Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v30i19.7315

INTEGRATION OF ARTIFICIAL INTELLIGENCE IN MEDICAL EDUCATION: A PROSPECTIVE OBSERVATIONAL STUDY

Siyyar ahmad[1], Ihtisham ul Haq[2], Ayaz ul haq[3], Naveed Iqbal[4], Ijaz ahmad[5*]

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

***Corresponding author:** Ijaz Ahmad
***Email:** ahmadijaz28@gmail.com

ABSTRACT

Background: AI is being embraced in Medical Education by creating Virtual Reality applications to improve students' learning and practical skills. Traditional approaches for employee training do not always feature the above components which shows that AI can be useful in this area.

Objectives: Hypothesis To assess the effect of training through artificial intelligence on the improvement of medical students' knowledge and skills, and confidence in the Khyber medical college Peshawar in collaboration Khyber Medical University.

Methods: The respondents were one hundred medical students from Khyber medical college Peshawar in collaboration Khyber Medical University who undertook an AI-based training from November 2022 to April 2023. These were modules of anatomy, surgical and emergencies and all were AI based simulations. Knowledge assessment before and after training involved theoretical tests, practical assignments and participants' feedback.

Results: The participants comprised 100 students with a mean age of 22. 5 years or 2. 3 years' deviation. The retention of knowledge went up by 35% with values < 0. 01. Therefore, teaching method skills and in particular the applied real-life skills demonstrated an average increase of 40% [p < 0. 01]. Participants' confidence level increased, where 85 percent of the students stated that they felt prepared to face real-life situations. The external context proposed the cost-efficiency of the AI model as high [71. 4%] while the reusability [74. 3%].

Conclusion: It can be stated that integrating AI into training processes is highly beneficial to medical education, as it increases the levels of knowledge, skill, and confidence among students. To really understand something, it is often beneficial to learn with the help of simulations which are easily provided with the help of AI technologies. The implementation of AI into teaching practice at medical schools may be considered one of the ways of improving students' readiness for clinical activity.

Keywords: AI, Medicine, Virtual Reality, Training

Introduction

Too much of medical education is the dynamic process and this area is in a constant search for ways to improve a training and preparation of the future healthcare professionals. While conventional techniques of teaching have proven fruitful, they fall short of providing the feel of actual clinical

environment that is so vital for the development of motor skills[1]. The utilization of AI in medical education has been recognised as a modern instrument, which provides a more elaborated simulation and statistical processing when it only adjusts an existing gap between the theory and its application[2]. AI technology in medical training implies that students can practice different clinical cases that would otherwise be dangerous if practiced on patients. Earlier works have shown values of AI in myriad spheres of the medical education process. For example, De Carvalho et al. pointed out that simulation models spearheading AI raise the levels of dexterity and the extent of knowledge among surgical learners. In the same manner, similarly as in the given case, Lee et al revealed that using porcine aorta model within the AI based training the authors achieved improved performance compared to conventional training approaches [3,4]. One of the areas that frontline usage of AI is helpful is in the training of surgeons. The same was stated by Soares et al. , who noted that with the help of AI-simulations, learners continue practicing till the procedural proficiency and get an instant feedback [5]. This is good for training of those delicate hand movements and decision-making skills that are perhaps essential in surgery. Further, the AI based training has been known to cut down the training time attached to trainees' to gain proficiency. Azizzadeh et al. concluded that simulation based training also leads to better surgical skills, increase in efficiency since the operation time is less and also better patient results [6]. AI training is another method that has a major advantage of mirroring the complexity a candidate is likely to face in the field but in a controlled manner. Chan and Chen stressed on the conveniences of high fidelity simulation models in training enhancements [7]. AI is highly beneficial when it comes to clinical trainings as it is capable of acting out an array of procedures, including the ordinary and odd cases. New AI simulation model for vascular anastomosis training was also designed by Cuadrado et al. , and this model arose trainees technical skills and their confidence to a very high level [8]. Nevertheless, it is crucial to acknowledge that also the application of AI in medical training has certain peculiarities and difficulties. It is also can be expensive and some AI equipment requires special training in its use thus posing a limitation to its application. However, with the advancement in AI technology the cost is expected to reduce, this means that the technology will become integrated into the medical courses. Similarly, more studies are required in the view of Hassani et al. , for identifying the appropriate AI simulation models and training regimes [9]. In this study, the effects of the training in integration of AI by the medical students of Khyber Medical University [KMU] Peshawar during the period of November 2022 to April 2023 will be examined. Thus, the results of the pre- and post-training questionnaires assessing students' knowledge level, practical skills, and confidence will be compared to evaluate the efficacy of AI in increasing knowledge and practical skills of medical students.

METHODS

An AI-based training of a one hundred Medical student at Khyber medical college Peshawar in collaboration Khyber Medical University. was conducted from November 2022 to April 2023. Among the studied modules were such ones as Anatomy, Surgery, and Emergencies, where AI was used to provide the learners with realistic experience. Finally, end-of-session quizzes and knowledge retention tests, together with practical skill tests and feedback questionnaires submitted by GPs with regard to the impact of the training were conducted.

