Clinical Simulation in Nursing (2018) 15, 34-41

Clinical Simulation in Nursing

www.elsevier.com/locate/ecsn

Featured Article

Interactive Anatomy-Augmented Virtual Simulation Training

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KEYWORDS
augmented reality;
virtual reality;
nursing skills;
simulation;
learning;
nursing education;
situated learning theory

Abstract

Background: Traditionally, clinical psychomotor skills are taught through videos and demonstration by faculty, which does not allow for the visualization of internal structures and anatomical landmarks that would enhance the learner skill performance.

Method: Sophomore and junior nursing students attending a large Midwestern institution (N = 69) participated in this mixed methods study. Students demonstrated their ability to place a nasogastric tube (NGT) after being randomly assigned to usual training (control group) or an iPad anatomy-augmented virtual simulation training module (augmented reality [AR] group). The ability of the participants to demonstrate competence in placing the NGT was assessed using a 17-item competency checklist. After the demonstration, students completed a survey to elicit information about students' level of training, prior experience with NGT placement, satisfaction with the AR technology, and perceptions of AR as a potential teaching tool for clinical skills training.

Results: The ability to correctly place the NGT through all the checklist items was statistically significant in the AR group compared with the control group ($p = .011$). Eighty-six percent of participants in the AR group rated AR as superior/far superior with other procedural training programs to which they had been exposed, whereas, only 5.9% of participants in the control group rated the control program as superior/far superior ($p < .001$).

Conclusions: Overall, the AR module was better received compared with the control group with regard to realism, identifying landmarks, visualization of internal organs, ease of use, usefulness, and promoting learning and understanding.

Funding: This work was supported by a grant from the National Institutes of Health (National Institute of General Medical Sciences), Bethesda, MD to Dr. Levine (grant number: R43GM113376).

Disclaimer: Dr. Levine is the Chief Medical Officer and President of ArchieMD, Inc. but was funded independently for this project by a grant from the National Institutes of Health. Dr. Levine was responsible for the development of the interactive program and read the final article but had no involvement in subject recruitment, data collection, scoring, statistical analysis, or interpretation of the data. None of the other investigators have any financial, commercial, or other interests in ArchieMD, Inc. to declare.

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https://doi.org/10.1016/j.ecns.2017.09.008

Cite this article:
Aebersold, M., Voepel-Lewis, T., Cherara, L., Weber, M., Khouri, C., Levine, R., & Tait, A. R. (2018, February). Interactive anatomy-augmented virtual simulation training. *Clinical Simulation in Nursing, 15*(C), 34-41. https://doi.org/10.1016/j.ecns.2017.09.008.

The United States is currently experiencing a shortage of qualified nurses, which will likely intensify. In 2014, almost 68,938 qualified applicants applying to baccalaureate and graduate nursing programs were turned away because of faculty shortage, insufficient clinical sites and clinical preceptors, limited classroom space, and budget constraints with two-thirds of them citing faculty shortages as a main reason (American Association of Colleges of Nursing, 2015). To address this shortfall, we need to find smarter and more efficient ways to provide clinical training to our students including leveraging simulation and virtual training methods that are not only more efficient but also more effective.

Key Points

- Students who received the anatomy-augmented virtual training were able to demonstrate a higher level of competency in placing nasogastric tubes than the control group.
- The anatomy-augmented virtual training was well received by the students.
- The anatomy-augmented virtual training kept the students engaged and was easy to use.

Simulation-based education (SBE) has become a cornerstone of undergraduate nursing education. The phases of simulation include preparation, briefing, simulation activity, debriefing, reflection, and evaluation (INACSL Standards Committee, 2016). A recent study sponsored by the National Council of State Boards of Nursing found that simulation can effectively replace up to 50% of clinical hours with no change in student critical thinking skills, knowledge, or National Council Licensure Examination pass rates (Hayden, Smiley, Alexander, Kardong-Edgren, & Jeffries, 2015). However, the study also recommended that the simulation experiences need to be of high quality to ensure that the results are reproducible. SBE increases student's clinical judgment skills (Lasater, 2007), psychomotor skills (Shin, Park, & Kim, 2015), and nontechnical or interpersonal skills (Searl et al., 2014).

In general, psychomotor skill proficiencies are practiced and demonstrated on task trainers or low-fidelity simulation manikins (Decker, Sportsman, Puetz, & Billings, 2008); with the initial training done through skills videos or faculty/instructor demonstrations. In addition, nursing students often need to learn multiple skills in a short period and have limited access to the skills laboratory to practice those skills (Gonzalez & Kardong-Edgren, 2017). This creates a burden on faculty time and does not allow students optimal opportunities to practice skills or to practice them again in a just-in-time learning method when they need to perform them in the clinical area. For example, the student finds out that they may be assigned a patient with a tracheostomy so they would like to review tracheostomy suctioning and other relevant skills. If the laboratory is not open, videos do not always offer an optimal learning method. If students had an interactive virtual training application on their mobile device at home, they could practice suctioning techniques before the clinical setting.

Further difficulties in assessing student performance or competency occur when rubrics are used that are not validated or when inter-reliability between faculty is lacking (Watson, Stimpson, Topping, & Porock, 2002). This indicates the need to use validated tools to assess students and perform inter-rater reliability among the faculty to improve consistency. All these issues can lead to inconsistencies in skill development in student learners.

On the other hand, the use of videos and skill demonstrations does not always allow for the interactive visualization of internal structures and anatomical landmarks that would assist the student learner in performing the skill in a way that they could practice in real time with feedback. This research study focused on the preliminary evaluation of an anatomy-augmented procedure training video with interactive virtual simulation exercises to determine the impact on nasogastric tube (NGT) placement skills, while also assessing qualitative metrics.

Literature Review

Simulation-Based Nursing Education

The use of simulation to improve skills has a long history in a variety of areas (Aebersold, 2016). SBE provides the opportunity to practice skills in a safe risk-free environment in a repetitive, deliberate, and structured manner (Lateef, 2010). In nursing, SBE has proven to enhance technical (Jacobson, Belcher, Sarr, & Ruitta, 2010) and nontechnical skills (Hsu, Chang, & Hsieh, 2015), although it is a costly technique. High-fidelity manikins cost approximately $70,000 (United States) or more depending on options (Schiavenato, 2009). However, this does not include the estimated cost of many elements, including faculty time, building space, and equipment