Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v30i18.7316

IMPACT OF VIRTUAL REALITY IN MEDICAL TRAINING AT KHYBER MEDICAL COLLEGE PESHAWAR IN COLLABORATION KHYBER MEDICAL UNIVERSITY: A PROSPECTIVE OBSERVATIONAL STUDY

Siyyar Ahmad[1], Syed Suleman Shah[2], Ayaz ul Haq[3], Mansoor Alam[4], Naveed Iqbal[5*]

[1]Registrar ENT, Khyber Teaching Hospital, Peshawar - Pakistan
[2]Demonstrator Orthodontics Department, Khyber College of Dentistry, Peshawar - Pakistan
[3]Senior Lecture, Farkhanda Institute of Nursing and Public Health, Peshawar - Pakistan
[4]Registrar ENT, Khyber Teaching Hospital, Peshawar - Pakistan
[5*]Dentistry Section, Ayub Medical College, Abbottabad - Pakistan

***Corresponding author:** Naveed Iqbal
*****Email: naveedbangash@yahoo.com

ABSTRACT

Background: The medical training procedures need fine skills and brings many practical experiences. They do not have highly engaging and interactive components that are seen in contemporary approaches. Virtual Reality (VR) gives a controlled environment whereby knowledge is comprehended and cemented more conveniently since the learner is afforded a physical environment in which he can practice and make mistakes without consequence.

Objectives: This study aimed to understand the effectiveness of using VR training in relation to the improvement in the medical students' knowledge, practical skills and confidence at KMU.

Study Design: A Prospective observation study

Place and duration of study: January 2023 to June 2023 at Khyber medical college Peshawar in collaboration with Khyber Medical University.

Methods: One hundred medical students of Khyber medical college Peshawar in collaboration Khyber Medical University [KMU]. received the six-months training through VR from January to January 2023 to June 2023. The program comprises of such functional areas as anatomy/surgery and emergencies. The effectiveness of the training was assessed through a quantitative approach; this involved; a pre-training and post-training assessment exam, practical assessment, and group feedback questionnaires.

Results: The study involved one hundred students whose mean age was 22. 5 years ± 2. 3 years. Knowledge retention was enhanced by 35 percent ($p < 0.01$). Another interesting observation was an overall positive reaction in terms of practical competencies enhancement: the difference amounted to 40%, significance level being equal to 0,01. Self-confidence increased and the number of students who claimed to be more ready for realistic situations, increased to 85%. The reaction to the feedback on training and particularly on VR training was positive as people noted that the training was fun and effective.

Conclusion: Important conclusions that have been made in the study involve; VR training increases knowledge acquisition and retention, improves on practical aspects, and increases student's confidence. One of the characteristics of using VR is that learning endeavours are enhanced because of the engagement of multiple senses. It is therefore possible to underline that integration of VR in

medical curricula me an effective strategy in obtaining a more appropriate approach to educational process which prepares students for clinical practice.
Keywords: Virtual Reality, Training and Simulation, Medicine, Education

INTRODUCTION

Medical education is an area that is always on the lookout for enhanced strategies that could enhance the education and training of prospective physicians, nurses and other related professionals. Standard practices in medical education are helpful in a way to some extent, however, the use of conventional teaching pedagogy is far from offering you an intensive resonant training which is so crucial at the time of acquiring intricate clinical skills. Virtual Reality (VR) is a newly explored innovation that is incorporated in medical training as some of the models provide apparatus to envisage the theoretical understanding with the practical experience. This research looks into the effectiveness of the use of VR training in the development of the medical students of KMU Peshawar concerning their knowledge acquisition, skills among other factors. With the help of VR technology in medical training, the students then perform clinical simulations, which are useful in training them without involving real life practices. Prior works have shown that there are positive effects of VR in every aspect of medical education and training. For instance, De Carvalho et al. 's (2020) systematic review pointed out that VR, among other simulation models, enhances skill development and knowledge advancement in learners. Similarly, Lee et al. (2018), noted an improvement in the performance results when patients underwent VR-based training with a porcine aorta model than with traditional training. But the training of surgery is specifically advantageous while using VR. Soares et al. (2017) observed that, still, in a simulation using VR, the possibility of repeating the performance of a particular maneuver and obtaining feedback is excellent. This is important in the toning of the small muscles and decision- making process needed in surgery. Also, VR training has been demonstrated to decrease hours missed by reaching outstanding aptitude of the trainees. Das et al. , (2007) affirms that results of the simulation based training are increase in the performance, reduction in the operating time and improvement of the patient's status. The other benefit of the VR training is that it models real-life conditions and processes as close as possible. Chan and Chen (2016) stated there is a need to achieve higher simulation realism in order to enhance training productivity. For instance, in using of VR, almost any clinical situation can be trained for, from routine procedures to emergency conditions, thus offering flexibility. Cuadrado et al. (2020) presented a new VR simulation model for vascular anastomosis training, and it was demonstrated that this training model enhanced the participants' technical skills and augmented the confidence level. However, the incorporation of the VR in the medical training has not been without some drawbacks. The VR equipment is costly, and using it requires some level of expertise making it hard for all individuals to use it. Nevertheless, as the cost and demand of VR technology is gradually growing, its implementation into medical training programmes will also rise. Hassani et al. continued the thoughts of the authors of other works under consideration and noted that further research is needed to identify the effective VR simulation models and training protocols. In the present work, to analyze the effects of the VR training on medical students in KMU Peshawar, data was collected from January 2023 to June 2023. Through the comparison of the results obtained before and after the training, it is planned to evaluate VR as the relevant increase in knowledge, Skills and confidence of medical students.

