A Teacher Training on Geosciences in Virtual Worlds

Annalisa Boniello[1], Eleonora Paris[2]
School of Science and Technology, University of Camerino (ITALY)
[1]annalisa.boniello@unicam.it, [2]eleonora.paris@unicam.it

Abstract

The research project focuses on the experimentation of a teacher training in Earth sciences through an immersive learning using virtual worlds. The aim is to engage science teachers to use new methodologies and technologies in geosciences education. The experience has been developed within the PhD in "Teaching Earth Science" at the University of Camerino, School of Science and Technology (Italy). Science teachers experienced immersive paths on geosciences in which they could communicate with other teacher in a social virtual environment. The immersive paths are built through simulations of natural environments (volcanoes, magmatic rocks, 3D Earth, eruptions), rich of animations, interactive objects. In the virtual paths there are pre-tests and post-tests for evaluating the perception and the level of involvement of the science teachers in the geosciences virtual paths. The science teachers experience an immersive teaching, using a technology in which the user, through the screen, has the illusion to live a real experience. A novel and outstanding aspect of this technology is the degree of presence that is simulated through the use of an avatar, a virtual representation of the user. In this context, virtual worlds have a high degree of immersion and presence, therefore, their use in education is spreading as a socio-constructivist environment, where teachers can use the learning by doing and situated learning. The experimentation described in this paper presents data which demonstrate the interest in the potential use of virtual worlds for the development of scientific skills in geoscience education.

1. Introduction

Today the educational environments, in which training takes place, are various and this aspect has allowed the creation of different learning ways according to the different styles of student's learning [1]. The virtual worlds can be an innovative approach to training experience for science teachers in order to respond to different styles of students' learning in their classroom. The virtual worlds are multiuser virtual environments, three-dimensional, in which an immersive experience takes place through a simulation of the physical presence online with an avatar, a digital representation of a user. In this type of environment we obtain an immersive learning which represent a learning with a technology in which the user (learner), through a computer screen, feels to live a real experience, of "being there" [2]. Today the effectiveness of the use of 3D virtual environments for science education is shared in the literature as well. These environments have a high degree of immersion and presence. Their features are the learning by doing and situated learning [3] [4] [5], so they represent a new strategy to innovate science teaching and to improve motivation and the scientific skills of the students.

2. Background

In recent years, the use of virtual worlds in education is rising. This interest is marked by different educational experiences in virtual worlds [6], which are constructivist virtual environments where collaborative learning and the learning by doing are possible. de Freitas [7] has classified the virtual worlds for educational use in:

- Role play worlds: multiplayer role play online games
- Social worlds: open-ended exploratory immersive worlds
- Working worlds: corporate and business 3D spaces and intranets
- Training worlds: 3D training simulations and serious games
- Mirror worlds: using geo-spatial databases and mapping services

They all have, for de Freitas, the following features:

- user control
- collaboration
- they are persistent
- they allow interaction and experiences

- they let inclusion and sharing
- they allow immersion and interactivity.

These learning experiences are built with different software and technologies and on different topics, like history, sciences, math, languages. Some examples of educational uses have been recently presented by many University and school educators at the Opensimulator conference and at the Virtual Worlds Best Practice in Education conference [8].
Only some of these virtual worlds are dedicated to the sciences, such as Vibe , Fleepgrid, River City and Ecomuve. Fleepgrid and Vibe are created on Opensimulator [9] a open source software.

3. Methodology

In this context, a science teacher training on geosciences education was created with the aim to both improve competencies of science teachers to use virtual worlds and apply them in themes related to the Earth sciences. A virtual island called UnicamEarth island [10,11], dedicated to the geosciences, was created using Opensimulator platform on the server of University of Camerino where the science teacher training has been organized. The training was organized with a blended method: residential seminars in the schools and online meetings. The residential seminars have been in the Marche region schools (Camerino, Civitanova Marche, S.Severino, Fabriano) and in seven schools of Naples. In the seminars an introduction to virtual worlds and to serious games was preliminarily carried out followed by a practical activity on the use of virtual worlds for geosciences education. The science teachers have been them invited to an online registration on Unicamearth island. The call to the registration was also widespread online in Facebook groups dedicated to science teachers. The registration form has been filled by 50 science teachers localized in the whole Italian territory. Everyone has received a tutorial by email with user name and password, data for logging in the UnicamEarth Island and an invitation for a drop-box folder with tutorial to get in touch with the virtual environment. Only 30 of 50 registered science teachers joined online meetings, performed on the UnicamEarth island (fig.1).

