

Abstract

When students arrive in the classroom they expect to be involved in immersive, fun and challenging learning experiences. There is a high risk that they become quickly bored by the traditional instructional methods. The technological evolution offers a great variety of sophisticated interactive devices and applications that can be combined with innovative learning approaches to enhance study efficiency during the learning process.

3D immersive multi-user Virtual Worlds (VWs) are increasingly becoming popular and accessible to wide public due to the advances in computational power graphics and network bandwidth also connected with reduced costs. As a consequence, it is possible to offer more engaging user experiences. This is particularly true in the learning sector, where an increasing interest is worldwide rising towards three-dimensional (3D) VWs and new interaction modalities to which young digital native people are accustomed to. Researches on the educational value of VWs have revealed their potential as learning platforms. However, further studies are always needed in order to assess their effectiveness, satisfactorily and social engagement not only in the general didactic use of the environment, but also for each specific learning subjects, activities and modality. The main challenge is to well exploit VW features and determine learning approaches and interaction modalities in which the didactic actions present added value with respect to traditional education. Indeed, educational VW activities are evolving from the early ones based only on information displaying towards simulated laboratories and new interaction modalities.

The main objective of this thesis is to propose new learning methodologies in Virtual Worlds, also experimenting new interaction modalities and evaluating the effectiveness of the support provided.

To this aim we first investigate how effectively a 3D city-building game supports the learning of the waste disposal practice and promotes behavior change. The game is one of the results of a research project funded by Regione Campania and is addressed to primary school children. A deep analysis of the didactic methodologies

adopted worldwide has been performed to propose a reputation-based learning approach based on collaborative, competitive and individual activities. Also, the effectiveness of the proposed approach has been evaluated.

The didactic opportunities offered by VWs when considering new interaction approaches are also investigated. Indeed, if for the last four decades keyboard and mouse have been the primary means for interacting with computers, recently, the availability of greater processing power, wider memories, cameras, and sensors make it possible to introduce new interaction modalities in commonly used software. Gestural interfaces offer new interaction modalities that the primary school children known well and may result accepted also for higher students. To assess the potentiality of this new interaction approach during learning activities we selected Geography as subject, since there is a decreasing interest of the students towards this topic. To this aim the GeoFly system supporting the Geography learning based on a Virtual Globe and on the interaction modalities offered by Microsoft Kinect has been developed. GeoFly is designed for elementary school level Geography students. It enables the exploration of the World by flying, adopting the bird (or aeroplane) metaphor. It also enables the teacher to create learning trips by associating to specific places images, text and videos, to develop learning activities concerning geographically situated scenarios. The proposed approach has been evaluated through a controlled experiment aiming at assessing the effect of the adoption of GeoFly on both the students' attitude towards learning Geography and also on their knowledge.