ORIGINAL ARTICLE

Comparing the efficacy of virtual reality versus traditional model-based learning methods of anatomy; a perspective of physical therapy students

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ABSTRACT

Background: Anatomy is a major subject taught in early foundation years of medical education which provide information regarding the basic structure of body and their spatial relationship. Initially students learnt anatomy by the visual images on textbooks, atlas, cadavers and 3D models of body structures in labs. However, as the digital world is advancing, and the virtual reality has created an environment of computer-based learning which has created multidimensional model for learning anatomy through immersive or semi-immersive methods. This study was designed to compare the efficacy of virtual reality versus traditional model-based learning methods of anatomy among the physiotherapy students.

Methodology: This was a cross-sectional study conducted over a period of 1 month on undergraduate physical therapy students at Rehman College of Rehabilitation Sciences. 142 students of 1st, 2nd and 3rd year were included in the study through universal sampling. After the approval from the principal of the college the participants were approached, and their informed consent was taken. The 23-item questionnaire was distributed among the participants. Data was analyzed using SPSS version 22**.** Percentages and frequencies were used to present demographics and graphically presented by bar chart. To find association between independent and dependent variables, Chi square test was applied.

Results: The response rate was 87.3 % out of which 72.6% were females while 24.7% were males having mean age ± 20.2 ± 1.37 and majorly 38.1% students were from 1st year. On average 34.43% and 39.82% students agree regarding the perception of learning through virtual method and traditional method of anatomy respectively. Between the group there was no significance regarding which method of learning was better for students (p value = 0.5) and no association was found with independent variables (age, gender, and year of study).

Conclusion: The use of VR is as effective as traditional model method of leaning anatomy among physical therapy students however, professionally trained faculty could play a better role in understanding of anatomy learning.

Keywords: Anatomy, Model based learning, Physical Therapy, Virtual Reality

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INTRODUCTION

In 2013 the American physical therapy Association states that physical therapist will "transform society by optimizing movement to improve the human experience," guiding the profession to embrace the role of movement expert (1). As such, examining and treating movement dysfunction is a foundation of physical therapist practices which include observation and task analyzation to understand patients' functional challenges, to make informed clinical decision and to provide interventions to optimize participation (2). These skills require the synthesis of students' basic knowledge of anatomy, physiology and motor control to master the title of movement expert (3). Anatomy is a major subject taught in early foundation years of medical education which provide information regarding the basic structure of body and their spatial relationship (4). Initially students learnt anatomy by the visual images on textbooks, atlas, cadavers and 3D models of body structures in labs (5). But, as the digital world is advancing the virtual reality (VR) has created an environment of computer based learning which has created multidimensional model for learning anatomy through immersive or semi immersive methods providing visual, auditory and haptic feedback creating environment of realistic and interactive learning (6,7). With innovative advancements in educational system by using digital technologies,

the need of cognitive development according to the standards will also be a challenge specially for those who use conventional tool for learning (8).

A study conducted by Peterson and Robertson in 2013 showed good evidence that this is of proven efficiency in improving the quality of the medical educational process by teaching anatomy through virtual means (9). Another study conducted by Alfalah et al in 2019 suggested that students who have been taught heart anatomy through computer-Based virtual reality when compared to model-based learning has satisfactory results in using technology (10). A systematic review was published in 2022 suggested that physiotherapy students have found VR equally effective as traditional method in terms of learning satisfaction. A study reported that there was no difference in the efficacy in the use of virtual simulation for the students of physical therapy in clinical reasoning when compared with the traditional method approach (11). A study carried out on the usability analysis of virtual learning of hip joint model among physical therapy students suggested significant benefits of learning and cognitive load through augmented method over traditional teaching (12).

The novelty in education through technology works on the theory of student-centered approach of learning creating cooperative and interactive environment and giving control over multi-dimension model-based education. The purpose of this study was to find out whether the use of virtual reality is effective in learning anatomy by physical therapy students who always find it hard to visualize the structures and movements at the joint level properly and mostly the traditional method learning is based on the concept of imaginations. Also, little literature is found on the efficacy of VR learning of anatomy among physical therapy students so, the aim of this study is to compare the efficacy of virtual reality versus traditional model-based learning methods of DPT students.