Fig.1: *Map of UnicamEarth Island*

The online meetings were divided into 4 steps: familiarization with the new environment, study of examples of geosciences paths, basic elements of building and scripting in the world, project work on new geosciences path.
In order to develop collaboration and familiarization among the science teachers, a group, called UnicamEarth Island, was created in Facebook as a diary in which photos and information on the activities of the online meetings were shared. Science teachers (fig.2), joined 10 online meetings, 90 minutes each, experimenting different paths on geosciences: on volcanoes, earthquakes and tsunami, minerals and rocks, the volcanic area of the Campi Flegrei (Phlegraean fields) near Naples.
Before the seminars every teacher filled a pre-test on biodata as school, degree, genre, age and about their knowledge and perception of the environment according to Likert scale (1, strongly disagree, to 5, strongly agree) on following statements: I know the virtual worlds, I know the serious games, I use the virtual worlds in science education, I use the serious games in science education, I think that virtual worlds and serious games must be used in science education, I think that virtual worlds and serious games could improve the motivation of the students in the study of geosciences.
At the end of the second step, science teachers filled a post-test of evaluation of the geosciences paths based on the following statements: I think that the 3D virtual path is difficult to use by students, I

have already used with students similar paths, the instructions on the use of the trail were clearly visible, I think this path may motivate students to the study of earth sciences, I believe that the path could help students in developing scientific skills, I would like to experiment with my students paths with the same methodology, I would like to learn how to use a 3D virtual environment for teaching. The Likert scale (1, strongly disagree to 5, strongly agree) has also been used for every question in the post-test.

Fig.2: *Volcanic path on volcanoes and pre-test*

During every online meeting teachers (fig.3, 4) worked together and they joined the following activities: personalization of avatar, familiarization with the environments, collaborative activities with communication tool (local chat and private chat), learning by doing activities on localization in the map, science game design, instructional design on science, project work of paths on geosciences. In particular the step on game design was focused on the use of serious game in the virtual worlds.

Fig.3: *A Group of science teachers in the Unicamearth island.*

Fig.4: *Science teachers in the path on earthquakes and tsunami*.

4. Discussion

The data of the pre-test (fig. 5,6) show that the 30 science teachers involved in the experimentation were not previously involved in the use of virtual worlds and serious games for learning activities (73%). However before the experimentation they thought that the virtual worlds and serious games could improve the motivation of the students in study of geosciences (60% strongly agree and 37% agree). In the graph on the abscissa the scale of responses are shown according Likert (1, strongly disagree to 5, strongly agree) and on the ordinate the number of answers.

