Chapter 14
E–Learning and Augmented Reality (AR) for Chronic Wound Assessment: Promoting Learning and Quality of Care

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ABSTRACT

This investigation aimed to verify if augmented reality (AR) increases students’ motivation and enhances the development of clinical decision-making skills in wound diagnosis and treatment. A quasi–experimental study was carried out with a sample of 54 nursing students. A comparative analysis of the progress of the control and experimental group was made using the data extracted from the simulator and a questionnaire. First, both groups used e-FER, a virtual simulator that simulates the diagnosis and treatment of virtual clinical cases. In the second moment, the control group continued using only e-FER, while the experimental group used e-FER combined with an AR application to observe the chronic wounds. The results showed that AR enhanced student performance, particularly in wound diagnostic parameters, with highly statistically significant differences (p<0.001), and registering high levels of motivation and simulator usability, even with the introduction of an additional device in the activity.
INTRODUCTION

Emerging technologies for teaching and learning have enabled the creation of environments, scenarios and virtual patients, simulating clinical practices with the purpose to promote the development of skills and knowledge in healthcare education (Lewis, Davies, Jenkins, & Tait, 2005; Hogan, Sabri & Kapralos, 2007). These simulations are considered educational techniques that bring interactivity and immersion into the teaching and learning process, allowing the recreation of clinical experiences without the risk of causing harm to patients (Maran & Glavin, 2003). The possibility learners have to practice an unlimited number of times a procedure or technique until correct realization, before applying it in real-world scenarios, is also considered a valuable advantage (Rey, Visconti, Balaguer, & Martínez, 2006).

Virtual and Augmented Reality technologies, when used in education, allow the creation of digitally enhanced learning environments. These emerging technologies are expected to have a big impact in education in the coming years, as highlighted by the Horizon reports for Higher Education in 2010, 2011 and 2016 (Johnson, Levine, Smith, & Stone, 2010; Johnson et al., 2011, 2016). In fact, a positive impact of Virtual Reality (VR) and Augmented Reality (AR) can already be seen in healthcare education, where several studies have indicated the positive effect of VR and AR in developing decision making skills and practical procedures using virtual simulators, with a higher impact on participants with no experience (Zhu, Hadadgar, Masiello, & Zaryet, 2014).

However, using VR in healthcare education can be a debatable approach since it immerses learners in a synthetic environment, enabling them to see the real-world. Acting in a different environment from which learners will act in real life scenarios is another relevant concern. According to Ellaway (2010, p.791):

(...) in medicine and medical education aspects of virtual reality have found their way into the mainstream through the use of 3D animations, digital imaging tools that can make 3D models (...) and more interactively through the use of synthetic worlds such as Second Life and haptic simulators for technical procedures such as laparoscopic surgery.

A key limitation however for virtual reality in medical education is that it requires participants to step away from the environment in which the practice for which they are preparing takes place. Virtual reality is therefore essentially divergent from real world practice and the embodied experiences within it.

In AR environments, digital objects are added to the real-world, enhancing it and not replacing it. AR is a technology that allows the integration of virtual objects into the physical real-world. It supplements the real world with virtual objects in a way that they seem to coexist in the same space (Zhou, Duh & Billinghamhurst, 2008). The combination of real with virtual, real time interactivity and three dimensional (3D) virtual content are the three commonly accepted characteristics of AR systems indicated by Azuma (1997). In this way, AR plays an important role in education, as the 2011 Horizon report states (Johnson et al., 2011, p.22):

Augmented reality has strong potential to provide both powerful contextual, in situ learning experiences and serendipitous exploration and discovery of the connected nature of information in the real world.
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