



The Effectiveness of Virtual Reality Software in Teaching Anatomy: Controversial Results

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Several 3D visualization approaches for teaching anatomy are being created, in part because of the scarcity of cadavers, the expensive cost of acquiring and preserving them, and the ethical issues surrounding their use [1-3]. Despite the variety of available instructional approaches, many undergraduate and graduate students regard their anatomical knowledge inadequate [4,5]. Nevertheless, numerous students are interested in learning anatomy using 3D pictures [2,4]. A recent study proposed combining 2D and innovative 3D teaching approaches to attain the needed degree of anatomical knowledge [2].

The effectiveness of 3D virtual reality in teaching Anatomy is controversial. De Faria evaluated the interactive virtual reality (VR) lectures that were accessed via students' personal computers. As a result, the study team determined that the 3D method was more effective at teaching anatomical concepts because the 3D group of students got significantly higher exam scores than their peers who attended the conventional lectures that used 2D images [6]. Agbetoba attributed the effectiveness of virtual reality to its ability to allow the students to understand spatial orientations [7]. On the other hand, some studies investigated the effect of using 3D virtual reality on studying neuroanatomy [8] and musculoskeletal [9] systems on medical students. Both studies found that the 3D software had no significant advantage over the 2D illustrations since the traditional method group of students' mean test scores was nearly identical to that of the virtual reality group. Also, a similar conclusion was obtained by [10,11] after using "Virtual Human Dissector" software and Virtual pelvic anatomy simulator, respectively, in learning about abdominal and pelvic structures. In 2014, Hoyek, *et al.* compared the assessment scores after studying the anatomy of the trunk by two different groups of students; the test group used 3D virtual reality while the second group used 2D

drawings within PowerPoint presentations. The study results were unexpected since they observed that the 2D group performed better than the 3D group in knowledge and comprehension questions [12].

The controversial research results were explained by [13,14], who attributed that to the different body organ systems used in each study and the variation of difficulty of each organ system. For one thing, understanding the anatomy of medical neurosciences is more complex than learning the anatomy of the musculoskeletal system [15] since the nervous system is one of the most spatially complicated systems in the human body [8]. In addition, the shoulder joint is widely regarded as one of the most challenging joints for medical students to understand [16]. Another cause of difference between the research results is the inclusion of participants at a different stage of their education compared to participants in other studies. For example, some studies included first-year medical students as participants [10,17-19], whereas others included fifth-year medical students as participants [20]. Hence, the longer students study medicine, the more fundamental knowledge of anatomy they acquire, and subsequently, the research results seem better. These confounding factors mentioned before complicated the task of comparing outcomes among studies.

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