Exploring Evidence for the Use of Immersive Virtual Reality Simulation with Undergraduate Nursing Students

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Objectives

Following this presentation, participants will be able to:

• Distinguish types of virtual reality education strategies for use in nursing education
• Describe immediate and long term outcomes using virtual reality to teach the skill of decontamination
• Apply the NLN Jeffries Simulation Theory to the implementation and evaluation of virtual reality simulation
Review of Literature

• Virtual Reality Simulation (VRS)
  – Levels of immersiveness
    • Desktop virtual reality (2D)
    • Fully immersive virtual reality (3D)

• VRS and Disaster
  – Positive student outcomes
  – Realistic and enhances learning
Background

– Nurse educators have been called upon to transform nursing education to prepare students for complex healthcare environments
– Disasters can be one of the most complex environments faced in practice
– Virtual reality simulation (VRS) is one strategy for preparing nurses for disaster response
  • Little is known about outcomes based on the varying levels of VRS immersiveness
  • Little is known about the student experience using VRS at various levels of immersion
Trajectory of Current Research

• 2014 Pilot of pre/post test of performance/knowledge/self-efficacy; psychometric evaluation
  – 2 sites (WSU and Miami)
  – Kinect interaction

  – 2 sites (WSU and Miami)
  – Hydra Razer interaction
  – Added measure of retention

• 2015-2017 Pre/post test of performance and knowledge
  – 3 sites (WSU, Miami, Cedarville)
  – Maintained measure of retention
  – Added distinguishing between two types of VRS with different levels of immersiveness
Wright State University – Miami Valley
College of Nursing and Health
Wright State University - Miami Valley
College of Nursing and Health
Purpose

• Examine the longitudinal effects of two varying levels of immersive virtual reality strategies to teach the disaster skill of decontamination in terms of:
  – Cognitive knowledge
  – Psychomotor Performance
  – Satisfaction
Theoretical Framework

- NLN Jeffries Simulation Framework (Jeffries, 2016)
  - Simulation environment must experiential, interactive, learner centered
  - Incorporates design that includes level of fidelity, roles
  - Outcomes related to system, patient, and/or participant
  - Participant construct currently not well-explored
Methods

- Multi-Methods Design
  - Treatment group A-computer and mouse VRS
  - Treatment group B-VRS
  - Control group-Written directions
- Pre/post-test, 5 month follow-up
- Four campuses from 3 baccalaureate programs in Midwest
- Exempt IRB status at all universities
### Table 1. Demographic Information

<table>
<thead>
<tr>
<th>N= 189</th>
<th>Age</th>
<th>Gender</th>
<th>Ethnicity</th>
<th>Previous Disaster Training</th>
<th>Previous Virtual Reality Experience</th>
<th>Previous Gaming Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Age 18-25= 138</td>
<td>Age 26-34= 28</td>
<td>Age 35-50= 21</td>
<td>Greater than 50 = 2</td>
<td>Male= 24</td>
<td>Female= 163</td>
</tr>
</tbody>
</table>
Instruments

• Cognitive knowledge
  – 20-point multiple choice exam

• Performance
  – Researcher developed rubric—score based on 17 items
  – Time to complete procedure

• Satisfaction
  – Researcher developed focus group questions

• Demographic questionnaire
  – Age range, gender, previous disaster, gaming, and VRS experience
Procedures

• Senior baccalaureate students recruited electronically and in person at all campuses
• Students complete cognitive pre-test and demographic questionnaire
• Students view educational module decontamination as a group
• Students randomly assigned to mouse/keyboard VRS, immersive VRS or control (written instructions) group
• Repeat Cognitive post-test
• Students demonstrated skill of decontamination on mannequin
• Repeat cognitive and performance test 5-6 month post-training
Data Analysis

• Quantitative Analysis
  – Multilevel linear modeling with repeated measures

• Qualitative Analysis
  - Focus group data
## Cognitive Test Results by Treatment Group and Time

