Creation of Virtual Patients for Undergraduate and Postgraduate Medical Education: An Experience from Pakistan

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ABSTRACT

Objective: To create virtual patients as an educational tool to determine their feasibility and effectiveness in clinical problem solving.
Study Design: Cross-sectional study.
Place and Duration of the Study: The Aga Khan University Hospital, Karachi, from 2018 to 2021.
Methodology: Prototype virtual patients were developed at the Aga Khan University Hospital, Karachi, for medical trainees. Articulate Storyline 360 software was used for creating clinical encounters. Undergraduate students and postgraduate trainees were selected using purposive sampling to practice on these virtual patients (VPs). They were asked to provide feedback on the construction and usefulness of virtual patients as a learning modality.
Results: Two VPs were created and used. The geriatric VP was used for the assessment of final-year students. Twenty-five students gave detailed feedback after completion. Most (90%) agreed that the VP provided realistic scenarios and improved clinical reasoning. Almost five identified the need to improve navigational instructions. The pediatric VP for postgraduate trainees was well received. Almost 90% reported that it facilitated learning and improved knowledge and clinical reasoning. There was a 30% increase in post-test scores, supporting it as an adjunct resource for clinical learning.
Conclusion: Virtual patients can be easily created using local disease patterns to make learning more contextual. They enhance clinical reasoning and decision-making in a safe learning environment.

Key Words: *Medical education, Virtual patients, e-learning.*

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INTRODUCTION

Recent changes in healthcare settings have impacted the learning environment in medicine. Stricter patient care regulations, demands on clinical faculty, and the COVID-19 pandemic reduced opportunities of patient interaction for medical trainees.[1,2]

These factors lend justification to the use of alternative learning tools like virtual patients (VPs).

A VP is a computer-based simulation of clinical scenarios used for instruction or assessing learners. It emulates real-life scenarios and allows interactivity, knowledge application, and clinical problem-solving in a safe environment. Until recently, cost and time have limited the use of VPs.[3,4]

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Collaborations across North America and Europe have allowed the incorporation of VPs in medical curricula.[5,6] They are now an important pedagogical tool for motivating learners and attaining mastery in clinical reasoning.[7,8]

Low-resource countries like Pakistan have specific barriers to experiential learning.[9-11] Developing virtual patients would help overcome such obstacles. The Aga Khan University is adept at using technology for learning,[12] hence launching virtual patients seemed appropriate.

The aim of this study was to create virtual patients as an educational tool to determine their feasibility and effectiveness in clinical problem solving.

METHODOLOGY

The ADDIE model (Analysis, Design, Development, Implementation, and Evaluation phases) of instructional design was applied to develop the VPs.[13] At the *analysis* stage, the learning content and prioritised areas where VPs would be useful, were reviewed. Geriatric curriculum had limited faculty resources and required alternative strategies for clinical problem-solving.

Table I: Student feedback on Geriatric VP.

	Strongly disagree	Disagree	Don't know	Agree	Strongly agree	N
Did this virtual patient help with clinical reasoning skills?	1	0	1	18	5	25
Were the skills you applied transferable to real-life scenario?	0	0	0	18	7	25
Learning through a virtual patient helps enhance retention of knowledge and concepts.	0	0	1	11	13	25
Case content was focused and relevant.	1	0	1	13	10	25
Case content was culturally contextual.	1	0	2	13	9	25
Instructions for navigation were simple and clear.	1	3	0	15	6	25
Design of the virtual patient was engaging.	0	1	1	12	11	25
Quality of graphics and audio was suitable.	0	2	0	14	9	25
Was teacher feedback helpful in concept clarification?	0	1	0	13	11	25

In low-income countries, Pediatric Critical Care Medicine (PCCM) is underdeveloped. The virtual patient had *IntenSIM* curriculum to help amplify real experiences of critically ill patients for frontline physicians.

For design, the IT team opted to use Articulate Storyline 360 software, allowing to create characters and props that reflected the local clinical environment.

