Feasibility and Learning Outcomes Associated With Preparing Nursing Students for Simulation Using Virtual Gaming Simulations

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Background

Simulation-based education for health professionals and students is consistently associated with better knowledge, skills and behavioral outcomes (Cook et al., 2011); however, high costs of the technology, support staff and faculty time, have been a key criticism (Ker & Hogg, 2010, pp. 61-71). Thus, there is a need to explore efficient, innovative approaches to deliver quality simulation-based learning for nursing students. The simulation experience involves three distinct phases: preparation, participation and debriefing (Husebo et al., 2012). Pre-simulation preparation is a critical phase consisting of application of materials required by learners in advance of the scenario to optimize their learning during the simulation (Tyerman et al., 2016). Pre-simulation activities include readings, lectures, skills practice, quizzes, and self-assessments; however, in our experience, learners may fail to adequately prepare for simulation when given traditional pre-simulation preparation activities. Although approaches to scenario development and debriefing are widely reported, the literature describing pre-simulation preparation activities is just emerging. Preliminary results of a systematic review of the literature suggest that alternate pre-simulation preparation activities improve learning outcomes more than traditional approaches (Luctkar-Flude et al., 2016).

Virtual serious games or virtual gaming simulations are games accessed by computer for the purpose of education or training rather than entertainment (Verkuyl et al., 2016). Virtual games can be used to supplement learning that occurs in the classroom and simulation lab (Cant & Cooper, 2014). Nursing students reported high satisfaction and immersion when using a virtual game designed to develop pediatric skills (Verkuyl et al., 2016). Thus we propose that virtual simulation games used for pre-simulation preparation will prove to be more engaging to learners, resulting in better preparation and improved performance during live simulations. Accordingly, we will examine the feasibility and impact of virtual simulation games for pre-simulation preparation for nursing students.

Research question

What is the impact of traditional pre-simulation preparation versus blended delivery that includes virtual simulation games on nursing students' ability to achieve learning outcomes?

Methods

A multi-site, prospective, randomized controlled observational design is used in this study. The current project builds on a well-established provincial collaboration of nursing leaders in clinical simulation teaching and learning, and will demonstrate how collaboration across multiple university programs supports the scaling up of the research findings to help ensure all nursing students across the province have access to the same high-quality simulation-based learning opportunities.

Simulation Scenarios: This study will use four simulation scenarios developed through a previous collaborative grant (Egan et al., 2014); each scenario has validated clinical and learning outcomes and has a customized assessment rubric which has been tested for reliability. Rubrics are based on the principles of self-regulated learning. The scenarios involve complex, deteriorating patient care situations: 1) elderly urosepsis; 2) respiratory distress; 3) diabetic ketoacidosis; and 4) de-escalation of a violent patient. The proposed virtual gaming pre-simulation materials require students to view a nursing situation, filmed from the perspective of the nurse. At regular intervals students are required to select one of three or four potential nursing actions. The selected response will then play out for good or for bad such that students observe the expected consequences of their clinical decision-making. Students may replay the scenarios as many times as they wish, and select different actions each time and observe the associated outcomes. Two of the four scenarios will be implemented at each of the four sites, with each scenario implemented at two sites.

Sample: In total, 160 fourth year nursing students, from four Ontario University Schools of Nursing will be recruited to participate (i.e. 40 per site). At each site, students will be randomized into two groups: Group 1 will receive the revised simulation scenarios, which include virtual pre-simulation preparation, and Group 2 will receive the traditional approach to simulation, with a written scenario and "paper and pencil" questions that need to be answered prior to beginning the scenario. At the end of data collection, the virtual pre-simulation preparatory virtual materials will be available for the students in the control group (i.e. Group 2). Each learner will participate in two of the four scenarios.

Measurement: Data from the learning outcomes rubric and a clinical knowledge test will be used to evaluate nursing students' ability to achieve learning outcomes. Use of the customized learning outcomes rubric based, which is based on self-regulated learning (SRL) theory, allows student self-assessment at multiple points in time during the simulation. In the current study, students' self-assessments will be used to judge: 1) success on preparation for the simulation; 2) success during the simulation; and, 3) after post- simulation debriefing in order to identification remedial learning requirements. Further, by examining the difference between instructor assessment scores and students' self-assessments, we can develop an index of students understanding of course criteria. Because the rubrics describe qualities that demonstrate student competency of varying levels (i.e., descriptors not a check list), we will also use a written test to assess detailed clinical knowledge associated with each scenario (e.g. medications, laboratory values etc.).

Results

The four proposed virtual simulation games are currently under development. Usability testing will be completed prior to implementation at the four sites. Two sets of repeated measures analysis will be performed within and between experimental and control groups with data collected at three time points: end of pre-simulation preparation; end of simulation; and, end of the post-simulation debriefing. First, to assess the extent to which the virtual simulation enhanced the students' learning outcomes, the student self-assessment of learning outcomes will be compared within and between experimental and control groups. In addition, the instructor assessment of learning outcomes will be compared to student assessments. Second, to assess the impact of the virtual simulation on improved clinical knowledge,

knowledge scores for the experimental group will be compared to the traditional group. Process data will also be collected to evaluate feasibility, and qualitative feedback will enhance understanding of the value and limitations of using the virtual simulation games for pre-simulation preparation.

