TECHLAND: EVOLUTION OF A VIRTUAL WORLD

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ABSTRACT

Techland is an OpenSim based virtual world. It is a group of educational and service islands focused on math and science for middle school students, K6 – K8 degree. It has been owned and managed by the author since 2010 with the aim to engage students and to make learning easier. Students can log their personal avatar, hang out, meet other avatars of the school, collaborate in mathematical and scientific projects, build and code together. The teacher acts as a supervisor and facilitator as well, helping students to express their creativity and knowledge through the “learning by doing” methodology. This work is describing the evolution of Techland from a simple classroom teaching support to collaborative platform for scientific projects, and is showing how, year-by-year, students improve their building and coding skills, moving from the role of simple users to content and objects creators.

Keywords: Collaborative Learning, Constructivism, Coding, Machinima, Mathland, OpenSim, Techland, Virtual Worlds, Virtualscience, Learning Objects, 3D modeling.

Introduction

In this paper the author is describing how Techland, an OpenSim based virtual world, has been used for educational purposes since 2010. In those years the “Ministero della Pubblica Istruzione”, the Governative Italian Educational Department was involved in a general innovation of the educational methodologies based on new digital technologies.

The challenge was to fill the gap between the school and the digital native languages (Prensky, 2001), by finding alternative ways to the frontal lesson.

Teachers were strongly encouraged to try out new teaching approaches, by using the same technology loved by young students, and by making them learn the proposed contents in a more effective way.

In 2007, Second Life reached its highest fame so, researchers became more and more interested in exploring the potential of virtual worlds for teaching purposes (Littleton & Bayne, 2008). As years passed by, it was clear that Second life was not expressly designed for education, especially for underage students; but, meanwhile, a new open source multi-platform, multi-user 3D application server, OpenSimulator, (opensimulator.org) was developed.
when Linden Labs, the creators of Second Life, decided to release the code, in order to allow an open construction of virtual worlds. Differently from Second life, it had additional advantages:

- It could be hosted on a personal server or PC;
- Different OpenSim worlds can be connected by the Hypergrid protocol, that lets avatars move from a world to another;
- Our own islands and student permissions are easier to be administrated;
- It has a very low cost, compared to Second life.

So, it was the right time for the author to bring immersive education in her daily teacher’s job, by applying the skills acquired in Second life.

**Background**

The pedagogy used at Techland is based on constructivist learning theories having its roots in J. Piaget (Piaget, 1936) and, later, in the socio-constructivism of L. Vygotsy (Vygotsy, 1978). Dickey (2005) illustrated how 3D virtual worlds can provide “experiential” and “situated” learning. Clark and Maher (2005) emphasized how virtual environments encourages “collaboration and constructivism”.

Based on the reviews of publications spanning 20 years, Dalgarno and Lee (2010), identified the main characteristics of virtual learning environments that can facilitate learning, in addition to situated and experiential learning (spatial knowledge, increase motivation and collaboration).

According to the definition of Wilson (1996), an OpenSim virtual world can be considered a constructivist learning platforms. In this kind of VW people/avatars can build, interact and share space, tools, ideas and resource.

**Techland configuration**

Techland is an Opensim-based virtual world. It consists of a group of educational and service islands dedicated to math, chemistry, biology and earth science, suitable for K6-K8 students. It is hosted on a Linux server (Intel(R) Xeon(R) CPU E3-1225 V2 @ 3.20GHz, 4 cores - 2 TB local disk space, 32 GB real memory), owned and totally managed by the author (aka Michelle Techland) (Fig. 1.) . Techland is configured as a Hypergrid Grid. It means that avatars coming from similar OpenSim-based virtual worlds can “teleport” to Techland using the hypergrid protocol. The URL address of Techland is [http://techlandgrid.it:8002](http://techlandgrid.it:8002).

Avatars can log in Techland using a viewer, an user graphical interface (e.g. Singularity, Firestorm).

**Interacting with 3D learning objects**

To simplify mathematical and scientific concepts, Techland was initially developed as a giant 3D book, where scripted learning objects act as paragraphs, displaying mathematical and scientific properties and giving information (Fig. 2.).

Learning objects have been set up by the author.
combining building and coding techniques and they are placed along structured learning pathways in thematic areas (Occhioni, 2013).

During the author's daily activity, virtual world is showed by an interactive whiteboard and the teacher's avatar is a kind of assistant. When clicked, objects change their appearance and position, animating themselves and giving information.

This interaction helps students to visualize mathematical and scientific properties in a dynamic way and in real time, as a 3D vision gives a correct perception of space and geometric transformations (Kaufmann, 2011). So, 3D objects are something like metaphors of abstract concepts.

This 'modus operandi' is typical in islands (e.g. Mathland, Statland and Chemland) centered on curricular topics like mathematics, statistical science and chemistry (Occhioni, 2015, 2016).

After a short training time, students/avatars are also free to explore the educational islands from home or from computer lab, developing spatial abilities, experimenting a “first person” or a “third person” view of the objects (Gu, Nakapan, Williams & Gul, 2009). 3D objects make tangible and immersive the representation of abstract concepts (Bell T.J, Fogler H.S, 1995).

**From users to producers**

In the learning set described above, students were almost passive users, although with a relative degree of interactivity. The next step was making students develop an entire project in-world, by collaborating together. In this case the teacher had the role of facilitating and supporting learning. After a short training on building and terraforming techniques, students were encouraged to express their creativity and knowledge starting from scratching the setting of the construction of an entire island dedicated to a specific topic. The first island totally set up by students was Waterland (Fig. 3.).

