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Virtual Reality and Anatomy: Increasing Motivation and Learning Gains

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Abstract. Anatomy and physiology courses are an integral part of the curriculum of the many Health, Wellness, and Sciences diploma (e.g., acupuncture, biotechnology, massage therapy, occupational therapy assistant and physical therapy assistant) and degree programs (Honours Bachelor of Science – Nursing Honours Bachelor Degree program) offered at Georgian College. In 2020, Georgian College received a Future Skills Centre (FSC) Shock-Proofing the Future of Work: Skills Innovation Challenge grant. As part of this grant, Georgian College is exploring, through two pilot projects, the benefits and challenges associated with integrating virtual reality (VR) technology in anatomy courses in Health, Wellness, and Sciences programs to enhance learning by offering to students in addition to the conventional content, new ways (i.e., VR or non-immersive 2D programs) to engage, experience, and learn course content. More specifically, the goal of the two pilots is to examine the effects of using either VR anatomy or 2D anatomy on experience-based learning outcomes (motivational and enjoyment) and content-based learning outcomes (pre/post-test comparisons). The work-in-progress paper describes the development and implementation of the two pilot projects. For the last eighteen months, students enrolled in specific Health, Wellness, and Sciences diploma and degree programs have had the chance to engage with either human anatomy VR experiences or 2D human anatomy. So far, these pilots have generated important discussions among different interested parties regarding the viability of incorporating VR technology in the curriculum of Health, Wellness, and Sciences diploma and degree programs, as well as how VR anatomy-based experiences can be improved to meet the needs of different diploma and degree programs.

Keywords: Virtual Reality, Human Anatomy, Higher Education.

1 Introduction

VR has been used in higher-education settings across a variety of disciplines (e.g., engineering, computer science, astronomy, biology, nursing, geography, medicine, earth sciences, art, chemistry, manufacturing, mathematics, language, architecture [1], for a review, refer to [2]). Prior research has identified key benefits to using VR technology to enhance teaching and learning. For example, VR technology allows students to experience situations/environments that might be inaccessible (e.g., due to COVID-19 restrictions, time, and space) or particularly problematic or dangerous (e.g., hazardous situations during laboratory training [3, 4]). In addition, it also allows students to practice complex and demanding tasks multiple times (e.g., surgical procedures, land surveying) [5].

Of particular interest to the current study, VR technology has also been shown to increase retention of knowledge [6], [7], improve the spatial understanding of complex objects (e.g., heart; Maresky et al., 2019) as well as increase students' motivation and interest in the course content [9, 10] in higher-education settings. For instance, in a study by Krokos and colleagues, VR technology was found to increase memory recall as compared to a desktop display [7] during a facial recognition task. This finding is congruent with the theory of embodied memories that postulates that memories are stored "as mental simulations consisting in the reactivation of sensorimotor patterns originally

associated with events at encoding, rather than amodal mental representations" [11, p. 1747]. In other words, cognitive processes such as memory are mediated by sensorimotor processes, whereby recalling a construct triggers the sensory and motor experiences associated with that specific construct [12]. As such, better recall is expected in environments that allow for sensorimotor experiences during learning— which is an affordance of VR.
With regard to motivation and enjoyment, numerous studies have documented using self-report questionnaires that students feel that VR enhances their motivation and enjoyment for learning, as well as finding the course content more engaging [9, 13]. This is of particular interest given that prior research has shown that students of all ages that are more motivated are more likely to have higher academic achievement [14–16]. VR technology, therefore, has the potential to both support and enhance existing learning opportunities and also to create new ones to accommodate for the changes brought forth to the educational system by COVID-19 (e.g., remote teaching).

1.1 **Pilot 1a**

The first pilot project was deployed in three specific programs at Georgian College; the Honours Bachelor of Science – Nursing Honours Bachelor Degree program, the Primary Care Paramedic Program and the Biotechnology diploma program. Through a quasi-experimental research design, we compared the impact of using a VR version of 3D-Organon (i.e., VR headset version) as opposed to using a 2D desktop version on learning gains (difference between pre and post-tests), motivation, and how students felt about the technology.

1.2 **Pilot 1b**

The second pilot project was deployed in three diploma programs at Georgian College; the Massage Therapy diploma program, the Acupuncture diploma program, and the Occupational Therapy Assistant and Physical Therapy Assistant diploma program. Students in these programs were given the opportunity to volunteer for the research project in which students were asked to interact with human anatomy VR experiences in Bodymap. We measured how motivation and students' thoughts on using immersive VR experiences to supplement their learning.

2 Conclusion

Recent advances made in terms of visualization and interaction, combined with a decrease in production costs, have made immersive technology particularly appealing to educational systems, including higher education [4, 17]. To modernize its programs and keep up with the ever-changing digital demands brought forth by the COVID- 19 pandemic and working remotely, Georgian College has been investing time, efforts and resources to understand the benefits and challenges associated with integrating VR technology in anatomy courses.

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