



First Recorded Large-Scale Adoption of Virtual Reality as a Part of Curriculum

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Abstract

Virtual Reality (VR) has been gaining traction as a medium of training for medical students, with various studies finding a multitude of advantages. These developments have led to its inculcation into educational institutions and programs. This study intended to understand the impact of using VR training on Indian medical students. Over 200 students from KIMS were enrolled in a VR-integrated curriculum program consisting of 10 modules across an academic year (Aug 2021-June 2022). After completion of all modules in the guided and evaluation modes, each student was asked to fill out an online questionnaire. An objective analysis of the results suggested that it was an interesting form of learning (61% of students), one that was more effective than manikin training (47%), bringing an increased level of confidence post training (92%). Feedback on the modules included satisfactory learning points, room for improvement in the visual graphics, and positive opinions on the assessment aspect. Overall, this study found that medical students perceived VR training as a fun and effective way to not only educate but assess them on procedural skills. Limitations included the need for repeated practice and the need to develop more realism in the digital environment to bring greater immersion.

Keywords: *Virtual Reality, Healthcare Training, VR Skill Training, Medical Simulation, KIMS.*

Introduction

The versatility of Virtual Reality (VR) has been a subject of significant exploration for over a decade. Conventionally understood as a digitally created environment that facilitates user interaction using traditional headsets and hand controls, VR has transcended its initial functional boundaries. Widely assumed to reside solely in the entertainment and gamified region of media, it has presently taken on a more formal form, with an array of applications ranging from education to being used in the military and defence. A VR

headset display and handheld controllers allow a user entrance into a realistic and interactive artificially-generated simulations, which can be designed and modified to meet environment, duration, and complexity requirements⁽¹⁾. The research and use of VR in the field of healthcare has been steadily gaining traction, with documented success in areas of simulation based learning⁽²⁾, cognitive training⁽³⁾, and even patient management.

In the case of providing medical training via VR, advancements in technology have enabled

interaction with virtual patients, skill performance, and the practice of techniques in real time, alongside a host of other advantages. Studies have found that this method of training brings about improved skill performance when compared with traditional training⁽⁴⁾. In-built assessment and feedback on the user's performance, facilitated by VR systems, allows students to identify areas of improvement and help perfect their skill set⁽⁵⁾. Relative to its contemporary competition, manikin-based training, VR training was found to be more cost-effective, needing less staff time and resources while accommodating a greater number of students trainees⁽⁶⁾. And finally, as a system, an infinite number of scenarios and skills can be simulated and practiced an infinite number of times, aiding in the improvement of not only skill but confidence of students as well⁽⁷⁾.

In alignment with these advances in technology and features, MediSim VR is an Indian medical technology company that creates such VR skill training modules. In partnership with Karpaga Vinayaga Institute of Medical Sciences (KIMS), Maduranthagam, a fully functional Virtual Reality Laboratory was set up, allowing students to work with 10 VR based clinical skill simulations.

From this program, this study aimed to gain insight and understanding into the impact, effectiveness and perception of students receiving medical training through the use of virtual reality.

Methodology

This was a study that was conducted across one academic year, from August 2021 to June 2022, with the aim of understanding the perceptions of Indian MBBS students using VR-skill training modules. Over 200 students were recruited, and the study was conducted in a VR-based clinical skills laboratory at the KarpagaVinayaga Institute of Medical Sciences (KIMS).

A. Participants

207 medical MBBS students from KIMS were enrolled in the program via informed consent. The students were in their final year or were Compulsory Rotatory Residential Internship

(CRRI) students, with 102 MBBS and 105 CRRI students being compulsorily registered onto the VR program by the institution.

Virtual Reality Procedural Skill Modules

These VR Skill Training Modules were administered in a furnished VR lab, using equipment provided by MediSim VR. This consisted of 7 desktop PCs connected to Oculus Rift S Headsets. This equipment was chosen as it possessed the level of graphics required while being commercially available.

The modules used in this study were also provided by MediSim VR, a company that designs, develops, and produces virtual reality medical simulation education and training modules to healthcare providers. Modules such as Arterial Blood Gas (ABG) analysis, Electrocardiogram (ECG) test, Urethral Catheterisation, Nasogastric tube insertion, and Intravenous Canulisation were included in the 10 module curriculum that was chosen by the university. Every module offered allowed the participant to interact with patients, get informed consent, and follow all protocol set by a medical panel and approved by the institution. Each module featured two modes – an assisted mode that guided learners on how to perform procedures, and an evaluation mode that gave learners free reign to perform the procedure without guidance, with a comprehensive assessment upon its completion. Each module on average was 15 minutes long.

