

Implementation of a 3D Virtual Environment at the National University of the North West of the Province of Buenos Aires

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Abstract. The increasing incorporation of ICTs in education is generating a series of changes and transformations in the ways we represent and carry out teaching and learning processes. These changes can be seen in the traditional environments of formal education but also in the arrival of new educational environments totally or partially based on ICTs. This document discusses the design, creation and coordination of a 3D virtual teaching and learning environment for UNNOBA. With that aim, the definition and deployment of a 3D virtual environment [3DVE] focuses not only on technological and pedagogical aspects but also on a transition methodology to improve the quality of teaching methods and techniques.

Key words. 3D virtual environment, PACIE, OpenSim, ICTs.

1 Introduction

In the past few years, we have seen that education has been transformed as a result of the advent and introduction of new technologies, especially since the introduction of LMS (Learning Management Systems). These systems favored the growth of distance learning and helped to improve teaching and learning processes. Despite these advances, LMS providers compete to place their tool as the central element of e-learning [1] leaving aside what should be the main objective i.e., allowing students to assume more responsibility for their learning processes.

In the traditional approach of current LMS, teachers design courses and activities with a student-centered vision but this does not allow students to set their own goals and terms, manage their work, assess their use of time and work in collaboration with their classmates [2].

The impact of these new technologies has a lot to do with the advent of a new generation, born with technology at their fingertips, known as *digital natives* [3], who prefer to learn in an ICT tool-based environment. This is a challenge for traditional teachers who need to generate new methods or adapt their old ones so as to exploit students potential through new technologies [4].

As a result, we believe that, in order to design, create and coordinate a 3D virtual teaching and learning environment for UNNOBA, we should not focus on technical or pedagogical aspects only. We need to consider a transition methodology to improve teaching methods and techniques. For future implementation purposes, we will base part of the design and creation of our 3DVE on the PACIE method (Spanish acronym for presence, scope, training, interaction and e-learning) developed by Pedro Camacho [5].

2 Key concepts and aspects of the PACIE method

PACIE is a method to use ICTs as support for learning and self-learning processes that enhances a pedagogical framework of real education. This method differentiates three aspects that should be taken into account in the transition process for a 3DVE, as follows:

- The image to be given to our 3DVE
- Information management and organization within the 3DVE

- Virtual education management, organization and administration.

Our 3DVE proposal will focus on these three fundamental aspects. Other aspects will be open to inquiry until we have carried out different experiences after the 3DVE start-up [6].

2.1 3DVE image

The environment needs to be friendly and attractive. The following should be taken into consideration:

- Using the same typography and text size for titles.
- Using the same font for information.
- Highlighting relevant information by using different fonts and colors.
- Using the same size for all images.
- Using links with images to facilitate access to different items of the University.
- Including attractive web 2.0 resources such as animations, videos and other.
- Creating the need to discover new and appealing ways in 3DVE to motivate students to continue exploring and using it.
- Having and keeping an identity. This means making students feel that each virtual classroom is part of a single virtual education center [7].

2.2 Information Management and Organization

Now we should consider the importance of managing and organizing information inside our virtual classroom.

Based on the idea that to let students learn, the aims should be clear, we decided to use SBS (*Standards, Benchmarks and Skills*) in the proposed model. By using them, we can determine what skills the students need to acquire, develop or improve when they complete the educational process and achieve certain aims or products by meeting certain requirements and being ready to face new situations. All these skills are grouped into patterns or academic benchmarks with similar characteristics. All of them have been customized for our subject in an exclusive way. Once we have the academic benchmarks, we aim at certain standards that need to be established by the related academic department [8] [9].

2.3 Virtual Education Management, Organization and Administration

Following the PACIE method, to implement the proposed 3DVE, we believe that it is very important to have a specialized area of distance learning to manage and organize all the aspects related to virtual education, with decision-making powers over the 3DVE.

As stated in the PACIE method [10], the minimum human resources requirements include a teaching expert, an IT expert and a social communication expert. This allows us to divide tasks in a better way.

- The social communication expert should manage communication of virtual learning processes as well as any general aspect related to the 3DVE and the virtual classrooms. This person should be the link between the teaching expert and the IT expert.
- The IT expert should provide support in all aspects related to technology and the teaching and learning environment by providing solutions for the 3DVE to work properly.
- The teaching expert should be in charge of implementing learning methods suitable for the 3DVE and thus generate better learning techniques within the 3DVE and a teaching method especially designed for this specific 3DVE.

