



CSMEN – Simulation Publications Update

September 2020

Bulletin on

Technology in Simulation Based Education

Welcome

Welcome to the Simulation Publications Update a service brought to you by CSMEN in partnership with NES Knowledge Services.

The focus for this Simulation bulletin is on the use of **Technology in Simulation based Education**. The articles may be of interest or relevance to your current role in NHS Scotland. The articles may also be of use in your research. The articles are from those journals we currently subscribe to. If there are any journals that you would like us to add/consider please let us know.

Until now we have tried to provide approximately 30 links to articles on all aspects of simulation. WE are now moving to shorter more frequent Bulletins with a clear focus on an aspect of simulation. Augmented Reality and Virtual Reality are increasingly being used in simulation and are key to providing interactive safe learning experiences for participants which they can then transfer to their practice in the workplace.

If you would like to suggest a focus topic or become a reviewer please also let me know.

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The plan is to widen this service to focus on topic areas and to monitor its use and effectiveness so feedback would be much appreciated.

This bulletin has been developed by Jean Ker clinical lead CSMEN in partnership with Alan Gillies from NES Knowledge Services.

Access to Journals

Different journals have different processes for login so please follow the instructions for accessing the full text of the articles through the links provided.

On your behalf NES Knowledge Services subscribes to some journals direct and others via aggregators (i.e. journal collections or full text databases). We use something called a 'link resolver' to link you via the best route using your NHS Scotland OpenAthens password.

Some journals can detect that you're logging in from NHS premises, so won't ask for the OpenAthens password, but if you're accessing from home you may have to login.

None of the links should require you to set up a separate login – where there are login boxes for personal accounts, look for an OpenAthens or 'institutional login' option as well, which will accept your OpenAthens password.



Focus: Technology in Simulation based Education

[Effective virtual patient simulators for medical communication training: A systematic review](#), Lee, J., et al, Medical Education, 2020.

This article focuses on the evidence for the use of virtual patient simulators to train communication skills to try and identify those design factors which were successful. Communication skills are essential for the delivery of safe person centred care. VR has been more often been associated with the development of clinical reasoning, empathy and knowledge rather than communication skills capabilities.

Search methods

Using the recognized PRISMA guidelines the authors searched four databases over a 12 year period. They looked at papers using an adapted classification scheme published which provided data on

- Instructional design
- technological design
- evaluation (at learner satisfaction and learning levels)

in relation to the use of VR patients. The authors helpfully define in their paper what they mean by both VR and medical communication skills which informed their search terms. The process that identified the 14 articles they reviewed in more depth is presented as a flow diagram in Fig 1. The quality of the articles were assessed using the Medical Education Research Study Quality Instrument (MERSQI) for quantitative studies and the QualSyst standard for qualitative studies.

Findings

The majority of studies involved undergraduate students.

In terms of instructional design scenarios most commonly used included gathering information and breaking bad news often in different cultural and health care contexts. Instructional interventions varied from a virtual feedback to scaffolding using blended face to face debriefing and reflection. In terms of technological design most VP systems adopted a first person perspective so students' interacted with the avatar from their perspective and used their own voice or a text conversation or choose from three predetermined responses.

Evaluation was undertaken from two different perspectives that of the VR system or the learning> Nielsen's concept of usability was used to review the VR system evaluation. In most studies this included the reality of the simulation. Different validated tools had been used by different studies to measure communication skills from different perspectives (expert, self-assessment and patients). The summary of recommendations is useful particularly in highlighting of validated measurement tools for communication skills and the need for feedback. On balance, worth a read!

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[A skills acquisition study on ECMOjo: A screen-based simulator for extracorporeal membrane](#)

[oxygenation](#), Alsalemi, A., et al, *Perfusion*, Vol 35, 2, 110-116. 2020.

