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Immersive Education: What does the Future Hold?

J.UCS Special Issue

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1 Introduction

Immersive technologies are pushing the boundaries of human limitations enabling new ways of receiving, processing and communicating data. These technologies are being rapidly adopted by people of all ages and backgrounds who use them to socialize, to consume information, to make business and to have fun, among others. The field of education has not been immune to this disruptive process. Indeed, exploration of the technology and integration attempts with more consolidated but less immersive ICTs have been conducted. On one side, educators have explored representational fidelity and interactive capabilities of immersive technologies for deploying learning environments where learning activities are contextualized, experimentation and collaboration are promoted, and learners are motivated and engaged toward their learning tasks. On the other side, researchers have confirmed the usefulness of immersive technologies to deploy learning environments where it is possible fulfilling educational goals using modern pedagogical approaches and to reach desirable learning outcomes. Furthermore, some attempts to combine immersive technologies with real and digital worlds for educational purposes have also been held.

Despite the aforementioned research efforts, there are still no guidelines to design and develop learning activities that take advantage of singular capabilities of immersive technology for new trends in education. This special issue aims at a discussion on innovative uses of immersive environments that take advantage of the unique characteristics of this technology for educational purposes.

2 Contributions

We invited the authors of the best papers, which were presented at the 3rd European Immersive Education Summit, to submit extended versions of their contributions to this Special Issue. In addition, an open call for submission was launched. A total of 13 submissions were received for this Special Issue. Each submission was reviewed by at least two international experts. Finally, five quality articles came together for this special issue in the Journal of Universal Computer Science:

- *Exploring interrelationships among high school students' cognitive, Behavioral and Emotional Engagement Factors in Introductory Programming Courses via a 3D Multi-user Serious Game Created in Open Sim and Scratch4OS*, by Pellas Nikolaos.

  In this work, the author investigates the interrelationships of students' engagement among multidimensional construct consisting of cognitive, emotional and behavioral factors in order to a better understanding of learning effectiveness. The empirical findings indicated that students' behavioral engagement had a linear correlation with cognitive and emotional engagement in 3D multi-user serious games used for programming instruction.

- *PyMEL-WS. Physically Experiencing the Virtual World. Insights into Mixed Reality and Flow State on Board a Wheelchair Simulator*, by Carmen Fernández Panadero, Valentín de la Cruz Barquero, Carlos Delgado Kloos and David Morán Núñez.

  The authors present an immersive experience in a wheelchair simulator to foster awareness about the difficulties that people with disabilities face daily. The study shows that there exist discrepancies between emotions calculated from the flow state model and those expressed by users.

- *A Decentralized Infrastructure for Ubiquitous Learning Environments*, by Jorge Luis Victória Barbosa, Débora Nice Ferrari Barbosa, Jezer Machado de Oliveira and Solon Andrade Rabello Junior.

  The authors present a decentralized and extensible infrastructure based on software agents support ubiquitous learning environments in an immersive and context-aware way. The infrastructure supports the organization of ubiquitous learning spaces in the form of interactive contexts to provide adaptive contents for learners at the right time at the right place in the right moment.

- *City Ads: Embedding Virtual Worlds and Augmented Reality in Everyday Educational Practice*, by Juan A. Muñoz-Cristóbal, Alejandra Martínez-Monés, Juan I. Asensio-Pérez, Sara L. Villagrá-Sobrino, Javier E. Hoyos-Torío and Yannis Dimitriadis.

  The authors evaluate a system that helps teachers to put into practice learning situations that may make use of web technologies, immersive virtual environments and general-purpose mobile AR applications. Their system is tested in a ubiquitous learning scenario.

- *User Support for Managed Immersive Education: An Evaluation of in-World Training for OpenSim*, by Indika Perera, Colin Allison, Dulani Meedeniya and Alan Miller.

  The authors present a baseline for developing and enacting effective training environments for multi-user virtual environments.

3 Committee

We would like to express our gratitude to the committee members involved in this special issue for their valuable work on reviewing all contributions and giving detailed feedback:

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