MATERIAL AND METHODS

This was a cross-sectional study conducted on undergraduate physical therapy students at Rehman College of rehabilitation sciences over a period of 1 month. 142 students of 1st, 2nd and 3rd year were included in the study through universal sampling who attended anatomy classes on both traditional model learning and Virtual reality semi-immersive methods were included in the study. After taking the approval from the principal of the college the participants were approached. Purpose of the study was explained and informed consent was taken. The questionnaire was distributed among participants and the data was taken. The questionnaire comprised of 23 questions and based on 5-point Likert scale (ranging from 1 = strongly disagree, 2 = disagree, 3 = uncertain, 4 = agree and 5 = strongly agree). The same questionnaire was used for finding out the efficacy of physical traditional model and their behaviors in interpreting anatomy using VR Anatomy System. The data was analyzed using SPSS Version 22. The data was presented descriptively by mean and standard deviation. Percentages and frequencies were used to present demographics and graphically presented by bar chart. Pearson Chi square test was used to find association among independent and dependent variables.

RESULTS

The response rate of the participants was 87.3 % out of which 72.6% were females while 24.7% were males having mean age ± 20.2 ± 1.37. Around 38.1% students were from 1st year while the rest of the distribution is given in the graph. The overall students agree regarding the perception of learning through virtual method and traditional method of anatomy 34.43% and 39.82% respectively. The percentage in for each question is given in the table 1 and 2. Between the group there was no significance regarding which method of learning was better for students (p value = 0.5) and no association was found with independent variables (age, gender and year of study).

Table: 1 Traditional Method Learning

Question	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
Helps me to better understand and memorize the structure	3.20%	6.45%	9.67%	36.29%	41.93%
Enhances the visualization of the system details	3.20%	8.87%	18.54%	42.47%	25.80%
Will show clearly the relative position among the structures	3.20%	12.09%	16.93%	40.32%	27.41%
Understanding body structure is easier	3.20%	9.67%	37.09%	28.22%	20.96%
Having an opportunity for repeating a training task	3.20%	9.67%	35.48%	32.25%	18.54%
Is available when required	6.45%	33.87%	12.09%	25%	20.16%

I think it is a good learning tool	3.22%	4.03%	7.25%	48.38%	34.67%
Flexible enough for training	4.03%	7.25%	16.93%	56.45%	12.90%
I can easily recognize the body structure from different perspectives	2.41%	9.67%	15.32%	44.35%	27.41%
Understanding anatomy structure is fast.	6.45%	8.06%	33.06%	32.25%	16.93%
I can easily navigate through the parts of the body	4.03%	7.25%	20.16%	41.12%	25%
Will save the time required to learn the basic anatomy	4.03%	6.45%	14.51%	48.38%	24.19%
Will help me to develop basic anatomy skills prior to actual patient encounters	3.22%	6.45%	22.58%	42.74%	23.38%
Will cover most of the anatomy	3.22%	6.45%	20.96%	45.96%	22.58%
I think it can strengthen my intentions to learn	4.83%	7.25%	11.29%	44.35%	29.83%
Reduce use of cadavers as learning method	11.20%	9.67%	20.96%	40.32%	16.12%
Interaction is clear and simple while using it	2.41%	9.67%	15.32%	50%	20.16%
I feel enjoyment while using it	4.83%	8.87%	12.90%	40.32%	29.83%
It is easy to interact with others by using this system	3.22%	12.09%	12.90%	40.32%	29.03%
I can dissect into layers to clarify anatomical relations of the different parts	7.25%	12.09%	17.74%	37.90%	24.19%
It has pointers to provide information to the student about the components of the model	11.20%	12.90%	14.51%	35.48%	23.38%
I can approach the body structure from different angles	5.64%	11.29%	18.54%	33.06%	29.03%
I can open in different planes to visualize cuts through the structures of the body in several locations	9.67%	12.90%	20.16%	29.83%	25.80%