This article evaluates the educational efficacy of ECMOjo, an open-source screen-based extracorporeal membrane oxygenation simulator that aims to replace extracorporeal membrane oxygenation didactic instruction in an interactive and cost-effective manner. 44 participants either received traditional didactic teaching or used ECMOjo. The results indicated that the two groups show no statistically significant differences in knowledge and efficacy. Hence, ECMOjo is considered an alternative to didactic teaching. Both methods are very comparable in terms of the learner's reported self-efficacy and complementary to mannequin-based simulations.

[The effect of simulator-integrated tutoring for guidance in virtual reality simulation training.](#)

Andersen, S.A.W., et al, *Simulation in Healthcare: The Journal of the Society for Medical Simulation*, 2020.

Simulation-integrated tutoring in virtual reality (VR) simulation training by green lighting is a common learning support in simulation-based temporal bone surgical training. However, tutoring overreliance can negatively affect learning. Two cohorts of novices (medical students) were recruited: 16 participants were trained using the intervention program (intermittent simulator-integrated tutoring) and 14 participants constituted a nontutored reference cohort. Simulator-integrated tutoring by green lighting did not induce a better final-product performance but increased efficiency. The mixed effects on learning could be caused by tutoring overreliance, resulting from a lack of cognitive engagement when the tutor function is on. Further learning strategies such as feedback should be explored to support novice learning and cognitive engagement.

[Development and face validation of a virtual camera navigation task trainer.](#) Arikatla, V., et al, *Surgical Endoscopy*, 1927-1937. 2019.

The fundamentals of laparoscopic surgery (FLS) trainer box, which is now established as a standard for evaluating minimally invasive surgical skills, consists of five tasks: peg transfer, pattern cutting, ligation, intra- and extracorporeal suturing. Virtual simulators of these tasks have been developed and validated as part of the Virtual Basic Laparoscopic Skill Trainer (VBLaST). In this paper, the authors extend VBLaST by adding two camera navigation system tasks: (a) pattern matching and (b) path tracing. Face validity of the system was tested with medical students and residents. The subjects rated the simulator highly in all aspects including its usefulness in training to centre the target and to teach sizing skills. The quality and usefulness of the force feedback scored the lowest.

[The application of virtual reality and augmented reality in oral & maxillofacial surgery,](#) Ayoub, A. & Pulijala, Y., *BMC Oral Health*, 238. 2019.

The aim of this review was to provide an overview of the literature on the application of virtual and augmented reality in oral & maxillofacial surgery. It identified 101 articles related the broad application of virtual reality in oral & maxillofacial surgery. Dental implantology and orthognathic surgery are the most frequent applications of virtual reality and augmented reality. Virtual planning improved the accuracy of inserting dental implants using either a statistic guidance or dynamic navigation. In orthognathic surgery, prediction planning and intraoperative navigation are the main applications of virtual reality. Virtual reality has been utilised to improve the delivery of education and the quality of training in oral & maxillofacial surgery by creating a virtual environment of the surgical procedure. Haptic feedback provided an additional immersive reality to improve manual dexterity and improve clinical training.



Residency training in robotic surgery: The role of simulation. Bresler, L., et al, Journal of Visceral Surgery, 2020.

Simulation has become increasingly important in surgical teaching and the French National Authority for Health (HAS) recently underlined the goal and ethical priority: "never the first time on the patient". There is not yet a validated program specific for robotic surgery. The authors have developed a program in Nancy dedicated to outside-the-operating room (OR) teaching of robotic surgery using the Da Vinci robot. This teaching is based on a combined program of theoretical teaching (e-learning) and learning of practical skills using virtual simulators (DV-Trainer R, Robotic Mentor R, DVSS R), mechanical simulators (Dome, Applied R abdominal simulators), microsurgery and wet lab using ex vivo animal organs, anesthetized animals, and cadavers. This program also emphasizes team training.

Development and initial evaluation of a novel, ultraportable, virtual reality bronchoscopy simulator: The computer airway simulation system. Casso, G., et al, Anesthesia & Analgesia, 1258-1264. 2019.