3 Identification of the main aspects of the proposed 3D virtual environment

As a result of the research process, a series of issues and specific solutions for the model have been identified:

- *Administrative aspect:* A 3DVE is a system that integrates different solutions but its main objective is to provide adequate support to the teaching and learning activities of the main players: teachers and students alike. They need strong guidance to be provided by people who are highly trained and supported by well-defined processes.
- *Information management aspect:* We should put special emphasis on information management and organization, analyze what is done with such information and how to use it to generate learning. We can manage and organize information using current standards or methodologies and using SBS is one of them.
- *Educational aspect:* Teachers need to break with the traditional teaching scheme, they should guide students toward self-learning, make the environment a door to contents students find interesting so that they will continue exploring them and learning autonomously. This is done by developing adequate contents for the environment and guiding students through it [11].
- *Technical aspect:* A good 3DVE should be accompanied by people who are trained to use it and can coach those who have not learned how to use it.
- *Evolutionary aspect:* Any virtual system should take into consideration a potential evolution if it aims at being effective in changing times such as the present. Control and update process are necessary to adapt the system to new tools and create a virtuous circle to have it permanently optimized.
- *Graphic aspect:* Nowadays, the design and visual aspect of the 3DVE needs to be attractive to students, otherwise, they are likely not to access it very frequently and, as a result, they will not make use of its advantages.
- *Functional aspect:* Necessary tasks such as the management of virtual classrooms: their creation, enrolment process, teacher appointments and role allocation, etc., should be standardized and carried out by specific personnel. On the one hand, because these tasks should not be part of the teacher's responsibilities, the teacher is a user and not an administrator of the virtual environment but on the other hand, because the performance of these tasks needs to be uniform, since a diverse environment looks messy.

4 Choosing a tool to implement the proposed 3DVE

To implement the proposed 3DEV, we needed to go through a selection process for the IT tool to be used as a server for the 3D applications. One of the requirements in the process was that the tool needed to be open source. *OpenSim*¹ and *OpenWonderland* were among the 3D application servers we surveyed and researched into.

OpenSim and OpenWonderland are 3D servers that allow virtual environments (also known as virtual worlds) to be created. These environments can be accessed from a wide range of viewers, also known as clients. *Singularity*² and *Imprudence*³. are two of the most popular OpenSim viewers. In the case of OpenWonderland, the web server acts directly as a viewer. No additional software to act as a client and interact with the 3DVE is needed.

When we chose the tool, we tried to meet the requirement that the 3DVE could connect to the virtual teaching and learning environment (EVEA) currently in use at UNNOBA, known as UNNOBA Virtual [12]. OpenSim had existing modules that allowed us to meet this requirement. This, and its excellent graphic quality, the possibility of making synchronic voice communication, its various repositories and documentation available made OpenSim the best option to be used as a 3D application server.

¹ OpenSim official site, http://opensimulator.org/wiki/Main_Page

² Imprudence official site, <http://wiki.kokuaviewer.org/wiki/Imprudence:Downloads>

³ Singularity official site, <http://www.singularityviewer.org>

After choosing the tool, we continued working on the installation stage. To do so, we downloaded the latest version available on the official website (we are currently working on the 0.7.5 version) and we consulted the official documents available on the site so as to install it correctly.

After completing the installation, we started working on modeling a virtual world. The first step was to create a conference room for UNNOBA. To do, we downloaded a base building and free objects from different websites, such as *FleepGrid*⁴, *OpenSim-Creations*⁵ and *Zadaroo*⁶, among others, to give it the current look and feel through different modeling and object options associated with the viewers, as shown in figures 1 and 2.