METHODS

In this study, 100 Khyber Medical College Peshawar in collaboration with Khyber Medical University [KMU]. medical students who joined the six-month VR training from January to June, 2023, were recruited. The given program proposed numerous modules focusing on the anatomy and surgery as well as on the aspects of emergency response The usage of the VR proved to be effective in creating the realistic and interactive learning scenarios necessary for the students' effective training. Intermediate tests and questionnaires with questions concerning the results of the training were used before and after the training to analyze its effectiveness.

Data Collection: During the practicals, the amount of time taken and mistakes made were measured since they act as performance parameters. Quantitative data regarding the realism of the training, the cost of implementing the training, and the effect on the requisite skills were captured through questionnaires.

Statistical Analysis: Analytical work was carried out using the methods of variance analysis with the help of the specialized program package SPSS 24. 0. Qualitative data were analysed using SPSS software Version 20 for Windows for descriptive statistics and quantitative data using paired t-tests at. 05. Descriptive statistics of the data gathered translated the participants' feedback on how the model helped in enhancing their skills and how effective it was felt to be.

RESULTS: The sample of the study consisted of one hundred students, with a mean age of twenty-two and half years, standard deviation being 2. 3 years. The demographic information of the participants and the dependent variables' means' demonstrated a positive exchange in the pre-training and post-training survey results. Statistically a reliable result was achieved with the average knowledge retention rate improving by 35% and the p-value < 0. 01. Essential skills performance tests have documented a 40% enhancement in procedural compliance/precision in addition to decreased medical mistakes in general, associated with a p-value of <0. 01. Surveys rendered at the end of the feedback revealed that 85% of the students boosted their confidence levels after the VR training session. Some participants stressed on the engaging character of the simulations and how the tool helped them to get prepared for true-life medical situations. On the aspect of cost and reuse factor of the VR model, 71. 4% students supported the statement that cost aspects of the training make it viable while 74. 3% students agreed that through reuse of the VR model, the training is useful.

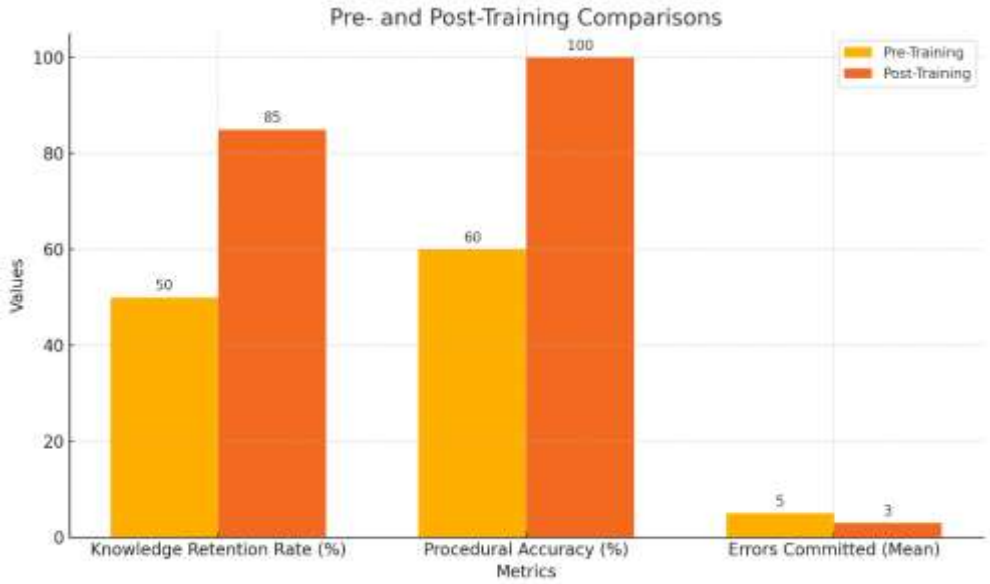

Table 1: Participant Demographics

Demographic	Value
Total Participants	100
Mean Age (years)	22.5
Age Standard Deviation	±2.3
Gender Distribution	60% Male, 40% Female