As a first step in *development,* the SME (subject matter expert), *i.e.*, faculty member, created learning outcomes of the virtual patient, based on which the design progressed. The IT team created storyboards (*pictorial representations with textual explanations)* for each scene that captured the details of the characters, audio communication, and navigation of each screen. Multiple iterations of the VP helped create a realistic approach for diagnosis and clinical reasoning.

Implementation began with a linear model of the geriatric VP that was changed to a branching model (after learner feedback) to better assess reasoning skills. Three segments were created: data gathering (history, examination, and investigations), diagnosis, and management.

The Aga Khan University's virtual learning environment (VLE) was used to house the VPs. For the *IntenSIM* curriculum, a need assessment survey was done to design the VP, and the respiratory module was selected for the formative learning. A clinical encounter similar to the geriatric VP was created. A timer was incorporated to allow participants a real-time feel of managing a critically ill child. The faculty members spent approximately 50 to 60 hours developing the VPs and the IT team spent 160-200 hours.

RESULTS

Two VPs were created and used at the institution for undergraduate and postgraduate learners. Both VPs were easy to navigate, and no technical difficulties were reported.

The geriatric VP was used for the assessment of final-year medical students, who gave detailed feedback (Table I). Comments were largely positive, about the *applicability to all clinical scenarios.* Majority (92%) of students suggested developing more VPs. Some participants reported that instructions needed clarity.

The *IntenSIM* was attempted by 15 residents as a pre and post-PICU rotation test and in a Basic Paediatric Intensive Care Course (BPICC) for 20 trainees from other institutions.

Almost 90% reported that it facilitated learning, improved knowledge, and clinical reasoning (Figure 1). There was a 30% increase in post-test scores.

About 10% felt that VP was more time-consuming than traditional bedside teaching. Both VP users found that immediate feedback was helpful.

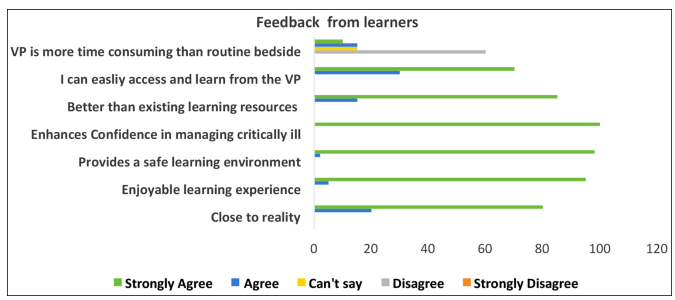

Figure 1: Learner feedback (%) on pediatric VP.

DISCUSSION

This paper describes the steps in creation, use, performance, and feedback on two VPs created for medical trainees in a developing country. To the best of the authors' knowledge, these are the first examples of locally developed VP in Pakistan.

Two VPs were created and launched for specialities, where learning opportunities were limited due to faculty resources and patient safety concerns. Outcomes ranged from improved motivation, diagnostic, and communication skills like those in previous studies.[7,14]

The faculty members engaged in this process were early adopters of technology in education. They required no formal training and created scenarios based on clinical expertise within a feasible time frame and cost, which have

been the major barriers in creating VPs. Busy clinicians can therefore take time out to develop VPs.

VPs were used for formative and summative assessment. VPs are multi-purpose and can enhance PBL sessions[15] and case-based learning. One VP can cater to different levels of learners and can be used for asynchronous and synchronous learning and assessment.

The authors plan to develop VPs for the obstetrics and gynaecology speciality as well. Other institutions may choose different areas based on their need. Collaboration at a national/regional level could create contextually relevant VP banks that could be shared across institutions.[6] As medical education shifts towards more competency-based learning, VPs offer an opportunity to gain mastery in clinical reasoning.

This was a single institute that shared its experience with the development of only two VPs. Whether this process can be replicated in similar steps/software at other institutions was not explored.

CONCLUSION

Virtual patients engage trainees in learning and improving clinical reasoning skills in a safe environment. Virtual patients can be practically and easily developed by faculty. Locally developed VPs can be created for prevalent diseases to contextualise learning.

ETHICAL APPROVAL:
Ethical approval was obtained from the Institutional Review Committee: 2022-7686-22373.