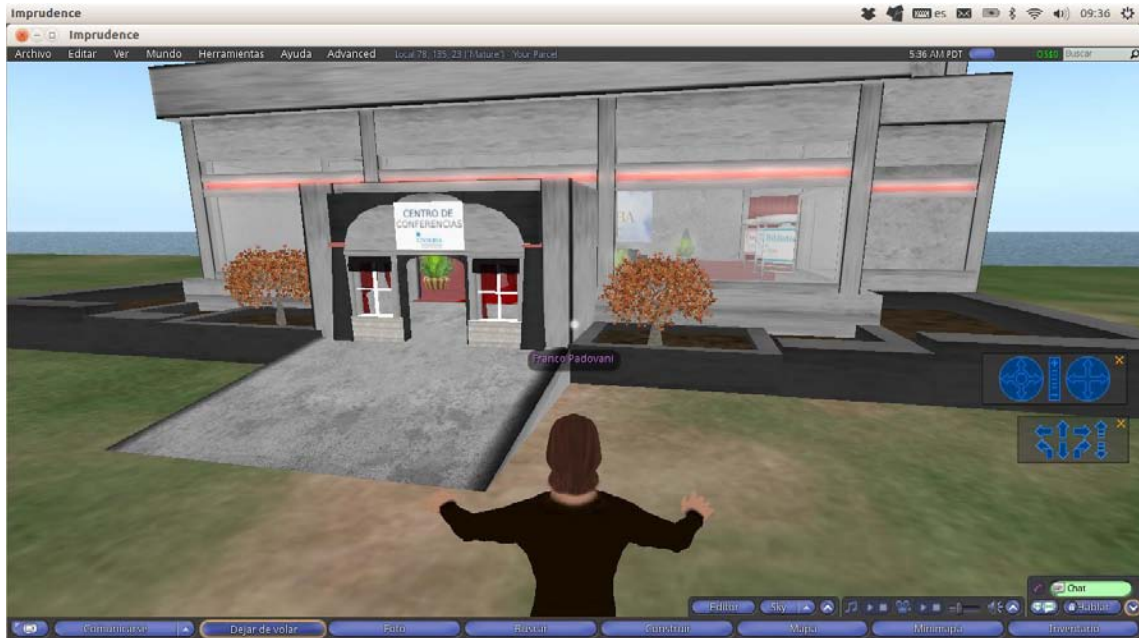


Figure 1. Conference room outside view.



Figure 2. Conference room inside view.

⁴ FleepGrid official site, <http://fleepgrid.com/store>

⁵ OpenSim-Creations official site, <http://opensim-creations.com>

⁶ Zadaroo official site, <http://zadaroo.com>

As second stage of the virtual world modeling, we worked on the idea of recreating one of UNNOBA's buildings. For such purposes, we had already obtained a blueprint of the building.

During this stage, research was conducted on the ways in which OpenSim would allow buildings to be created in its virtual worlds. Therefore, three ways of modeling and building were assessed using OpenSim. These are:

- Building them with a 3D modeling program and saving them in an extensible markup language, in the .XML format, compatible with OpenSim.
- Building them in a 3D modeling program and saving them with the .DAE format, also known as mesh, as this format is also compatible with OpenSim imports.
- Building them manually, object by object, using the viewer.

Out of these three options, we opted for a 3D modeling program that allows exporting .DAE files, because we had experience using programs with this format, such as *Blender* y *Google Sketchup*⁷, and, the *Singularity* viewer, that is the one used by the 3DVE, supported .DAE files.

We did not choose to create models manually because of the complexity of the task of creating buildings using primitive objects such as the spheres, squares and cylinders available on the viewers. The option of creating models and saving them on an extensible markup language was discarded because the tool we had, *SolidWorks*⁸, presented us with several inconveniences when importing the model into the 3DVE during the technical assessment stage.

Using the selected option, we managed to import, inside the 3DVE, a model based on a blueprint of one of UNNOBA's buildings. This is shown in figures 3 and 4.

