



Transforming the Healthcare Simulation Spectrum: Now, Next and Beyond

19 - 21 October 2022 Academia, Singapore



Increasing nursing students' safety awareness in the operating theatre using virtual reality simulations



Siah Chiew Jiat Rosalind, PhD, RN; Kow Wei Chieh, Alfred, MBBS, MMed (Surgery)

Introduction

Peri-operative nursing is a specialty concerning the care of patients who will be undergoing surgery or other invasive procedures. However, challenges such as variability and availability of learning opportunities in a practical setting may impair nursing students' confidence in their transition into the actual clinical environment. The use of virtual reality enables the creation and repetition of entire surgical procedures with reduced manpower, costs, and time. Thus, this study aspired to develop and evaluate virtual-reality simulations as a pedagogical approach to provide nursing students' the opportunity to practice their role as scrub nurses.

This study aimed to evaluate the efficacy, attitude, and level of confidence among nursing students as scrub nurse in a peri-operative environment via virtual reality simulation as an alternative experiential platform to a physical-simulation setting: such virtual reality entailed standardized scenario-based digital environment without compromising patient safety or learning opportunities.

Five features were accordingly developed in the simulated scenario to create awareness among the nursing students on patient safety during surgery (Figure 1). The first feature was the use of motion-triggered red grid-lines that would emerge if the users' hands were placed outside the sterile field, thereby ensuring aseptic techniques. The second was a time-out checklist, through which the users could identify each healthcare professional in the surgical team to promote safety.

The third feature was a quiz to assess their knowledge and the effectiveness of the virtual-reality simulation where quizzes in the form of "Yes" or "No" and "re-arrangement of sequences" were added into the simulation setting for participant interaction. The quizzes were marked instantly to provide immediate feedback to the participants to enhance the learning. The fourth feature was a cluster of task-affirmation check-points, which provided an opportunity for the users to review learning points at different stages. The last, a summary page for the users, allowed them to review their performances. The entire simulation was designed to be completed within 15 minutes.

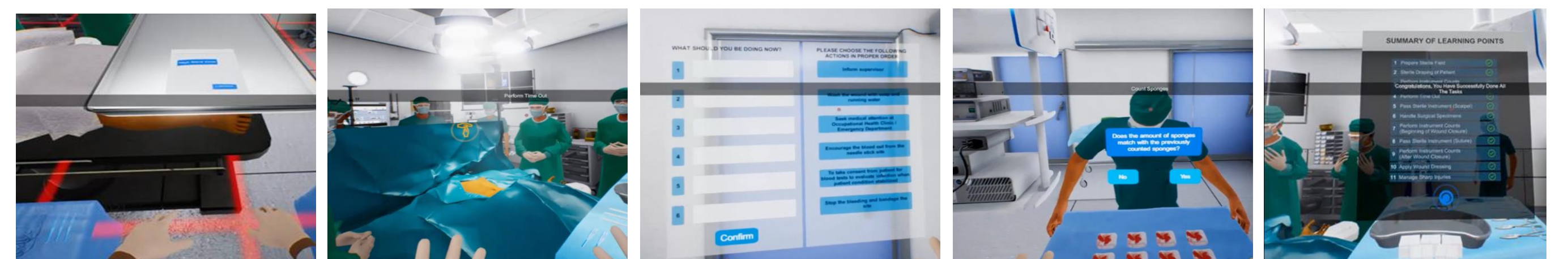


Figure 1: Features of VR simulation (from left) - red gridlines triggered by the hand motion; timeout checklist; quiz; task affirmation check points; as summary of learning points

Method

This was a single-group descriptive study design conducted in a university, with approval granted by the Institutional Ethics Review Board. The teaching scenario was constructed through: (1) conducting interviews with university-level nursing tutors, hospital-based operating-theatre scrub nurses, and a surgeon; (2) developing a virtual-reality prototype for nursing with developers and programmers; and (3) evaluating experiences with the virtual reality holistically. Revisions and enhancements were made accordingly until learning objectives were met and agreed to by both the faculties and the clinicians. The final list of scenarios captured in the simulation comprised: (i) preparation of a sterile field; (ii) performing "time-out" according to WHO Surgical Safety Checklist; (iii) sponge, sharps, and instrument counts before incision, at the beginning of wound closure, and at the end of wound closure; (iv) sterile draping of patients; (v) passing of sterile instruments; (vi) management of sharps injury; and (vii) handling of surgical specimens.

Before the intervention (VR simulation), the survey solicited the participants' socio-demographic information. After the intervention, information of other domains were collected, as follows: (1) perspectives towards peri-operative patient safety; (2) perspectives towards patient safety in pre-, intra-, and post-operative settings; (3) efficacy; (4) attitudes; and (5) confidence.

Intervention

Each two-hour session comprised: (i) an introductory instructional video; (ii) a pre-simulation survey; (iii) simulation; (iv) a post-simulation survey; and (v) a debrief. To ensure adequate technical support, a class-size ratio of 12 participants to two facilitators was maintained for each session.

During the virtual-reality simulation, the participants could notice graphical objects on display in the simulated operating theatre and control them on the screen and hear them. A virtual circulating nurse was also programmed within the simulation for the participant to acknowledge and interact during the simulation such as preparing the items and collect specimens from the participant during the simulation.



Furthermore, when the participants turned their heads, moved their hands, or interacted with the simulated surgical instruments such as "scalpels", "suturing items", and "receptacle for collecting specimen", the virtual-reality system would detect those movements.

Results

207 students were included for analysis. The participants, for whom the mean age was 22.28 years, comprised predominantly females (80.7%). The majority of them had not had any prior exposure to virtual-reality (70.5%) or experiences in the operating theatre (96.6%).

The mean score on perioperative patient safety and patient safety in pre-, intra-, and post-operative setting were 4.41 (SD=0.591) and 4.35 (SD=0.673) out of 5 respectively. The mean scores for the levels of efficacy, attitude, and confidence were 3.37 (SD = 0.600), 3.28 (SD = 0.489), and 3.34 (SD = 0.571), respectively. The Cronbach's alpha values were respectively 0.987, 0.976, and 0.967. Further analysis suggested that participants with prior experiences with virtual reality reported higher level of efficacy ($\chi^2(13, N = 207) = 173.73, p < .001$), attitude ($\chi^2(16, N = 207) = 207, p < .001$), and confidence ($\chi^2(19, N = 207) = 194.97, p < .001$) than those without.

Discussion

The students' attitudes toward such technologies were found to be positive. They believed that, despite its limitations, virtual reality provided them with a platform to comprehensively perform their role as scrub nurses throughout the entire surgical process, as opposed to the physical simulation setting which provided only a segment of the procedure. While technical skills are fundamental to the role of a scrub nurse, the ability to promote safe practice through critical thinking and decision-making are equally important. It was likely that the immediate feedback provided during the virtual-reality simulation improved their understanding of the workflow.

Conclusion

In essence, our post-intervention evaluation of the participating nursing students' awareness of patient safety, efficacy, attitude, and confidence suggests that they were able to function in and react to a variety of situations. This positively reflects the viable potential of virtual reality in preparing them to eventually practice in the setting of a real operation theatre and to apply their knowledge and experiences obtained through simulation.