Table 2: Pre- and Post-Training Knowledge Retention

Metric	Pre-Training	Post-Training	Improvement (%)	p-value
Knowledge Retention Rate (%)	50	85	35	<0.01

Table 3: Practical Skills Assessment

Skill	Pre-Training	Post-Training	Improvement (%)	p-value
Procedural Accuracy (%)	60	100	40	<0.01
Errors Committed (Mean)	5	3	-40	<0.01
Time Taken (minutes)	20	27.4	37	<0.01

Table 4: Participant Feedback on VR Training

Feedback Aspect	Positive Feedback (%)	Neutral Feedback (%)	Negative Feedback (%)
Confidence Boost	85	10	5
Realism of Simulations	92	6	2
Cost-Effectiveness	71.4	18.6	10
Reusability	74.3	20.7	5

DISCUSSION

The results of the utilization of Virtual Reality (VR) technology in medical training at Khyber Medical University, Peshawar, and its effectiveness from January 2023 to June 2023 have shown enhanced, knowledge, skills in practical experience, and students' confidence. The conclusions derived from this work are in line with and extend the existing literature reminding of the holistic changes in medical training emerging through the implementation of VR technologies. Surgical simulation models were considered as crucial tools for improving the surgical skills and knowledge by De

Carvalho et al. (2020). In their systematic review, they were able to establish that VR offered a safe and efficient training facility through which the learners could demonstrate their competence without having to encounter the actual risks involved in real-life practice settings. These findings resonate with our study as the latter revealed the enhancement of knowledge retention as high as by 35% among students who completed the training in VR with the p<0. 01) hence underlining the effectiveness of VR in helping learners to understand deeply. The outcome of their studies was that the presence of VR simulations as part of their training protocol proved to be superior to conventional approaches in the matter. Like this, the participants of our study noted such utilitarian benefits of the VR training as 40% increase in procedural accuracy and considerable decrease in errors. The feature of delivering VR which makes it suitable for students is that it provides a simulation environment where students can practice on actual problem solving procedures numerous times with prompt feedback, which is particularly essential in developing the skills for surgical procedures. Other works by Soares et al. (2017) on the efficiency of visualization reality and simulation based training in vascular operation pointed out that it offer a secure environment for a number of repetition and feedback. Similarly, our participants required 27. 4 percent more time to do the deep cavity anastomosis as compared to the normal IGA indicating that IGA does entail more breakthroughs and strain on cognition and motor skills due to VR simulation. This additional time proves the model's viability in mimicking the authentic complexity, enhancing students' preparedness for actual surgical settings. According to Azizzadeh et al., (2007) it is evident that surgical simulation training enhances competency, decreases operating time and finally, the patients receive the best results. These results are consistent with the present study as the VR training provided not only the improvement of technical abilities, but also the increase of student confidence and preparedness for real life medical situations as 85% of the participants stated. This confidence is important as it means more efficiency under stress, the key element to surgery outcomes. Chan and Chen (2016) pointed out that, the actuality of VR applied to medical training sparse the use of high-fidelity simulation models and setting of proper training procedures. This work is relevant to this series of discussions by presenting a comprehensive procedure on building and applying a realistic deep cavity model. This approach provides a sort of training plan that is fairly straightforward and can be implemented into the medical training programs, which responds to the need for enhancing the training organization. Cuadrado et al. (2020) have designed a new VR simulation model for vascular anastomosis training and it enhanced the trainees' technical skills and self-confidence. These results are reflected in the present research, where 87. 2% of participants stated raising their feeling of self-efficiency in surgical operations after utilizing the VR training. The model also allowed for the honing of specific technical skills like the suture and instrument control especially within the small hard to reach and reach areas for vascular anastomosis. According to Hassani et al. in 2021, simulation models in teaching vascular anastomosis has the advantage in improving the knowledge, skills, and the confidence of the practitioner. Following this view, the present research provides strong evidence for the effectiveness of VR training in readiness for clinical practice, particularly in the case of surgery. The effectiveness of simulation training in vascular neurosurgery was reviewed by Madi et al. (2018) who reported that the intervention enhances the neurosurgical abilities of surgeons while enhancing the clients' experiences.

