Virtual Laboratories Implemented in Serious Games for Virtual Heritage at University and for Teaching Sciences

Jean-Pierre JESSEL

IRIT – University of Toulouse, France
e-mail: *Jean-Pierre.Jessel@irit.fr*

ABSTRACT

Our goal is to provide users with virtual laboratories through 3D distributed environments. These virtual environments can be used for teaching in sciences curricula or for spreading scientific culture for a larger audience, to discover a basis of scientific principles and also history of Sciences. This innovative way to promote and teach sciences takes benefits of ancient scientific instruments and naturalist collections available in university collections and serious game technologies.

1. INTRODUCTION

Universities have significant heritage collections including ancient scientific instruments and naturalist collections. The ancient instruments and naturalist collections are valuable witnesses to study the uses and the practice of science in the past periods. It is very difficult for students to understand how these instruments work nowadays while the instruments of the nineteenth century are quite basic and more suitable to support scientific courses. They can be the main actors in virtual museums, so we want to offer them to relive in virtual laboratories for supporting an innovative way of teaching. Serious games are a relevant media to provide such innovative teaching. Then, one of the main issues is modeling the virtual instruments and objects from naturalist collections in order to build realistic simulations. Another important issue is modeling the transmission of knowledge and the associate pedagogical scenario.

2. A VIRTUAL LABORATORY BASED ON ANCIENT SCIENTIFIC INSTRUMENTS AND NATURALIST COLLECTIONS

Universities with a long scientific history have significant heritage collections. These collections are often valued in museums, and some of them are open to the public. These collections are often related to Paleontology, Mineralogy, and Zoology … and are sometime completed by collections of scientific instruments. At the University of Toulouse, these collections are currently valued by instruments exhibitions in the Science University Library and with a limited virtual exhibition on the university's website. If they allow highlighting some pieces of the collections, these evaluation ways remain static and do not allow understanding how to operate the scientific instruments either in the nature or in the theoretical mechanisms of the phenomena studied.

The ancient instruments and naturalist collections are valuable witnesses to study the uses and the practice of science in the past periods. Today technology allows us to benefit from very effective but often very complex scientific instruments. It is very difficult for students to understand how these instruments work nowadays. However, the instruments of the nineteenth century are quite basic and allow to address in a simpler way some fundamental concepts of today's science to appropriately support scientific courses at BSc level.

Our goal is to offer the opportunity to students to use these instruments virtually to discover great scientific principles to which they are linked and also the history of science. Providing this requires the implementation of computer applications that not only show these instruments in virtual museums but also offer them to relive in virtual laboratories to be handled freely (in discovery mode) or in a more guided way, for teaching sessions, for example, using serious games [1].

3. DEVELOPING SERIOUS GAMES FOR TEACHING SCIENCES

Serious games are computer applications that use the mechanisms of videogames for motivations other than entertainment, namely, here, the dissemination of knowledge, training and learning. The first step is defining and designing of the software architecture of the virtual environment and developing of the virtual environment as a framework to the virtual laboratory. The second step is modeling of the virtual instruments and objects from naturalist collections, both from a geometric point of view to represent their shape and from a functional point of view allowing designing and developing of the physical simulation to achieve serious games for training and applications for the virtual museum. At last, modeling the transmission of knowledge is based on the study of the design of educational scenarios, mediation processes, and the use of virtual tutors [2].

Our motivation is to provide to users with environments for building a new form of knowledge through a virtual environment in which the learning process would be built like in a real environment. The learner-user (i.e., a student in the virtual laboratory) may interact with simulated objects

(scientific instruments) and physical phenomena in 3D environments [3] that will be developed with the same mechanisms as a video game where the motivation will serve the process of knowledge construction and transmission. A simpler version would be a virtual museum as a place of selection, conservation and exhibition updating an academic and scientific memory, with lower interaction capabilities.

4. CONCLUSION

Results will be related to the project objectives (building a virtual museum on PC or online for scientific culture dissemination and building a virtual laboratory for students education) and also the informatics developments used to achieve them. 3D models of scientific instruments will safeguard the knowledge related to instruments.

The project will also provide advances in research on thematic aspects such as virtual environments for training, serious games and more generally the use of information and communication technologies to create new and innovative digital learning and collaborative tools.

REFERENCES

[1] Damien Djaouti, Julian Alvarez, Jean-Pierre Jessel. Classifying Serious Games: The G/P/S Model. Handbook of Research on Improving Learning and Motivation through Educational Games: Multidisciplinary Approaches. Patrick Felicia (Eds.), IGI Global, 6, p. 118-136, 2011.
[2] F. Bellotti, R. Berta, A. De Gloria, L. Primavera, "Supporting authors in the development of Task-Based Learning in Serious Virtual Worlds", British Journal of Education and Technologies (BJET), Vol. 41, No. 1, January, 2010, pp. 86-107.
[3] Sliney A., Murphy D., (2008), "JDoc: A Serious Game for Medical Learning," in Proc. International Conference on Advances in Computer-Human Interaction.