Table 2: Virtual Reality based Learning

Question	Strongly disagree	Disagree	Uncertain	Agree	Strongly Agree
Helps me to better understand and memorize the structure	2.41%	8.06%	10.48%	33.87%	41.93%
Enhances the visualization of the system details	4.83%	7.25%	8.87%	39.51%	36.29%
Will show clearly the relative position among the structures	4.03%	8.06%	8.87%	35.48%	41.12%
Understanding body structure is easier	4.03%	8.06%	45.16%	24.19%	16.12%
Having an opportunity for repeating a training task	5.64%	8.06%	23.38%	40.32%	20.96%
Is available when required	5.64%	39.51%	16.93%	22.58%	14.51%
I think it is a good learning tool	4.03%	6.45%	36.29%	31.45%	18.54%
Flexible enough for training	6.45%	8.87%	16.12%	41.93%	24.19%
I can easily recognize the body structure from different perspectives	4.03%	5.64%	11.29%	41.93%	33.87%
Understanding anatomy structure is fast.	4.83%	7.25%	15.32%	29.83%	39.51%
I can easily navigate through the parts of the body	2.41%	8.87%	12.09%	37.90%	37.09%
Will save the time required to learn the basic anatomy	3.22%	12.90%	20.96%	22.58%	38.70%
Will help me to develop basic anatomy skills prior to actual patient encounters	4.03%	4.83%	19.35%	35.48%	33.87%
Will cover most of the anatomy	2.41%	8.06%	13.70%	40.32%	33.06%
I think it can strengthen my intentions to learn	2.41%	4.83%	17.74%	41.12%	32.25%
Reduce use of cadavers as learning method	6.45%	9.67%	19.35%	35.48%	27.41%
Interaction is clear and simple while using it	4.03%	9.67%	17.74%	37.09%	29.03%
I feel enjoyment while using it	6.45%	8.87%	11.29%	37.09%	33.06%
It is easy to interact with others by using this system	6.45%	10.48%	18.54%	32.25%	29.03%
I can dissect into layers to clarify anatomical relations of the different parts	4.83%	10.48%	15.32%	33.06%	33.87%
It has pointers to provide information to the student about the components of the model	4.83%	8.06%	8.06%	35.48%	41.12%
I can approach the body structure from different angles	4.03%	3.22%	12.90%	36.29%	41.12%

I can open in different planes to visualize cuts through the structures of the body in several locations	7.25%	6.45%	13.70%	26.61%	43.54%

DISCUSSION

This study was carried out to compare the efficacy of Virtual Reality versus Traditional model-based Learning Methods of anatomy among physical therapy students. The findings suggested that students have same perception of learning through both methods, virtual Reality 34.43%, and Traditional model-based learning 39.82%. The findings suggested that the student's approach of learning through this model is novel and require more sessions on virtual reality-based learning to make significant learning difference. In contrast to the finding, study conducted by Kandasamy G et al in 2021 demonstrated that students prefer virtual based augmented method of learning the structure and function of spine more and believed that the AR model engage more attention through digital 3D visualization. The difference in findings may be due to the use of AR in their study through mobile app which make the use of technology easier to understand for every individual while in current study the students use the VR technology through computer based system in semi immersive method as a whole class (13).

A study conducted by in 2023 summarized that medical student enjoyed their learning through gadgets and indicated higher satisfaction towards the use of technological tools for learning anatomy. However, their findings also suggested that the mixed learning of traditional and technological methods have more acceptability rate among students in relation to our findings where students have equal response to learning of anatomy through both methods (14).

The majority of students in our study were females (72.6%), we did not find any influence of gender predisposition over the results (p value = 0.45) similar to the findings of Cabero- Almenara et al., 2019 negating the idea of gender-based ideology of technology use among female population and showing the digital competence is not gender based (15).

The findings of this study contrast with the work of Alfalah et al suggesting that students are more satisfied with VR anatomy system learning (mean ranging 4.00 to 4.7) when compared to physical model learning (mean ranging 1.13 to 3.47). The findings may be differed because the technology use is difficult and operating the hardware is challenging (10).

CONCLUSION

It is concluded that the efficacy of VR versus traditional model-based learning of anatomy were same and suggested that the use of VR is as effective as traditional model method learning However, there is huge potential in using novel technology for physical therapy in terms of basic science learning, motor control and decision making in later clinical years. Further studies are required to identify the effectiveness of teaching methods in technology-based learnings.

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