Chapter 2
Role of Immersive (XR) Technologies in Improving Healthcare Competencies:
A Review

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ABSTRACT

Immersive technology refers to technology that enhances reality by blending the physical environment with virtual content or by completely taking the user to a virtual world far away from reality. Different immersive technologies are augmented reality (AR), virtual reality (VR), and mixed reality (MR). As immersive technology is becoming more affordable, user-friendly, pervasive, and ubiquitous, it's been adopted and embraced by several industries. Though its early adopters were from the gaming industry, now it's explored and used by many other industries such as mining, healthcare, and medicine, retail, education, automotive, manufacturing, etc. Using these technologies, medical professionals can improve their competencies, and they will be able to effectively transfer the skill acquired through simulations to the operation theatre. This chapter focuses on uses, benefits, and adoption challenges of Immersive technologies with specific reference to healthcare training.

INTRODUCTION

As a result of technological advancements industries and consumers are inundated with technology choices that they can use it to their advantage. One such technology is immersive technology or extended reality (XR) that's been recently transforming the healthcare training by reducing medical errors, improving medical practitioners' competency, reducing training costs and providing immersive and interactive learning environment. Immersive technologies such as augmented reality (AR), virtual reality (VR) and mixed reality (MR) are increasingly used in Healthcare education to train medical professionals' complex procedures by simulating it, making the scenario interesting and realistic. Right from training medical doctors, it is used in treatment planning, pharmacy- specific training and in surgery. (Michael, Simon & Nicholas, 2018). These immersive technologies-based training programs focus on procedural skill thereby improving patient safety and competencies of medical practitioner. Compared to traditional tools for training, immersive learning tools can greatly improve the quality of training, reduces costs, provides deeper understanding opportunities and improves patient satisfaction through better care from healthcare professionals.

IMMERSIVE TECHNOLOGIES

Immersive technology refers to technology that provide users with an experience of immersing oneself in simulated world that users can interact with. Immersive technology or extended reality (XR) is a term used for collectively referring technologies such as AR, VR and MR each of these have some key differences. (Reality Technologies, n.d.) The AR, VR ecosystem can be largely classified in to components, Head Mounted Devices (HMD) and Applications (Goldman Sachs, 2016). The Landscape for Immersive technology is as indicated in Figure1.

Virtual reality refers to fully immersive virtual world environment which substitutes the real world. An important pieces of virtual reality kit are the VR Head-Mounted Device (HMD) which is the similar to glasses and may or may not require a PC/Smartphone/Console to power the content being produced. The tethered VR headset / HMD needs to be connected to a PC via cable for the VR experience, while untethered does not require a PC or a console to be connected as it has in-built processor, memory, battery, sensor, display etc. The Virtual learning experience is enhanced, when the VR HMD is worn along with Headphones, special gloves, tracking devices and other optional devices such as bio controller. The HMD has several sensors to aptly simulate the visual, aural and haptic senses of the user through sensory feedback integrated with the output devices. (Oluleke & Xuming, 2013). The three categories of VR based on the level of immersion they provide are: Non-immersive simulations which is the least immersive technology achieved using conventional desktop, Semi-immersive simulations give user a partial immersive experience using High performance computing systems and Fully immersive simulations give user fully immersive experience through HMD and tracking devices. Some of the VR headsets used are Occulus Rift, Occulus Go, HTC Vive, PlayStation, Google Daydream and Cardboard, Samsung Gear, Lenevo Mirage solo (Greenwald, 2018). (Bhone, 2019) in their systematic review, assessed the effectiveness of VR interventions for education of Health Professionals. They found evidence showing a small improvement in knowledge and moderate-to-large improvement in skills of learners taking part in VR interventions compared to traditional or other forms of digital learning. For VR HMD, trackers (head, motion, eye) and sensors with modern graphic processing unit (GPU) will give learners better im-

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