Starting from a grass expanse, students set up a project focused on water. The first step was to get information: a) brainstorming and research; b) statistical activities (consumption, resource, water footprint…); c) Scientific activities (chemical and physical properties of water); d) documentation activities (multimedia presentations). The second step was to translate information into 3D objects (tridimensional graphics, molecules, the water waste treatment and the phytoremediation plants, a house displaying domestic consumption of water). Notecards for additional information are often included into the objects. Some stuff used as background were imported from specialized websites. The third step, after the building activities, was the production of short movies about water by using the PC screen capture (machinima techniques). The actor/avatar was “forced” to play gestures, lips movements, facial expression by means of special animations. Movies and other multimedia presentations were collected in a website in Italian language: http://www.virtualscience.it/acqua/index.html

After Waterland project, students carried up other similar projects in a collaborative way.

In 2016, for example, K8 students were involved in the reconstruction of a plastic recycling plant as the final
outcome of a project about plastic materials.

In this type of projects students generally divided the island into different zones, including:

- an Info Point where to collect all contents displayed in a special presenter;
- a sandbox where to build and improve objects to be after moved to their definitive place;
- exhibition areas hosting the results of the project;
- a movie set for the students machinima activities;
- a Meeting Area.

Generally, all projects steps were discussed and planned in the classroom or in the computer lab and then carried out at school or at home, sharing objects, ideas and horizontal communication.

Year-by-year students improved their building skills, really contributing to the development of the Techland islands (Occhioni, 2017).

Producing scripting objects

In Second Life and in Opensim-based virtual world it is possible to include scripts in 3D objects and to give them a particular behavior or appearance, by using the Linden Scripting Language (LSL), a text-based programming language. Scripts are made employing a special editor included in the viewer.

When the author and her students started scripting objects with the LSL program, it was clear that it was quite difficult for pupils. They had to pay attention to syntax errors, spending a lot of time to debug and often they were discouraged to go on coding.

In 2014 the “Ministero dell’Istruzione, dell’Università e della Ricerca”, the Governative Italian Educational Department, started a three-year national project named “Programma il futuro” whose aim was to make students familiar with the key concept of computer science and with the computational thinking. Our school took part of that project since the beginning so, students became familiar with visual programming languages like Scratch, developed by M.I.T Boston and Bockly, a Google project.

Visual programs were more intuitive, and students easily combined functional/structural block to make scripts. They were more engaged; they avoided syntax errors and were able to run correct sequences of instructions as well. In order to combine coding and virtual worlds, we used the Flash Scratch to Linden Scripting Language (FS2LSL -http://inworks.ucdenver.edu/jkb/fs2lsl/), a visual graphical program developed by John K. Bennett from Colorado University, that translate the visual code into the textual LSL language.

Since then, students started producing 3D learning objects, becoming more and more creative, adding contents and behavior to their products. Coding helped students to think in a sequential manner, to decompose complex problems into simpler sub-problems, to be clearing giving instructions and to share jobs. The combination of coding and building activities has increased the students’ engagement with mathematics. 3D objects can be divided in:

- Functional objects (animated objects displaying properties and concepts);
- Assessment objects (to test one’s knowledge);
- Content Objects (multimedia presenters or video screen);
- Instructional Objects (saying how to proceed);
- Recalling Objects (linking to external resources).

In 2016 about 80 students from 4 different cohorts were involved in the “Mathland arithmetic” project for about 4 months, developing a new section focused on arithmetic under the supervision of the teacher (http://www.virtualscience.it/arithmetic/index.html) (Fig.4.).

They divided into three groups: Builders, Coders, Content Creators, working together to accomplish all tasks. Generally, the final product of a project is used with other cohort of student to be displayed on an interactive whiteboard or to be expanded in content and creations.
Conclusions

Techland is a learning environment that allows the use of different teaching methods, in particular “learning by doing” and “cooperative learning”. Besides, in Techland, students can use effectively skills learnt in other areas too. Indeed, they can combine in-world modeling with desktop modeling, developing creativity and design skills (Thornburg, 2014).

By now, 3D modeling is practically one of the most important or necessary 21st century skills. This is the reason why it is quite advantageous having experience of it since the very beginning of compulsory education. One of Techland’s strengths is that it is constantly evolving and expanding: new islands and new content are added from time to time, depending on the needs of the pupils and on the projects they are participating in.

Modeling objects

The virtual worlds viewers have recently started supporting the COLLADA files (COLLAborative Design Activity), enabling users to create objects with desktop 3D modeling applications and import them in Second Life or OpenSim. In 2016-2017, a group of about 50 students of our school started an extracurricular project to learn the key concepts of 3D modeling and 3D printing, using a solid modeling CAD software (Autodesk 123D Design). As compared with mesh modeling CAD, such as Blender or Maya, it was easier and more intuitive to be used and very close to the in-world building. So, after sixteen hours of training, they were able to build their objects and then to import them in Techland (Fig. 5.).

That type of objects, commonly called ‘mesh’, is very detailed, realistic and improves the aesthetics of Techland. Students can also build objects in-world and then export them to be printed in 3D.
Year-by-year Techland has become a collaborative platform where teachers can approach to new methodologies and students are active protagonists of their own knowledge.

References