COMPETING INTEREST:
The authors declared no competing interest.

AUTHORS' CONTRIBUTION:
SRS: Conceptualised, wrote and revised the manuscript, and added the references.
SI: Co-authored the manuscript, provided the figure, and reviewed and revised the manuscript.
SJ, SIM: Provided technical expertise including the creation of virtual patients and storyboard templates. They also reviewed and revised the manuscript.
All the authors have approved the final version of the manuscript to be published.

REFERENCES

1. Sani I, Hamza Y, Chedid Y, Amalendran J, Hamza N. Understanding the consequence of COVID-19 on undergraduate medical education: Medical students' perspective. *Ann Med Surg (Lond)* 2020; **58**:117-119. doi: 10.1016/j.amsu.2020.08.045.
2. Goh P-S, Sandars J. A vision of the use of technology in medical education after the COVID-19 pandemic. *MedEdPublish* 2020; **9(49)**:49.
3. Cendan J, Lok B. The use of virtual patients in medical school curricula. *Adv Physiol Educ* 2012; **36(1)**:48-53. doi: 10.1152/advan.00054.2011.
4. Huang G, Reynolds R, Candler C. Virtual patient simulation at US and Canadian medical schools. *Acad Med* 2007; **82(5)**:446-51. doi: 10.1097/ACM.0b013e31803e8a0a.
5. Poulton T, Balasubramaniam C. Virtual patients: A year of change. *Med Teach* 2011; **33(11)**:933-7. doi: 10.3109/0142159X.2011.613501.
6. Ellaway R, Poulton T, Fors U, McGee JB, Albright S. Building a virtual patient commons. *Med Teach* 2008; **30(2)**:170-4. doi: 10.1080/01421590701874074.
7. Berman NB, Durning SJ, Fischer MR, Huwendiek S, Triola MM. The role for virtual patients in the future of medical education. *Acad Med* 2016; **91(9)**:1217-22. doi: 10.1097/ACM.0000000000001146.
8. Moran J, Briscoe G, Peglow S. Current technology in advancing medical education: perspectives for learning and providing care. *Acad Psychiatry* 2018; **42(6)**:796-99. doi: 10.1007/s40596-018-0946-y.
9. Frost L, Liddie Navarro A, Lynch M, Campbell M, Orcutt M, Trelfa A, *et al*. Care of the elderly: Survey of teaching in an aging sub-Saharan Africa. *Gerontol Geriatr Educ* 2015; **36(1)**: 14-29. doi: 10.1080/02701960.2014.925886.
10. O'Connor E, Moore M, Cullen W, Cantillon P. A qualitative study of undergraduate clerkships in the intensive care unit: It's a brand new world. *Perspect Med Educ* 2017; **6(3)**: 173-181. doi: 10.1007/s40037-017-0349-x.
11. Munir K, Oner O, Rustamov I, Boztas H, Juszkiewicz K, Wloszczak-Szubzda A, *et al*. Social distance and stigma towards persons with serious mental illness among medical students in five European Central Asia countries. *Psychiatry Res* 2022; **309**:114409. doi: 10.1016/j.psychres.2022.12.
12. Naseem A, Ghias K, Sabzwari S, Chauhan S. Perceptions of technology-enhanced learning in undergraduate medical education at a private medical college in Karachi, Pakistan. *J Pak Med Assoc* 2019; **69(8)**:1108-14.
13. Cheung L. Using the ADDIE model of instructional design to teach chest radiograph interpretation. *J Biomedical Education* 2016; **2016**:1-6.
14. Isaza-Restrepo A, Gomez MT, Cifuentes G, Arguello A. The virtual patient as a learning tool: A mixed quantitative qualitative study. *BMC Med Educ* 2018; **18(1)**:297. doi: 10.1186/s12909-018-1395-8.
15. Noverati N, R Naro G, J Fischer R, M Thompson B. Using video and virtual patients in problem-based learning: A scoping review. *Med Sci Educ* 2020; **30(4)**:1685-91. doi: 10.1007/s40670-020-01108-7.