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>Pre-Test Score</th>
<th>Post-Test Score</th>
<th>6 months Post-test Score</th>
<th>Pre-Post p value</th>
<th>Post-6 months p value</th>
<th>Pre-Final p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A: Immersive VRS</td>
<td>8.78 ± 0.29</td>
<td>16.25 ± 0.29</td>
<td>14.19 ± 0.33</td>
<td>&lt;0.0001*</td>
<td>&lt;0.0001*</td>
<td>&lt;0.0001*</td>
</tr>
<tr>
<td>Group B: Computer/Mouse VRS</td>
<td>9.47 ± 0.29</td>
<td>16.19 ± 0.29</td>
<td>14.07 ± 0.34</td>
<td>&lt;0.0001*</td>
<td>&lt;0.0001*</td>
<td>&lt;0.0001*</td>
</tr>
<tr>
<td>Group C: Written Instructions</td>
<td>9.38 ± 0.29</td>
<td>16.07 ± 0.30</td>
<td>14.25 ± 0.33</td>
<td>&lt;0.0001*</td>
<td>0.0006*</td>
<td>&lt;0.0001*</td>
</tr>
<tr>
<td>p value</td>
<td>0.77 (A vs. B)</td>
<td>1.00 (A vs. B, A vs. C, B vs. C)</td>
<td>1.00 (A vs. B, A vs. C, B vs. C)</td>
<td>1.00 (A vs. B, A vs. C, B vs. C)</td>
<td>1.00 (A vs. B, A vs. C, B vs. C)</td>
<td>1.00 (A vs. B, A vs. C, B vs. C)</td>
</tr>
</tbody>
</table>
## Performance Rubric Scores by Treatment Group and Time

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>Performance Post Score/S.D.</th>
<th>Performance 6 months post Score/S.D.</th>
<th>Post-6 months p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immersive VRS</td>
<td>14.24 ± 0.29</td>
<td>12.61 ±0.33</td>
<td>0.0017*</td>
</tr>
<tr>
<td>Computer/Mouse VRS</td>
<td>14.93 ± 0.29)</td>
<td>12.03 ± 0.33</td>
<td>&lt;0.0001*</td>
</tr>
<tr>
<td>Written Instructions</td>
<td>13.48 ± 0.30</td>
<td>12.14 ± 0.34</td>
<td>0.0226*</td>
</tr>
<tr>
<td>p value</td>
<td>0.5450 (A vs. B)</td>
<td>0.8269 ( A vs. B)</td>
<td>0.0084* (B vs. C)</td>
</tr>
<tr>
<td></td>
<td>0.4429 (A vs. C)</td>
<td>0.9200 (B vs. C)</td>
<td>0.999 (B vs. C)</td>
</tr>
</tbody>
</table>
### Performance Time to Completion by Treatment Group and Time

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>Time post (seconds)</th>
<th>Time 6 months post (seconds)</th>
<th>Post-6 months P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immersive VRS</td>
<td>530.11 ± 18.62</td>
<td>514.51 ± 20.62</td>
<td>0.9638</td>
</tr>
<tr>
<td>Computer/Mouse VRS</td>
<td>543.92 ± 18.67</td>
<td>472.34 ± 20.84</td>
<td>0.0038*</td>
</tr>
<tr>
<td>Written Instructions</td>
<td>574.91 ± 19.29</td>
<td>499.04 ± 21.01</td>
<td>0.0020*</td>
</tr>
</tbody>
</table>

*p < 0.05

| p value          | 0.9951 (A vs. B) | 0.7036 (A vs. B) |
Analysis Based on Demographic Characteristics

• Generally no demographic characteristics were associated with outcomes
  – Gaming experience mattered between computer/mouse group and control group in terms of performance
  – Females were faster than males in the computer/mouse group
Results:

• Qualitative
  • Simulation Experience/facilitator educational strategies
    – Scaffolding, game-like, active learning
  • Simulation Design
    – Fidelity, extension, barriers, skills training
  • Participant Outcomes
    – Satisfaction, memory retention, self-confidence
  • Simulation Experience/Participant
    – Participant attributes, learning styles
Future Research

• Identify appropriate ‘dosing’ between training
• Solicit more diverse and larger sample sizes
• Repeat with this skill and others
• Repeat with RNs, other healthcare providers
Nursing Education

Implications

• Multi-site studies require time and coordination
• Busy students are difficult to recruit
• Need for evidence to best practice approaches for acquisition and retention of complex skills
• Advantages of VRS/Disadvantages of VRS
• Effect of repetition, current events
References:


Acknowledgements

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Questions???????