes:

- ***Independent mode:*** Clients authenticate themselves to the server before they are teleported to the virtual world. The server has all the basic services integrated into an executable image that dynamically invokes libraries
- ***Network mode:*** This mode has a range of specific services: **U**ser, **G**rid, **A**sset, **I**nventory, **M**essaging (UGAIM). The authentication service is responsible for managing the users who connect to the grid. The grid service understands the general layout of the grid including the Internet addresses associated to each region. A grid consists of regions and includes everybody. The assets service manages all the assets (basic geometry, texture maps, audio files, terrain geometry) in the regions. The inventory server administrates the goods that are linked to a particular agent, in such a way that when users authenticate themselves as agents they are automatically linked to a set of inventory articles. The messaging service is responsible for the text chat.
- ***Hypergrid mode:*** The hypergrid mode is a set of simulators connected without a global grid manager. In many respects it resembles the Internet's hypermedia platform. The equivalent of the web link for OpenSim is teleporting from one region to another.

Image 1 shows the typical interface of a virtual world in OpenSim.

Image 1: OpenSim interface.

Fuente: An introduction to opensimulator and virtual environment agent-based M&S applications (Fishwick, 2009).

3.1.2. Simulation-linked object-oriented dynamic learning (SLOODLE)

Sloodle is an open-source Project that was developed with the purpose of integrating a web-based LMS (Moodle) and the wide variety of interactions made possible by the MUVEs (OpenSim) (http://www.sloodle.org/moodle/).

Image 2 shows the integration between LMS and MUVEs through Sloodle.

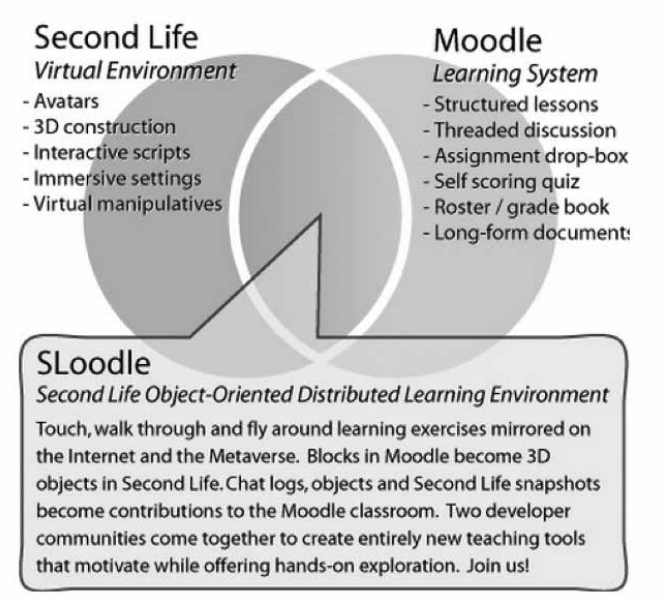


Image 2: Sloodle project

Source: Configuration of learning objects in 3D virtual environments (Samaniego, et al., 2011).

Sloodle increases educational possibilities synergically by creating the potential for immersion and immediacy, which improves Internet-based processes.

Image 3 shows Moodle's 2D activities, its corresponding 3D objects in OpenSim and their integration and interaction through Sloodle.