Virtual reality (VR) simulation is an effective and safe method of teaching bronchoscopic skills. Few VR bronchoscopy simulators exist; all are expensive. This study aimed to describe the design, development, and evaluation of a new, affordable, VR bronchoscopy simulator - the Computer Airway Simulation System (CASS), an iPad-based, high-fidelity, VR bronchoscopy simulator. An initial evaluation of CASS found that its face validity was supported by excellent assessments from senior anaesthesiologists with regard to anatomical realism, quality of graphics, and handling performance, even though some future refinements are required. All the practitioners agreed on the significant educational potential of the CASS.

From the simulation center to the bedside: Validating the efficacy of a dynamic haptic robotic trainer in internal jugular central venous catheter placement. Chen, H., et al, American Journal of Surgery, 379-384. 2020.

The objective of this study was to validate the transfer of ultrasound-guided Internal Jugular Central Venous Catheterization (US-IJVC) placement skills from training on a Dynamic Haptic Robotic Trainer (DHRT), to placing US-IJVCs in clinical environments. The results failed to show a statistical difference between DHRT-trained and manikin-trained residents the authors conclude that the study validates the transfer of skills from training on the DHRT system to performing US-IJVC in clinical environments.

Telehealth in mental health nursing education: Health care simulation with remote presence technology. Danesh V., et al, Journal of Psychosocial Nursing and Mental Health Services, Vol 57, 7, 23-28. 2019.

This study evaluated the feasibility of integrating remote presence technology within a simulation scenario for psychiatric-mental health nursing (PMHN) students to develop telehealth competencies. A wireless, audiovisual robot from Double Robotics, manoeuvrable by smartphone or tablet computer, was used to simulate the facilitation of students' patient assessment and treatment decisions from a distant location for 32 weeks. Overall, students participating in the telehealth-enabled simulations reported moderate to strong value for the use of telemedicine within the simulation in a 3-point Likert scale post-simulation survey.

Application of virtual reality technology in disaster medicine, Duan, Y., et al, Current Medical Science, 690-693. 2019.

As an emerging technology widely used in recent years, virtual reality (VR) technology is very



suitable for many fields of disaster medicine, such as basic education, professional training, psychotherapy, etc. The purpose of this review article is to introduce the application of VR technology in the disaster medical field and consider future trends.

[Effective virtual patient simulators for medical communication training: A systematic review](#), Lee, J., et al, Medical Education, 2020.

This systematic review aimed to summarise the design and evaluation of VP-based medical communication skills training systems in order to identify features of successful cases. Fourteen studies were included for review. The most common VP training scenario was history-taking followed by delivering bad news. Diverse instructional interventions, including tutorials, learning activities, and feedback, were embedded in the VPs. First-person perspective animated within-screen sized VP was a popular technological feature. Of the eight comparative studies, half reported significant attitude or skill improvement in the VP group. The distinct features of VPs shown to be effective were well-designed instructional interventions (e.g. pre-activity with a protocol-informed tutorial) and post-activity (e.g. debrief or reflection), scaffolding, and human feedback but not system feedback.

[Creating a new "reality" for medical education: The nexus reality lab for virtual reality](#). Lilly, J., et al, Journal of the Medical Library Association, 609-610. 2019.

To lower the entry barrier to VR, the Technology Team at the Ruth Lilly Medical Library, Indiana University collaborated with the IU Advanced Visualization Lab to establish a reality lab. The lab opened in the fall of 2018 and consists of four high-end VR stations that are accessible to students at any time, but they can also make an appointment for a more guided experience. Information and instructions are available on a LibGuide. The Technology Team is currently collecting data on the number of unique users and evaluating application usage. It is working on a feedback mechanism and looking to develop collaborative partnerships across the university.

[Using virtual standardized patients to accurately assess information gathering skills in medical students](#). Maicher, K.R., et al, Medical Teacher, 1053-1059. 2019.