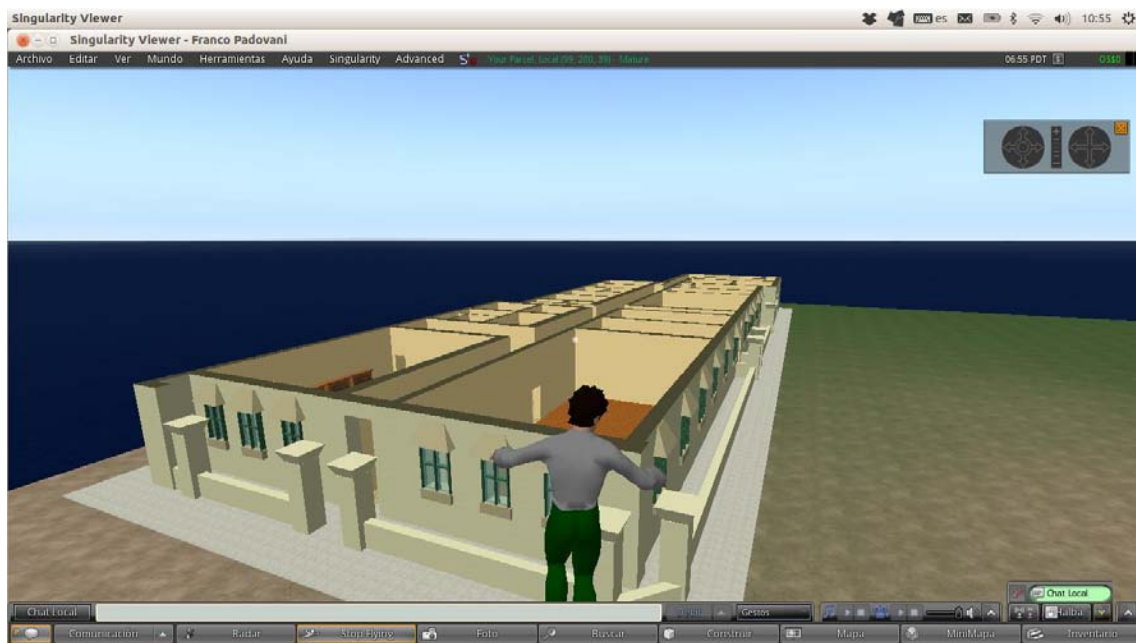


Figure 3. UNNOBA's building constructed from Google Sketchup already imported into OpenSim.

⁷ Google Sketchup official site, <http://sketchup.google.es/index.html>

⁸ SolidWorks official site, <http://www.solidworks.com>



Figure 4. Library UNNOBA's building constructed from Google Sketchup already imported into OpenSim.

5 Integration and technical assessment of the proposed 3D virtual environment

Once the virtual world mentioned above was created, we started its technical assessment.

One of the aspects we analyzed and assessed was real-time voice interaction. This was one of the requirements to be met. In these communication modes i.e., open voice interaction and close voice interaction, for public and private communication respectively, we detected that open voice communication can be configured so as to listen within a set distance, which would allow splitting working stations and allow only the avatars in the area to listen and be listened. "Avatar" is the name given to the virtual representations of the human body of the user in the environment.

Another aspect to be taken into consideration was the possibility of integrating the 3DVE into UNNOBA's teaching and learning environment, UNNOBA Virtual [12]. To do so, we used a module known as *Sloodle*⁹ that allows integrating a *Moodle*¹⁰ based LMS, the one used in UNNOBA Virtual, and OpenSim, the tool selected for the implementation of the proposed 3DVE. By using Sloodle, any component created on UNNOBA Virtual could be accessed from the 3DVE. The main technical assessments and trials conducted in connection with this integration were as follows:

- Access using existing access credentials from the the 3DVE to the virtual teaching and learning environment used at UNNOBA.
- Creating presentations in a virtual classroom of the environment and being able to access them from the 3DVE.
- Taking exams or assessments in a virtual classroom used at UNNOBA allowing students to complete them from the 3DVE, thus enriching the virtual assessment experience.
- Integrating a synchronic communication tool, as the chat used at UNNOBA's virtual environment, with the 3DVE, which gives the possibility of starting a synchronic written and verbal communication among the participants in a virtual classroom.

⁹ Sloodle official site, <http://www.sloodle.org>

¹⁰ Moodle official site, <https://moodle.org>

6 Conclusions and future work

One of the aims we seek to attain by using the 3DVE is to introduce and generate innovative strategies to meet the need to improve the teaching and learning process, allowing students to be involved in their academic education and favoring open and dynamic communication.

We believe that although we are still on an assessment and continuous improvement stage, the proposed 3DVE, thanks to its real-time interaction capacity and its "face-to-face" feel, adds a social dimension to the teaching and learning environment similar to the one of "face-to-face" education which makes our distance learning proposal richer and more dynamic.

However, we are aware of the fact that to improve this process, having and implementing a 3DVE is not enough. Having a transition methodology to improve the quality of teaching methods and techniques is not enough either. The design of educational activities and the generation of specific content for the 3DVE is an emerging perspective in the practice and research of the e-learning community.

Therefore, we should focus on generating and designing specific content for this kind of environments and, as a result, in the future we will attempt to design specific content for the 3DVE to be used at UNNOBA.

In connection with our future work, with the integration of the teaching and learning environment used at UNNOBA and the 3DVE, we aim at creating a collaborative learning environment and designing specific content and activities suitable for both environments and also at assessing, measuring and comparing the impact of the introduction of a 3DVE into the different teaching modes at UNNOBA.

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