

Virtual Reality Simulations for Presenting Cultural-historic Content in e-Learning for Kids

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Abstract. Cultural heritage is a priceless asset for humanity, as it shows our achievements throughout the ages. Rapidly developing technologies and tools provide new opportunities in the process of preserving the cultural heritage. That process includes searching, research, identification, documentation, registration, conservation, restoration and adaptation of cultural-historic objects and resources. It is very important to include children in this process, to increase their awareness, stimulate their willingness to participate in its preservation and develop their affiliation with the values of the pan-European cultural heritage. Access to these resources, however, is not always possible or suitable for kids that are increasing their national identity and patriotism. That brings the need of developing new and different tools and methods for presenting digital cultural assets to a wider and more diverse audience and using them for educational purposes. In this article we describe a software component for Virtual Reality simulations and using them to present cultural-historic content to kids. We also demonstrate a three-dimensional lesson, taught in the web browser, which includes a collection of 3D objects for simulating the authentic room of the Bulgarian revolutionary Vasil Levski.

Keywords: e-Learning for Children, Virtual reality, 3D, Education for Kids, Serious Games, Gamification.

1 Introduction

Education including cultural-historic content can be viewed as a process, focused not only on knowledge, but also on acknowledgement and significance of common cultural heritage. It is usually conducted in learning scenarios, in which learners are presented with previously defined educational programs, using traditional teaching strategies. Nowadays users have multiple educational opportunities using mobile technologies in different contexts. Such technologies can be integrated in cultural heritage education to allow learners develop a conscience for the values of humanity's cultural heritage and its significance for the future. Additionally, technologies like 3D can attract visitors by providing experience and information for cultural objects in a virtual environment. By

immersing into such experiences, children to increase their awareness, reach and sense of affiliation with the values of their cultural heritage.

2 Serious Games and Gamification in e-Learning for Kids

During the last couple of years, gamification and related methods have become the leading instruments in socialisation and innovative communication of users in a wide variety of areas – marketing, finance, education, and others. Research on the relationship between games and skills shows that games have a strong and constructive role in developing key skills and competences, needed for their success in real life, education, and professional realization.

Gamification in e-learning for kids is a method for increasing the motivation and engagement of learners by using elements of game design in a learning environment. The inclusion of cultural-historical heritage in education through gamification and serious games serves both as an instrument for education and a basis for a modern and innovative approach for motivating students for cultural and scientific research. Serious games stimulate studying the cultural-historic heritage by offering more choices and flexibility for the place of learning, time management, pace, and autonomy in the context of the game, self-control, problem solving, systematic thinking and desire for co-operation.

Serious games have the potential to improve the user experience through multimedia interaction (Arnab et al., 2011), (De Freitas et al. 2011). That can be applied in different contexts like education, healthcare, or interpersonal communication. Most researchers agree that digital serious games contain different media, which can be combinations of text, graphics (Consolvo et al., 2008), animations (Lin et al., 2006), audio and video (Yim et al., 2007), haptics (Arnab et al., 2011), (Orozco et al., 2012) and others. Besides that, the term “serious” in serious games comes from their role of passing a message or contribution like knowledge, skills, or certain content to the player. This means the player is exposed to an environment, which offers content, driven by know-how or experience. This experience is based on the specific context of the game like wellness, education, and health.

Using serious games as an integrated instrument in complementary education helps learners concentrate on the target subject. Perceived usefulness, ease of use and clear goals are the satisfaction benchmarks for such scenarios. When learners clearly understand the goals and there is ease of use, they are willing to focus on the content (Wang et al., 2017). Serious games are an effective way to improve cognitive abilities and increase the positive learning outcomes. They expand the academic achievements of learners and stimulate their involvement in the learning activities. Education based on games is also proven effective in social and cultural education, regarding cognitive and motivational effects (Nikolova & Georgiev, 2021).

3 Virtual Reality Simulations for Presenting Cultural-Historic Content in e-Learning for Kids

Three-dimensional technologies are becoming more important in the areas of digital libraries and e-learning, offering virtual reality for the Internet. Presenting 3D objects allows learners to thoroughly examine and compare not only visual, but also spatial characteristics of the artifacts. In addition to improving the visual presentation, they are also an excellent tool for maintaining student engagement and helping with the education for cultural heritage and national identity for children. To increase children's access to cultural-historic resources and introducing them to the values of their cultural heritage, we have developed a set of components and an online platform for visualizing virtual three-dimensional learning environments in the web browser (Georgiev & Nikolova, 2020). They can be configured to show standalone objects, as well as complete and interactive virtual environments.