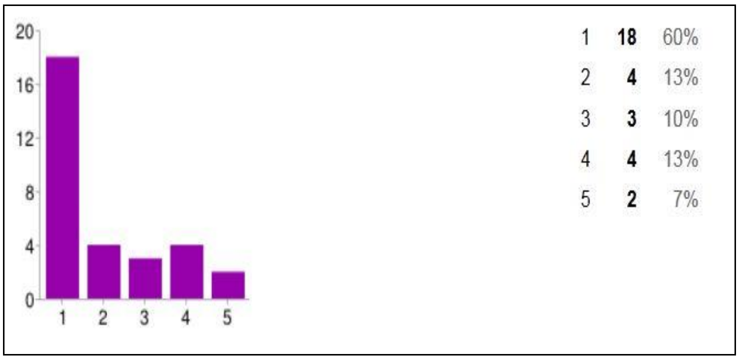

Fig 5: *I use the virtual worlds in science education*

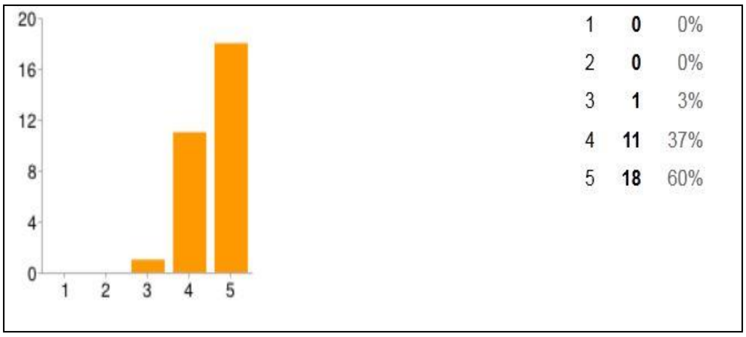

Fig 6*: I think that virtual worlds and serious games may motivate students to the study of Earth sciences*

The data obtained from the post-test show (fig. 7,8) that science teachers would like to learn how to use a 3D virtual environment for teaching (100% on 30 teachers) and after the training they think that these environments may motivate students to the study of Earth sciences (77% strongly agree and 7% agree). In this last case there is an increase in the percentage of teachers strongly agree.

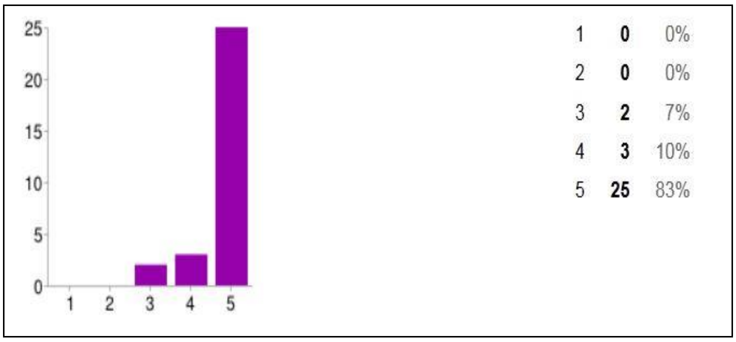

Fig 7*: I would like to learn how to use a 3D virtual environment for teaching*

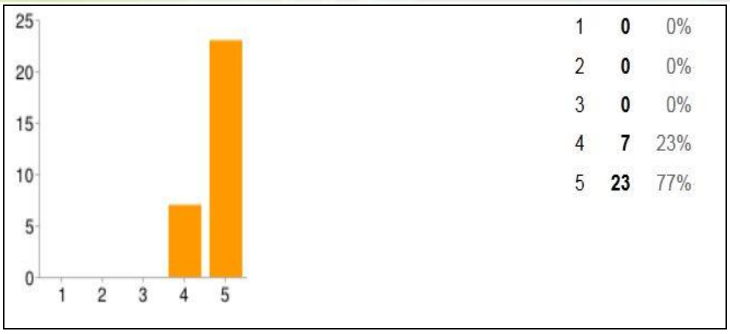

Fig 8*: I think this path may motivate students to the study of Earth sciences*

From the bio data information and registrations online it resulted that the science teachers came from secondary schools of first (11-13 years old students) and second grade (14-19 years old students), and, on average, the age of the teachers is 50 years old.

5. Conclusion

In this experimentation science teachers have been involved in producing geosciences activities with new methodologies in a virtual world. The results of participation and of the test show that the demand of new technologies in science education is growing fast. Science teachers would like to innovate their methodologies with tools close to the interests of their students, like the serious games. This approach can improve the motivation in geosciences learning and can motivate science teachers to innovate their science education methods. These environments have produced participation and motivation in the science teachers in order to change learning activities on geosciences in the classroom. This shows that the use of virtual worlds in geosciences education can be an innovative approach for the future evolution of the science education.

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