B. Measures

After completing the all the modules, students' experiences were recorded via the use of a survey questionnaire, filled out digitally. Consisting of multiple choice questions, this survey was designed to collect data on experiential factors regarding usage, functionality, and overall experience. Once collected, the responses was transformed into numeric data, allowing for quantitative statistical analysis to be carried out.

C. Procedure

Student participants were exposed to VR-based clinical labs set up at KIMS, where classes in the VR lab were scheduled as a part of a clinical

rotation. In these sessions, each student was provided a tethered Virtual Reality Headset along with two controllers. Trained lab personnel provided assistance with inducting them into the process, after which the students were allowed to use the headset and controllers to interact within a virtual environment resembling inpatient/outpatient settings based on the skill requirements of the procedures offered.

A minimum of two tries in guided mode, where they had to follow protocol, was allowed. Following this, participants tried a scored evaluation mode, where they had to complete the module without guidance, aiming to clear an institutionally set benchmark. After completion of this evaluation, participants could proceed to the next available module. Upon completion of the programs, the questionnaire was handed out to all participating students.

Results

The questionnaire yielded responses that provided much understanding into the perceptions of the student learners, addressing the program module, the impact, and user experience.

With regard to the program modules in particular, students' opinions on the learning points, module content, and scoring system employed was enquired about. The majority of students found the learning points to be adequate enough at 36%, a close 31% found them to be good, 19% believed them to be detailed enough, and 14% suggested that there was room for improvement. Students felt different ways about the content. When asked to choose multiple options that resembled their opinion the closest, 35% said it felt like watching a demonstration, another 35% said it felt like training on a manikin, 25% said it felt closest to actually performing a procedure while another 25% said it felt nothing like training, with 5% stating that felt similar to reading an instruction manual. When asked if the scoring system provided an accurate representation of their knowledge, 69% of students said yes, 31% said somewhat, and none said no.

User experience was addressed through questions on ease of use, what they liked about the experience, and how fun one found it to be. The majority 49% of responses stated it was easy to learn, 41% said that though they struggled initially, they gradually felt comfortable, 8% claimed they were a natural at it, and 2% found it difficult to grasp when asked if they found the technology easy to use. 39% learners found that the program's relatability to real life was what they liked most about the experience, other 39% suggested the ease of use, 17% found the learning points to be their preferred aspect, and 5% said it was the visuals. When asked how fun the overall experience was, 61% of students found it interesting, 26% found it to be very exciting, and 13% found it to be average.

The perceived impact of these program modules was enquired after as well. When compared with manikin training, 47% of students believed that it helped them understand the procedure better, 23% said it gave them more confidence, 11% believed it helped them better identify their problem areas, 10% claimed it felt more extensive, and 2% stated that they did not find it to be as helpful. With regard to the impact on students' confidence levels post completion of the guided mode, 82% stated that they couldn't wait to perform the actual procedure, 10% felt more confident and adequately prepared, and 8% found no improvement.

Discussion & Conclusion

This study intended to understand the impact, effectiveness and perception of students using VR to train in medical procedural skills. The responses from students provided insight into how they felt about VR being used in education.

With regard to virtual reality, the majority seemed to adapt to the virtual environment while enjoying the sessions and seeing it as a fun way of learning. With respect to feedback for the educational component, medical students felt that the learning points were satisfactory, with a majority finding that it was close to learning on a simulated

environment. As only 39% of students found the modules to resemble real life experience, there may be more room to refine the VR environment to have it better resemble reality. The assessment part of the module found high rates of approval. Increased levels of confidence were a direct effect of VR training, but it did not match that of performing independently on a real patient. Nevertheless, a majority of responses stated that this training platform was better than manikin training.

In conclusion, VR-based medical training was perceived by students to be a fun way of learning procedural skills. It has been found to be an effective modality to not only deliver educational content but assess users after as well. One limitation that remains is the need for students to get repetitive practice to improve their confidence levels, and a point of improvement is the need to make the VR environments more realistic in order to bring about greater levels of immersion.

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