Fig. 1. A three-dimensional cultural-historic resource.

Figure 1 shows the component for visualizing single 3D objects, which can be rotated and zoomed, allowing viewers to inspect them from any angle and distance. The other component allows authors to define a set of three-dimensional objects and 2D images, which are shown on a common scene and have different options like position, rotation, level, size, etc. The scene also supports additional personalization options like title, description, dimensions and different textures for the floor, ceiling, and walls.

Figure 2 contains an example of a created three-dimensional learning module, shown in a web browser and containing a collection of 3D objects, created with Autodesk Maya. The demonstrated scene is a simulation of Vasil Levski's room, located in the "National museum Vasil Levski" in Karlovo, Bulgaria. By using the context resources

in the 3D scene, learners can get a better feel to the personal belongings and life of Vasil Levski. They can see a part of his authentic life, examine in detail artifacts from his daily manners and learn new facts about his family.

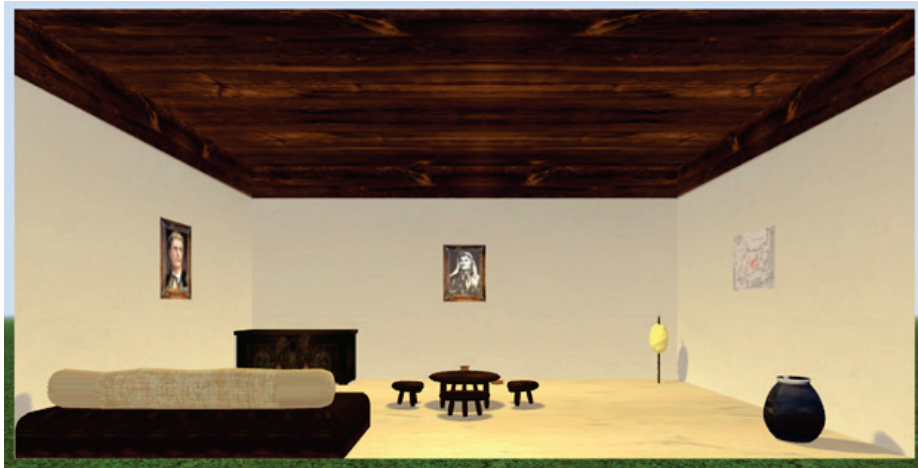


Fig. 2. 3D simulation of Vasil Levski’s room, located in the national museum “Vasil Levski”.

To the young learner, the component allows viewing the created virtual environment in a first-person manner through free movement in the scene using the mouse and keyboard. It lets them see the three-dimensional objects in realistic dimensions, from all angles and distances. The shown scene can be configured with a different color and texture for the outer floor, and different textures for the floor, walls, and ceiling of the virtual room. It is also possible to add interactive 2D and 3D objects throughout the scene, which can react to mouse events, like pointing and clicking, and trigger specific actions. To indicate the currently selected object, it turns into transparent, which makes it stand out and attract the user’s attention. This functionality can be used for navigating within the learning materials. Examples include showing additional information, related to the object, moving to another virtual room, and initiating a mini-game, test or other interactive learning resource. By adding several light sources and shadows for each object, the visualization of the inner and outer parts of the virtual environment becomes more realistic.

The developed components and environment for visualizing virtual three-dimensional learning environments is a multi-functional, having the purpose of increasing children’s access to digital cultural-historic learning resources. The presentation of cultural artifacts in a more realistic, attractive, and accessible for children manner creates a newer and more exciting experience for them, which builds their national identity and patriotism.

4 Conclusion

In this paper we described several interactive and immersive tools for presenting cultural-historic content to children for supplementary learning purposes. We illustrated two major components for visualizing single objects and simulated virtual environments, in the web browser. We also described how they can be used to increase children awareness of and stimulate their involvement in the process of preserving their national cultural heritage from a younger age.

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