Chapter 6
Virtual and Augmented Reality in Medical Education and Training: Innovative Ways for Transforming Medical Education in the 21st Century

Paraskevi Papadopoulou
Deree – The American College of Greece, Greece

Kwok Tai Chui
City University of Hong Kong, Hong Kong

Linda Daniela
https://orcid.org/0000-0002-0712-2276
University of Latvia, Latvia

Miltiadis D. Lytras
Deree – The American College of Greece, Greece

ABSTRACT

Virtual and Augmented Reality (VR & AR) with its various computer-based virtual simulations and teaching aids have already begun to transform the medical education and training. The use of virtual labs and anatomy lessons including the use of Virtual Learning Environments (VLEs) as in the delivery of lectures and surgery operations are explored. The purpose of this chapter is to promote the role of VR & AR in the context of medical education as an innovative, effective, and cost-reasonable solution for the provision of better and faster practical training. This chapter overall investigates and explores the potential of VLEs in terms of the necessary concepts and principles that allow students to develop a more direct and meaningful experiential understanding of the learning goals and outcomes of courses and of the practical and transferable skills required. A business model related to cloud active learning in medical education and training is proposed in line with the idea of an Open Agora of Virtual Reality Learning Services.

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INTRODUCTION

The use of Virtual and Augmented Reality (VR) & (AR) in medical education and practical student training has been adopted quite early. The benefits of exposing students to 3D animations or even better simulations seem to be many, as evidenced by numerous researchers. Equally important is the potential of embedding (VR) & (AR) into medical school curricula. Yet, up to now, in most medical schools, students were taught anatomy the traditional way, at least in their introductory courses, and it was quite confusing to properly orient themselves around different organs, bones, muscles, vessels and nerves as they would perhaps get the chance to work on a human cadaver late in their studies. In a Virtual Learning Environment (VRL) though, the students right from their introductory courses could begin to get a real sense of organs and structures and be able to manipulate them and orient themselves and also understand their anatomical shape and form plus the relations of the various body parts with each other. Student performance, studies indeed have shown, greatly improves when the students are exposed to 3D animated tour of organs such as the heart in comparison to 2D PowerPoint presentations (Kockro et al., 2015). Similarly, when students are first trained with virtual reality robotic simulators such as arthroscopic knee simulator for a particular surgery knee problem, those who had received the training did better than the control group (Cannon et al., 2014). Kamphuis, Barsom, Schijven and Christoph (2014) in their article point out that whereas AR learning environments potentially offer a meaningful situated learning experience they conclude that it may enable transfer of learning by possibly leading to enhanced conceptual understanding of complex causality but more studies are necessary for such a conclusion to be reached. The results of another study concerning cardiac surgery were also similar in terms of speed and effectiveness of the technique taught via a robotic surgical simulator (Valdis, Chu, Schlachta, and Kiaï, 2015). So, it is generally agreed that surgical trainees can better prepare themselves for real-life scenarios if they are first exposed to virtual reality environments and thus be mentally and physically better equipped to deal with real life problems. Yet, Barsom, Graafland and Schijven, (2016) in a systematic review on the effectiveness of augmented reality applications in medical training with the aim to investigate to which extent blended learning and augmented reality applications are currently used to validly support medical professionals training they cautiously point to the fact that the literature to date is lacking to support fully such evidence.

Similarly, numerous studies on pedagogy in Higher Education (HE) point toward innovative and often interdisciplinary curricula utilizing virtual and augmented reality simulations and other kinds of Information Communication Technologies (ICTs) applications (Visvizi, Lytras, & Daniela, 2018). This incorporation helps educators to apply an integrative approach to learning. By focusing on innovative
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