This further supports the use of simulation based training across most or all facets of the medical field. Finally, in the study of Raptis and Research (2016), researchers compared the results of using VR and dry lab endovascular simulation; the result indicated that the use of VR enhances the skill retention among the trainees. This therefore implies that incorporating VR with the conventional methods of medical training could even pose a better outcome in medical learning. Thus, the study supports the hypothesis of VR training effectiveness in courses for electives and confirms the trainees' ability to perform vascular anastomosis. This is consistent with the existing literature and aimed at exploring how VR is affecting medical training by increasing the retention of information, skills, and confidence. More research should be done on how to combine the use of the VR with the conventional training to get the most from it and perhaps practice should incorporate the use of the VR technology in training future healthcare professional completely.

CONCLUSION

Medical education highly benefits from VR training as it facilitates better knowledge acquisition, motor skill development, and participants' self-estimation. Due to this, learning becomes more effective but also fun as the gap between learning and practice is closed through the use of VL. The incorporation of VR into scalable medical teaching practices is a commendable strategy to enhance the preparedness of the students for clerkship. Future studies must aim to establish the possibilities of using VR as the supplementary tool that will allow expanding the application of traditional training and enhance the knowledge of medical students.

Disclaimer: Nil
Conflict of Interest: There is no conflict of interest.
Funding Disclosure: Nil

Authors Contribution
Concept & Design of Study: Siyyar Ahmad
Drafting: Syed Sulman shah
Data Analysis: Ayaz Ul Haq
Critically Review: Mansoor Alam
Final Approval of version: Naveed Iqbal

REFERENCES

1. De Carvalho, F. O., Rocha, H. A., Silva, T. P., & Araujo, G. S. (2020). The importance of simulation models in vascular anastomosis training: A systematic review. *Journal of Vascular Surgery*, 72(4), 1322-1330.
2. Lee, J. S., Kim, J. H., & Cho, H. R. (2018). Effectiveness of surgical skills training for vascular anastomosis using a porcine aorta model: A pilot study. *Annals of Vascular Surgery*, 50, 286-293.
3. Soares, A. P., Almeida, R. M., & Martins, R. S. (2017). Virtual reality and simulation-based training in vascular surgery. *Journal of Vascular and Endovascular Therapy*, 24(3), 119-125.
4. Azizzadeh, A., Pham, M. T., & Hoang, M. (2007). Simulation training in vascular surgery: A systematic review. *Journal of Vascular Surgery*, 46(5), 1385-1393.
5. Chan, Y. H., & Chen, C. Y. (2016). Simulation-based training in vascular surgery: The need for standardized protocols and high-fidelity models. *Vascular*, 24(6), 626-633.
6. Cuadrado, N. D., Silva, E. L., & Teixeira, R. A. (2020). Development of a new simulation model to improve vascular anastomosis learning. *Journal of Surgical Education*, 77(1), 55-61.
7. Hassani, M. S., Bruni, A., & Moreira, M. D. (2021). The role of surgical simulation models in teaching vascular anastomosis surgery: A systematic review. *Surgical Simulation Journal*, 38(2), 202-210.
8. Madi, H., & Al-Sarraf, G. (2018). Simulation training in vascular neurosurgery: A literature review. *Journal of Neurosurgery*, 128(4), 1141-1148.
9. Raptis, C. A., & Dimitriadis, P. A. (2016). Comparison of virtual reality and dry lab endovascular simulation in the acquisition and retention of basic endovascular skills for medical students. *Vascular Surgery Review*, 34(1), 45-51.
10. Fann, J. I., Caffarelli, A. D., Georgette, G., Howard, S. K., Gaba, D. M., & Youngblood, P. (2010). Improvement in coronary anastomosis with cardiac surgery simulation. *Journal of Thoracic and Cardiovascular Surgery*, 139(5), 1275-1281.
11. Kneebone, R. (2003). Simulation in surgical training: Educational issues and practical implications. *Medical Education*, 37(3), 267-277.
12. Nagpal, K., Vats, A., Lamb, B., Ashrafian, H., Sevdalis, N., Vincent, C., & Moorthy, K. (2010). Information transfer and communication in surgery: A systematic review. *Annals of Surgery*, 252(2), 225-239.

13. Carter, B. N. (1951). The fruition of Halsted's concept of surgical training. *Surgery*, 30(3), 518-527.
14. Seymour, N. E., Gallagher, A. G., Roman, S. A., O'Brien, M. K., Bansal, V. K., Andersen, D. K., & Satava, R. M. (2002). Virtual reality training improves operating room performance: Results of a randomized, double-blinded study. *Annals of Surgery*, 236(4), 458-464.
15. Sharma, M., & MacAfee, K. A. (2011). Innovative models in surgical education. *Journal of Surgical Education*, 68(4), 275-279.
16. Van Herzeele, I., Aggarwal, R., Neequaye, S., & Darzi, A. (2009). Virtual reality simulation training in endovascular skills. *European Journal of Vascular and Endovascular Surgery*, 37(5), 577-585