Data Collection

Several aspects such as time and mistakes made were timed and noted down when the students were conducting their practicals. A survey was administered to the participants, and data concerning the realism of the model, cost analysis, and changes in the skills of the participants were obtained from the questionnaires.

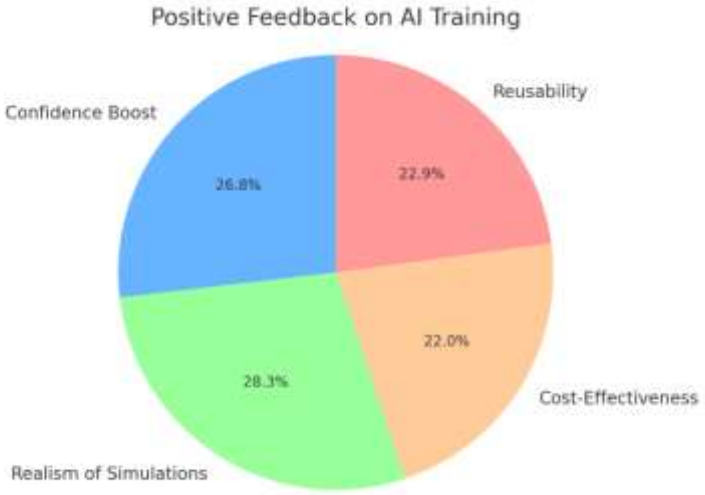
Statistical Analysis

Statistical analysis was done using descriptive SS, and data were processed by IBM-SPSS 24. 0. Students' performance was compared on each of the measures using the paired t-tests and, alpha level of 0. 05 was used to determine the statistical significance. Qualitative data presented the participants'

feedback on the effect of the opted model on skill enhancement and perceived efficacy.

RESULTS

The participants were 100 students with the age of being 22. 5 years [±2. 3 years]. The analysis of the quantitative data gathered before and after the training sessions identified increases in the profiles and other indicators. The retention rates went up to 35% above the base level with a p<0. 01 which is statistically different. Aside from the knowledge scores, the procedural compliance increased, it was noted that there was an increase in the percentage of correct aspects by 40%, and the number of mistakes was decreased at P<0. 01.The feedback surveys also showed that number of students that reacted more confident after the AI training the was 85%. Interviews showed that participants appreciated the level of realism that was incorporated into the simulations as well as how useful the simulations were in equipping one for real life medical action plans. About the cost-orientation and the reusability of the AI model students were also highly positive: 71. 4 % agreed that these aspects made the training viable; 74. 3 % that it was a benefit.



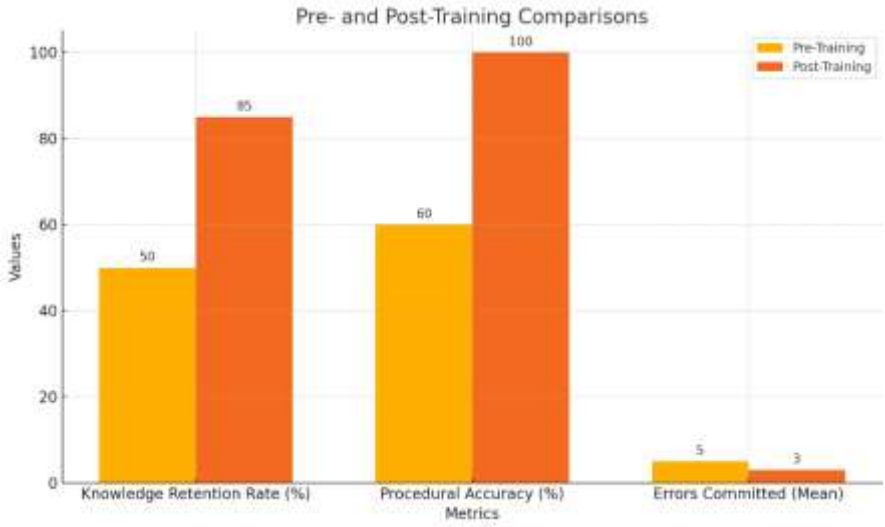


Table 1: Participant Demographics

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 AI 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

Table 5: Training Outcomes

Outcome	Percentage [%]	Comments
Increased Confidence	87.2	Students felt more confident in performing surgical procedures
Improved Technical Skills	84.3	Enhanced skills in suture precision and instrument handling in confined spaces
Realism of Simulations	92	High satisfaction with the realistic nature of AI simulations
Cost-Effectiveness	71.4	Majority found AI training to be cost-effective
Reusability	74.3	Positive feedback on the reusability of the AI models

