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3D Simulation of Muscular System in Anatomy Learning

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ABSTRACTS

The purpose of this study is to locate papers examining the effectiveness of three-dimensional (3D) simulation of anatomy models on learning and to rate the standard of research in this field. An understanding of anatomy is crucial for several clinical procedures and is a fundamental part of biological sciences and medical education. Many educators, anatomists, and researchers employ three-dimensional (3D) visualization technology to supplement the present curriculum and enhance students' spatial understanding of anatomy.

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1. INTRODUCTION

The active development of several software applications to support anatomy teaching has been prompted by the rising interest in technology-enhanced learning. The term "3D simulation" will be used in this study to refer to computed muscle systems that are shown as 3D simulations using virtual reality (VR) technology.

To identify anatomical structures in anatomy, students must rotate and manipulate structures from different perspectives. It has been said that the capacity for three-dimensional mental manipulation of objects is known as visual-spatial ability (Vandenberg, *et al*., 1978). Such skill is essential for surgical trainees and surgeons as well as medical students learning about the muscular system. Therefore, when the anatomy is presented in different planes and locations, medical students need to be able to cognitively manipulate and envision 3D components to accurately identify them and their associated structures (Ullman, 1998; Cai *et al*., 2019).

In the study of anatomy, spatial vision is crucial. Not only anatomical components and functions but also spatial links to adjacent structures must be taught to students (Berney, *et al*., 2015). The two-dimensional (2D) static anatomical images used in anatomy textbooks and atlases are useful, but they are not very effective at revealing the three-dimensional (3D) simulation of muscular systems in anatomy learning (Triepels *et al*., 2020). It could be challenging for learners to comprehend some dynamic features of functional anatomy and to envision 2D representations as 3D.

The viewpoints of the students on how they may use and profit from the 3D simulation are important to understand to better assist and promote the learning of anatomy. Perspectives on the 3D simulation's format and the layout of the learning activities should be included. The view of lecturers on how students utilize 3D simulation to study anatomy is another crucial topic to investigate. An interpretive qualitative method was used in the study to provide light on the significance of the experiences of the students and the lecturer. As a result, the emphasis is on understanding occurrences through the participants' representations.

2. METHODS

A market research technique known as qualitative research focuses on gathering information through conversational and open-ended dialogue. Qualitative research techniques are made to assist people to understand how a target audience behaves and thinks about a particular subject. Numerous qualitative research techniques, including in-depth interviews, focus groups, ethnographic studies, content analyses, and case study studies, are frequently employed. Results from qualitative methods are more descriptive, and inferences may be made from the collected data relatively simply.

3. RESULTS AND DISCUSSION

Muscles play a part in every function of the body. There are more than 600 muscles in the muscular system. The smooth, skeletal, and cardiac muscle types are among them. In the muscular system, each kind of muscle serves a certain function. The muscular system is an intricate web of muscles that is essential to the human body. Every movement involves the use of muscles. They aid with digestion, regulate respiration and pulse, and permit mobility.

The ability of VR technology to combine clinical imaging data and information into a virtual and real anatomical environment helps to increase the interest in teaching and the learning initiative of medical students, which in turn enhances the effectiveness of clinical teaching,

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particularly in anatomy learning. This VR technology may help in understanding the complexity of the muscular system.

Two senior lecturers and twenty-five students from different levels representing the Faculty of Medicine and Defence Health participated in this study. Oculus VR headset has been used as a display tool. 3D simulation of the muscular system has been installed from OCULUS (see **Figure 1**).

Figure 1. OCULUS VR Headset.

The Oculus VR Headset comes with one VR headset and two touch controllers. Before participants experience the 3D simulation using VR technology, they need to answer several questions about the muscular system. Then, participants of this study experience the 3D simulation of the muscular system using a VR headset.

After participants experienced a 3D simulation of the muscular system, participants need to answer the same questions about the muscular system (see **Figure 2**). Results before and after using 3D simulation have been recorded. Furthermore, the participants were interviewed about their opinions on learning anatomy using 3D simulation and VR technology.

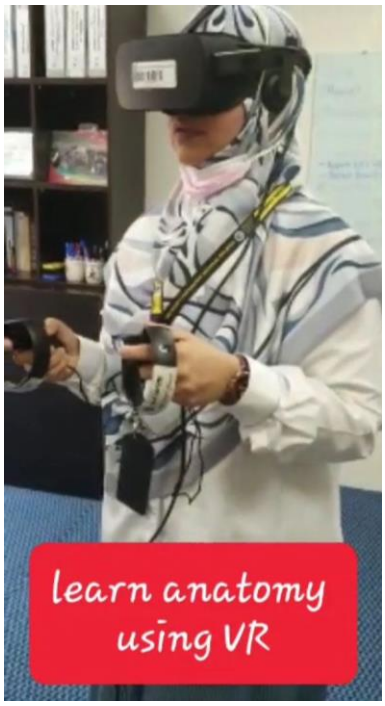

Figure 2. Senior lecturer of Anatomy experiencing 3D simulation of muscular system.

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This study shows the capabilities and abilities of VR technology in improving the quality of learning medicine. This is because the advantages found in these VR features can increase student involvement in learning as well as improve visualization skills. These features indirectly help the teaching staff to explain better which allows for acceptance and understanding of what students learn increases. The use of VR technology has been numerous shows when this technology is used optimally, the standard of education in teaching and learning will increase. The aims of this research are achieved:

(i) Medical students develop a deeper understanding of the human muscular system.
(ii) Lecturers develop memorable and effective learning of the muscular system.
(iii) Increase students' interest and involvement in anatomy learning.
(iv) Improving the effectiveness of hybrid learning using VR technology.

4. CONCLUSION

The results support the idea that VR may effectively raise learners' anatomical knowledge levels. When assessing the educational efficiency of VR in anatomy, future studies should take into account other elements including the level of pleasure, cost-effectiveness, and adverse effects. VR has the potential to change medical education as a new and growing technology. Anatomy instruction may be more successful using VR. Universities and hospitals may investigate using VR in medical teaching scenarios to improve the quality of instruction.

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6. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

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