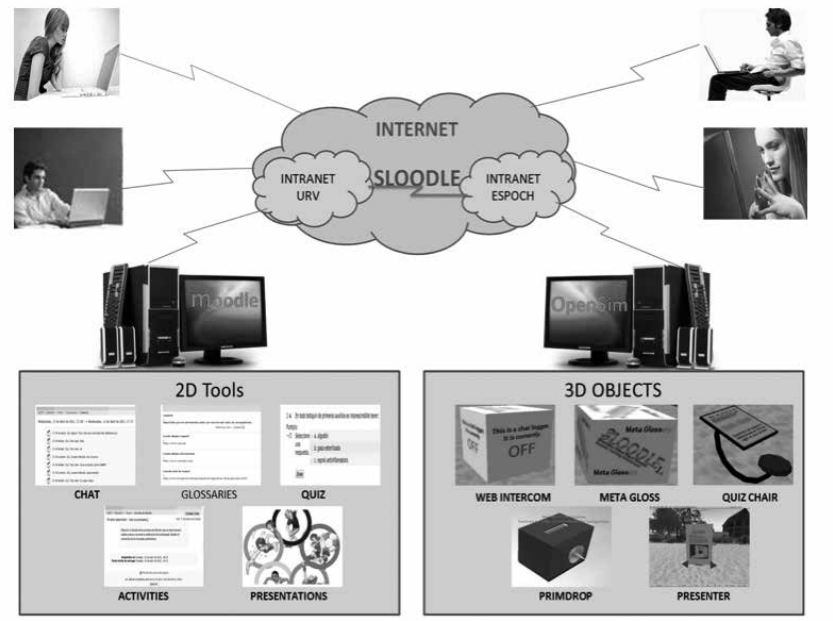


Image 3: 2D tools and 3D objects integrated through SLOODLE
Source: author

4. INTEGRATION OF MOODLE AND OPENSIM USING SLOODLE

To integrate Moodle and OpenSim, Sloodle must first be installed and configured in the two platforms. Image 4 shows the layered architecture of the platforms.

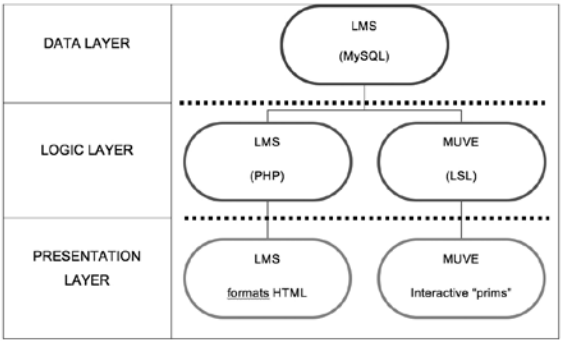


Image 4: Layered arquitecture

The data layer stores the data of the system and the users.

The logic layer executes the functions and operations requested by the user, processes the information and sends the responses after the process. This layer communicates with the presentation layer to receive applications and present results, and with the data access layer to store and retrieve data.

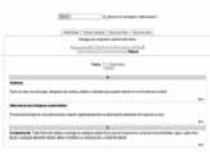
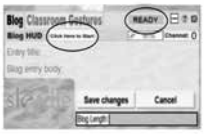
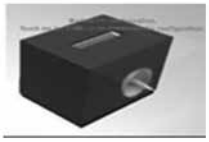
The presentation layer is the user's interface: it is responsible for the system interacting with the user and viceversa, it shows the system to the user, it presents information to the user and obtains information from the user

5. 3D OBJECTS AND 2D ACTIVITIES

A set of important Tools have been developed for MUVEs that enable the content and activities to be displayed in a 3D context. However, not all the tools available in Moodle have a corresponding tool in the 3D environments. The table below shows the interaction between the 3D objects and 2D tools made available by Sloodle.

Table 1: Interaction between 3D objects and 2D tools through Sloodle.

3D object	Description	2D tool
Sloodle Set 	This 3D object connects or links the MUVE environment to the Moodle environment.	**Connect con Moodle** 
Web Intercom 	This object links the chat sessions that are carried out in the 3D environment to the Moodle chat module and records all the interaction that takes place in the 3D environment in the Moodle platform.	**Chat** 
Presenter 	This object displays the content of websites, pdf documents and videos uploaded to Moodle as presentations in the 3D environment.	**Web, pdf, videos** 

Meta Gloss 	Using Moodle's glossary tool, you can integrate all the content you like. The Meta Gloss tool in the 3D environment makes it possible to access and consult the content prepared in the glossary.	**Glossary** 
Quiz Chair 	Multiple-choice questionnaires are prepared in Moodle and can be displayed and answered by students in the 3D environment using the Quiz Chair object.	**Quiz** 
Toolbar / Freemail 	This object allows you to publish on the Moodle blog and provides a set of icons for interaction.	**Blogs** 
Drop box 	A task can be prepared in Moodle and this object can be used in the 3D environment to hand it in.	**Tasks** 

Source: author

6. CONCLUSIONS

With the passage of time, more and better tools are becoming available for promoting and supporting learning using the new information technologies. Virtual worlds are one of the many alternatives and, if they are used appropriately, they can increase the teaching possibilities enormously and democratize and improve the quality of educational processes.

Learning objects in a 3D space can be configured and used for such specific needs as reality simulations in educational and training situations.

Most Moodle activities can be represented in a 3D environment such as OpenSim, in which the data on the interaction of users are recorded in Moodle, thus allowing them to be subsequently analysed and evaluated.

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