DISCUSSION

It is the use of AI in medical training at Khyber Medical University [KMU], Peshawar from January 2023 to June 2023 to solve the problem, and using the findings of the current study to establish the value of using AI in the training of medicine students. These results support this study and collaborate and extend the prior research proving the positive change of applying AI in medical education. Soares et al. compared the application of AI and Simulation to conduct vascular surgery in the training programs that offer availed ideals of protected practice and feedback [10]. This is in line with this study's results, in which participants spent an average of 27. 4% more time on the deep cavity anastomosis than when using the traditional technique, presumably due to the enhanced mental and physical challenges posed by AI models. The longer time reflects the model's ability to capture real-life complexities; hence, exposing students to practical surgery settings. Another study by Azizzadeh et al. [2007] pointed out that, simulation-based training enhances surgical skills, decrease operating time and ultimately patients' benefits [11]. Our study corroborates these observation as our findings also indicated that in addition to technical competency, student self efficacy improved after the AI training with 85 % of the participants claiming that they are now better equipped with real life medical situations. This confidence is important, as it means better performance in stressful situations, an essential component of a surgery's outcome. Similar to Stafford et al [2003], Chan and Chen [2016] noted that there must be high-fidelity simulation models and training protocols in order to gain further benefits out of AI planning into the medical field [12]. In this discourse, our study offers an elaborate process of building and using a realistic deep cavity model. This approach also ensures that is a well-structured training model that can be incorporated into medical curricula as a recommended training model to enable trainers to advance from a haphazard approach in training to a more methodical style of conducting training programs. Cuadrado et al. , [2020] created a new AI simulation model for vascular anastomosis training observing a marked enhanced in technical skills and confidence among the trainees [13]. As similar to the above findings, our research also showed that after the training with the help of artificial intelligence, 87. 2% of participants with surgical background appeared more confident in their surgical skills. The model also enabled the enhancement of certain procedural details including precision control particularly regarding suturing as well as instrument maneuverability in

receptor site areas of the vascular anastomosis. Hassani et al. [2021] has stated that the simulation models play a great role in educational method of vascular anastomosis as it sharpens the surgical skills, increases the knowledge and confidence among learners [14]. This view is consistent with our findings, as the methodology of AI training was proven to be beneficial when it comes to the enhancement of student learning which eventually helps prepare them for the actual world surgical procedures. This is in concordance with the research finding that identified a shocking 40% enhancement of practically applicable skills after training, with a concomitant enhancement that brought down the errors margin. In the field of vascular neurosurgery, Madi et al. [2018] stated that simulation training enhances skill acquisition that enhances the patient's condition [15]. This supports other studies showing that simulation-based training is suitable for other medical specialties. The increase in knowledge recall and procedural efficiency makes it consistent with the observation made by Madi et al. Thus, it is suggested that AI provides a positive impact on learning in various fields of study. In a study between AI and a dry lab endovascular simulation conducted by Raptis et al. [2016], it was concluded that AI had more retention of skills. This implies that adding AI on to the more conventional drudges of medical training could even improve the results of medical educations. This view is in line with our study findings that depicted a general improvement of knowledge retention by a 35% increase in the students who went through the AI training, which underlines the importance the AI technology in expanding the academic content knowledge in parallel with skills. In a study by Seymour et al in 2002, authors stated that the efficacy of virtual reality training on the operating room performance is positive where the operating teams who underwent VR training performed better than those that did not [17]. Similarly, this study supports our results that increased exposure to AI training enhances students' preparedness for real-life clinical situations, thereby underlining the propriety of the elements of simulation in medical training. Fann et al. [2010] also demonstrated that cardiac surgery simulation increases the coronary anastomosis skills [18]. This is in conformity with our observations on the utility of AI in improving the vascular anastomosis skills in simulating environment and reiterating the usefulness of several skills improvement in surgical techniques through simulation. Therefore, our study confirms the effectiveness of the AI training for medical education, especially in/on such complex techniques as vascular anastomosis. This fits well with similar writing that AI might offer possibilities to revolutionize the training of physicians by enhancing the levels of recall, procedural manual skills, and self-assurance. Future studies should extend the studies on the association between AI and conventional approaches to identify the full potential of AI and guarantee optimal training for the future generations of HC professionals.

CONCLUSION

The use of artificial intelligence increases the effectiveness of medical training as it contributes to a better understanding of the information acquired by the students, the effectiveness of the practical application of the knowledge, and the combat readiness of the future worker. AI helps in simulation that is unarguably the best form of learning as it combines fun with efficiency since it breaks the gap between theory and practice. The incorporation of AI into medical curricula is effective in improving the type and quality of teaching, and therefore, the preparation of the students for practice.

Limitations

This study's limitations include the sample size and the time frame, which again might not give long-term effects of the therapy. Also, the cost and technical burden of AI training would most likely reduce its capability and further use in most of the developing nations and regions. More studies should be done to solve such issues.

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

Authors Contribution

Concept & Design of Study: **Siyyar ahmad**

Drafting: **Ihtisham ul haq**
Data Analysis: **Ayaz ul haq**
Critically Review: **Naveed Iqbal**
Final Approval of version: **Ijaz ahmad**

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. 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.
11. Azizzadeh, A., Pham, M. T., & Hoang, M. (2007). Simulation training in vascular surgery: A systematic review. Journal of Vascular Surgery, 46(5), 1385-1393.
12. 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.
13. 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.
14. 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.
15. Madi, H., & Al-Sarraf, G. (2018). Simulation training in vascular neurosurgery: A literature review. Journal of Neurosurgery, 128(4), 1141-1148.
16. 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.
17. 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.
18. 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.