This article describes a virtual standardized patient (VSP) system that allows students to practice their history taking skills and receive immediate feedback. The VSPs consist of artificially intelligent, emotionally responsive 3D characters which communicate with students using natural language. The system categorizes the input questions according to specific domains and summarizes the encounter. Automated assessment by the computer was compared to manual assessment by trained raters to assess accuracy of the grading system. Overall scores calculated by the computer were not different than those provided by the human raters, and overall accuracy of the computer system was 87%, compared with 90% for human raters. Inter-rater reliability was high across 19 of 21 categories. The authors conclude that the system can understand, respond, categorize, and assess student performance in gathering information during a typical medical history, thus enabling students to practice their history-taking skills and receive immediate feedback.

[The virtual operative assistant: An explainable artificial intelligence tool for simulation-based training in surgery and medicine](#). Mirchi N., et al, Plos One, Vol 15, Article Number: e0229596. 2020.

Simulation-based training is increasingly being used for assessment and training of psychomotor skills involved in medicine. A significant criticism of the use of artificial intelligence in education has been a lack of transparency in the algorithms' decision-making processes. This study aimed to 1) introduce a new framework using explainable artificial intelligence for simulation-based training in surgery, and 2) validate the framework by creating the Virtual Operative Assistant, an automated



educational feedback platform. The Virtual Operative Assistant successfully classified skilled and novice participants using 4 metrics with an accuracy, specificity and sensitivity of 92, 82 and 100%, respectively. A 2-step feedback system was developed to provide participants with an immediate visual representation of their standing related to expert proficiency performance benchmarks.

[How does virtual reality simulation compare to simulated practice in the acquisition of clinical psychomotor skills for pre-registration student nurses? A systematic review](#), Rourke, S.,

International Journal of Nursing Studies, Vol 102, 2020.

This review aimed to critically appraise and synthesise the published evidence to answer the question 'How does virtual reality simulation compare to simulated practice in the acquisition of clinical psychomotor skills for pre-registration student nurses?' Nine studies were included in the review. Virtual reality groups performed favourably in comparison to simulation groups in posttest knowledge scores, cognitive gain, skill performance scores and skill success rate. There was divergence of results in relation to time taken to complete the skill. Whilst the results are generally favourable for virtual reality, variation in devices, data collection tools and outcome measurements mean that caution must be used in their interpretation. Consensus in definitions is needed along with further research to advance knowledge of this developing area of practice. Such research is needed to justify the cost of investing in this new technology.

[Nurse-physician communication team training in virtual reality versus live simulations: Randomized controlled trial on team communication and teamwork attitudes](#), Sok, Y.L., et al, Journal of

Medical Internet Research, Vol 22, 4, 2020.

This study aimed to evaluate a team training program using virtual reality vs conventional live simulations on medical and nursing students' communication skill performances and teamwork attitudes. The study outcomes did not show an inferiority of team training using virtual reality when compared with live simulations, which supports the potential use of virtual reality to substitute conventional simulations for communication team training.

[Effect of virtual reality training to decreases rates of needle stick/sharp injuries in new-coming medical and nursing interns in Taiwan](#). Wu, S., et al, Journal of Educational Evaluation for Health

Professions, 2020.

This prospective cohort study examined the effect of a new developed (virtual reality (VR) game, which uses the Ganngne's learning model to improved universal precaution for NSI/SI prevention and decrease the rates of needle stick/sharp injuries in new-coming medical and nursing interns in Taiwan. Before VR training, the familiarity and confidence for NSI/SI prevention were higher among nursing interns than medical interns. Trainees with past experiences of deep NSI/SI exhibited better performance on the accuracy rate and time need for complete 20 decisions than those without past experiences in VR practice. The performances of all trainees were improved after VR training. A high proportion of trainees reported that the VR-based training significantly decreased their anxiety about NSI/SI prevention.