Conclusions

The key anticipated innovations and contributions of this project include: (1) the design and implementation of an online virtual pre-simulation preparation module; and (2) the expanded use of learning outcomes and clinical knowledge assessments for student evaluation. The advantages to using virtual games for pre-simulation could include the promotion of self-regulated learning, enhanced preparation for simulation teaching and learning encounter, enhanced knowledge with a potential decrease in student anxiety, improved clinical performance and job preparedness. Additionally, we anticipate that standardized pre-simulation preparations will reduce faculty preparation time and student assessment time, and may decrease instructional time in the simulation laboratory. Over the longer-term, the systems and processes put in place through these innovations will enhance our ability to continue to develop high-quality clinical simulations.

Global Implications

Once completed, the virtual simulations will be available online, providing access to high-quality simulations to nurse educators worldwide, including those teaching in settings that lack the resources to develop or provide simulation-based learning.

Title:
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Keywords:
Learning outcomes assessment, Pre-simulation preparation and Virtual simulation games

References:
Cant, R.P., & Cooper, S.J. (2014). Simulation in the internet age: The place of web-based simulation in nursing education. An integrative review. *Nurse Education Today, 34*, 1435-1442. http://dx.doi.org/10.1016/j.nedt.2014.08.001

Cook, D.A., Hatala, R., Brydges, R., Zendejas, B., Szostek, J.H., Wang, A.T.,…Hamstra, S.J. (2012). Technology-enhanced simulation for health professionals' education: a systematic review and meta-analysis. *JAMA, 306,* 978-88. Doi: 10.1097/SIH.0b013e3182614f95

Egan, R., Luctkar-Flude, M., Sears, K., Medves, J., Justinich, D., Tregunno, D. (2014, June). *Enhancing Registered Nurse job readiness through constructive alignment and standardization in simulation design*. Podium presentation at the 34th Society for Teaching and Learning in Higher Education Conference: Transforming our Learning Experiences, Kingston, Ontario.

Husebo, S.E., Fribert, F., Soreide, E., & Rystedt, H. (2012). Instructional problems in briefings: How to prepare nursing students for simulation-based cardiopulmonary resuscitation training. *Clinical Simulation in Nursing, 8*(7), e307-e318.

Ker, J., & Hogg, G. (2010). Cost effective simulation. In: K. Walsh (Ed.), *Cost effectiveness in medical education* (pp. 61-71). Oxon: Radcliffe.

Luctkar-Flude, M., Tyerman, J., Graham, L., & Coffey, S. (2016, May). *Pre-simulation preparation and briefing practices for healthcare professionals: Preliminary results of a systematic review*. Podium presentation at the Canadian Association of Schools of Nursing 2016 Canadian Nursing Education Conference: Expanding Horizons in Nursing Education, Toronto, Ontario.

Tyerman, J., Luctkar-Flude, M., Graham, L., Coffey, S., & Olsen-Lynch, E. (2016). Pre-simulation preparation and briefing practices for healthcare professionals and students: a systematic review protocol. *Joanna Briggs Institute Database of Systematic Reviews and Implementation Reports, 14*(8), 80-89. Doi: 10.11124/JBISRIR-2016-003055

Verkuyl, M., Atack, L., Mastrilli, P., & Romaniuk, D. (2016). Virtual gaming to develop students' pediatric nursing skills: A usability test. *Nurse Education Today, 46*, 81-85. http://dx.doi.org/10.1016/j.nedt.2016.08.024

Abstract Summary:

This presentation describes a multi-site randomized controlled study that aims to evaluate the feasibility and impact of using virtual simulation games to prepare nursing students to participate in live clinical simulations.

Content Outline:
BACKGROUND

- Pre-simulation preparation:
    - traditional preparatory activities are not always effective
    - alternate innovative activities improve learning outcomes more than traditional ones

- Virtual simulation games
    - may be more engaging to nursing students
    - may result in better preparation for simulation
    - may result in improved performance during simulation

RESEARCH QUESTION

What is impact of virtual simulation games used for pre-simulation preparation?

METHODS

- Design: multisite, randomized controlled observational study
- Simulation scenarios: four deteriorating patient clinical scenarios
- Sample: 160 4th year nursing students from four University Schools of Nursing
- Measurement:
    - customized learning outcomes assessment rubric
    - written clinical knowledge test

RESULTS

- Virtual simulation games under development
- Usability testing will be completed prior to implementation
- Repeated measures analysis will be performed with data collected at 3 time points
- Process data will assess feasibility
- Qualitative feedback will enhance understanding of value and limitations of virtual simulation games used for presimulation preparation

CONCLUSIONS

- Key anticipated contributions
    - Design and implementation of online virtual pre-simulation preparation module
    - Expanded use of learning outcomes assessments

- Advantages to using virtual games for presimulation preparation could include
    - Promotion of self-regulated learning
    - Enhanced preparation for simulation
    - Improved clinical performance
    - Reduced faculty preparation and instructional time

GLOBAL IMPLICATIONS

- Virtual simulations will be available online
- Provides worldwide access, including to nurse educators from low-resource regions

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