

Chapter 23

Design of a Web3D Serious Game for Human Anatomy Education: A Web3D Game for Human Anatomy Education

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ABSTRACT

The use of 3D web-based models allows researchers to explore interesting characteristics searching for the increase of quality in the anatomy education. This chapter aims to present the design of a serious game for human anatomy education that can assist the students in the understanding of the anatomical structures as well as the relationship between them in a virtual environment. The digital game design and development was carried out in partnership with specialists in human anatomy for the study of the lower limb bones (skeletal system), vessels and arteries (cardiovascular system), and lower limb skeletal muscles (muscular system). A case study was performed with students of physiotherapy undergraduate program in the course of anatomy through usability assessment techniques. Based on the results obtained it was possible to identify fundamental and innovative features that have to be present in the design of serious games for the teaching of health sciences.

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INTRODUCTION

Human anatomy is an indispensable course and the foundation of all clinical studies. The goals of anatomy teaching are, at the very least, to know the anatomical structures and the relationships between them; recognize anatomical structures through imaging techniques; and, understand the anatomical bases of Pathology (Corredera & Santana, 2003). The knowledge of the anatomy is fundamental for the formation of health professionals and comprises the macroscopic study of the organs and systems that make up the human body, using its own terminology and descriptions from innumerable anatomical studies (Bastos & Proença, 2000). Due to its interdisciplinary relationship, the knowledge associated to human anatomy becomes imperative as a foundation in the professional courses of health programs (Neves, 2010). Improving the teaching resources applied to the teaching of anatomy tends satisfactorily for the direction of actions, stimulates the student's participation as an active subject in the search for new information, promoting indispensable support to the teaching-learning process (Guiraldes *et al.*, 1995).

The traditional teaching of human anatomy involves two distinct moments: the exposition of theoretical concepts and definitions of the systems and organs of the human body; and, the practical approach, which, through anatomical pieces and cadavers in the laboratory, allows to study the general characteristics and their interrelationships. Among the different methods used in teaching anatomy, can be cited studies on previously dissected anatomical pieces, anatomical models, interactive virtual environments, general purpose software and even social media (Lopes & Teixeira, 2018; Nuland & Rogers, 2016; Hennessy *et al.*, 2016).

However, the immense anatomical nomenclature can make complex the learning of the course for the students, therefore, leading to a weak learning experience, being responsible for the origin of negative connotations in relation to the subject and resulting in a superficial approach to the learning process and even being able to lead students to dropout the course (Smith *et al.*, 2016). In that scenario, virtual environments for anatomy teaching play a large role in learning by providing a new study environment other than the anatomy laboratory (Richardson *et al.*, 2011).

A great applicability of virtual environments is based on the fact that the virtual tool replaces the use of anatomical models and, within certain organic systems, replaces the cadaveric anatomical parts itself. The preservation of small and fragile anatomical structures such as blood vessels and nerves, which require a perfect dissection for a satisfactory visualization by the students, is one of the great challenges of the anatomy laboratories. In addition, another difficulty that anatomy laboratories face is the mechanical wear of corpses and cadaveric preparations during anatomy classes. The cost of maintaining an anatomy laboratory is high since the preparation of an anatomical piece for study involves the use of large quantities of reagents as well as dissecting materials and technical work. Moreover, it is a major obstacle for laboratories to obtain bodies for the teaching of anatomy.

Based on that, virtual tools and digital games have been gaining space in theoretical and practical classes of anatomy, which are being increasingly used by teachers as a tool that, through its playful aspect, arouses a great interest of the students and excludes most of the issues during the learning process. In addition, virtual tools not only enhance teaching-learning but also enhance the potential of the course content.

The use of games in the educational context can be called serious games, and usually aims at learning (Birkenbusch & Christ, 2013). With the development of new technologies, games have become an ally of the classroom, allowing the educational environment to move away from traditional teaching and starting to function within the information. Therefore, the use of games to train, learn and perform real

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