Simulation: Head to Head with other Educational Methods

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Disclosure

• Co-author of Elsevier Simulation Learning System
Introduction

• “Clinical simulation is on the point of having a significant impact on health care education across professional boundaries and in both the undergraduate and postgraduate arenas.”

Definitions

• The technique of imitating the behavior of some situation or process by means of a suitably analogous situation or apparatus, especially for the purpose of study or personnel training.

• Set of techniques for re-creating aspects of the real world, typically to replace or amplify actual experiences.

Simulations include devices, trained persons, lifelike virtual environments, and contrived social situations that mimic problems, events, or conditions that arise in professional encounters.

• Activities that mimic the reality of a clinical environment and are designed to demonstrate procedures, decision-making, and critical thinking through techniques such as role playing and the use of devices such as interactive videos or mannequins.

• May be very detailed and closely simulate reality, or it can be a grouping of components that are combined to provide some semblance of reality.

Low Fidelity Simulation in Professional Disciplines

- Cardiac simulator for heart sounds (Issenberg, et al, 2000)
- CD’s to understand the interdisciplinary training in care of asthma patients (Rodehorst, 2005)
HPS in Professional Education

- Anesthesia
- Medicine
- Trauma Team Performance
- Trauma and Warskills Performance
- Orientation to the professional workplace
- Critical Care Nurse Training
- Pre-Hospital and in-hospital care providers
- Neonatal Skills Training
- Evaluative purposes
The Use of Simulation in Nursing Education

- Lack of research studies involving nursing students (Rhodes & Curran, 2005)

- Lack of research studies focusing on educational outcomes of simulation (Cioffi, et al, 2005)

- Lack of research studies or data focusing on the use, implementation or value of simulation in the curriculum (Ravert, 2002; Seropian, 2004)
The Use of Simulation in Nursing Education

- 513 references with computer based simulation in the educational process
- Only 9 references met her inclusion criteria:
  - Contains some type of computer based simulation
  - Utilizes an outcome measure related to education
HPS and Undergraduate Nursing Education

- Competency based instruction and critical incident nursing management (Nehring, et al, 2002)
- Student and faculty perceptions with respect to the use of HPS (Feingold, et al, 2004)
- HPS as an alternate clinical experience (Bearnson & Wiker, 2005)
- HPS to teach difficult concepts (Doyle, 2002)
- Enhance learning of resuscitation scenarios (Long, 2005)
HPS in Graduate Nursing Education

- ACNP and CNS training (Hravnak, et al, 2005)
- Midwifery students and clinical decision making (Cioffi et al, 2005)
- Remediation for Nurse anesthesia students (Haskvitz & Koop, 2004)
Updates since 2005

- Clinical Judgment Rubric designed to describe the development of Clinical judgment (‘learning to think like a nurse’) Lasater, 2006
- Sim involves successes and failures which are a prerequisite to expertise (Feltovick, et al, 2006)
- Self reflection leads to self-correcting behaviors (Rudolph, et al, 2006)
- Importance of debriefing in sim education (Fanning & Gaba, 2007)
- *Sim vs. Case Study approach for NP’s (Scherer, et al, 2007)
Updates since 2005

- Theoretical Frameworks and Sim (Waldner & Olson, 2007)
- *Sim for measuring clinical parameters (Radhakrishnan, et al, 2007)
- Sim to teach new clinical instructors (Kraugscheid, et al, 2008)
- Sim and Self efficacy – lit review (Leigh, 2008)
- Use of Sim in Ambulatory care (Maynes, 2008)
Updates since 2005

- Implementation of Sim throughout a curriculum (Tuoriniemi, et al, 2008; Starkweather & Kardong, 2008)
- Sim to enhance nurse-physician collaboration (Messmer, 2008)
- Simulation Typology-low to high fidelity – for developing competencies in new nurses (Decker, 2008)
New Simulation Journals

- Simulation in Healthcare
  - Journal of the Society for Simulation in Healthcare
- Clinical Simulation in Nursing
  - Journal of the INACSL Organization
Basis of Simulation Education

- Criticized for adopting and implementing education innovations without sound evidence of their efficacy.
- Literature on simulation is increasing.
- Limited scope on simulation evaluation.
- Research including an improved methodological base.
- Retains a peripheral place in education and training.
- **Increased need for outcomes-based education.**
Gaps in the Literature

- Costs
- Cost-benefit ratio??
- Minimal evidence that demonstrates positive impact on learning outcomes
- Impact of simulation on critical thinking skills?
- Minimal studies with nursing students
- What are considered best practices?
Best Practice in Nursing Education

- P: Population
- I: Intervention
- C: Comparison Group
- O: Outcome
A COMPARISON OF EDUCATIONAL STRATEGIES FOR THE ACQUISITION OF MEDICAL-SURGICAL NURSING KNOWLEDGE AND CRITICAL THINKING SKILLS: HUMAN PATIENT SIMULATOR VS. THE INTERACTIVE CASE STUDY APPROACH

(HOWARD, 2007)
The Study

- Independent Variables
  - Educational Intervention
  - Sim or Case Study
- Dependent Variables (Instrumentation?)
  - Medical Surgical Nursing Knowledge
  - Critical Thinking
  - Learner’s Perspective
Critical Thinking

A challenge to define—
even more difficult
to measure!
Critical Thinking

• “Include the ability to reason, deduce, and induce based upon current research and practice findings”
  • Conger & Mezza, 1996
Measuring Critical Thinking and Nursing Knowledge

- Health Education systems Incorporated (HESI)*
- Methods of exam construction / evaluation rooted in critical thinking theory (Paul, 1990) and Bloom’s cognitive taxonomy (Bloom, et al, 1956)

*Now Evolve Elsevier
HESI Exam Construction

• Requirements:
  • Inclusion of rationale
  • Writing test item at the application level or above
  • Requiring multi-logical thinking to answer each question
  • Requiring a high level of discrimination to choose from plausible alternatives
HESI Item Analysis

- Measures of reliability
  - KR 20
  - Point biserial correlation coefficients

- Measures of validity
  - Content validity
  - Construct validity
  - Convergent validity
Kolb’s Theory of Experiential Learning (1984)

- Application of theoretical and abstract concepts enhance cognitive development
- Education is a result of Experience (Dewey, 1938)
- Explains the importance of incorporating practice (clinical) in the curriculum
- Importance of reflection (debriefing)
Learner Participation & Learning Retention Rates

Source:
National Training Laboratories
Bethel, Maine
Research Questions

• How does the effect of an educational intervention using the HPS on nursing students’ knowledge of medical surgical nursing compare to the effect of an educational intervention using a written case study?

• How does the effect of an educational intervention using the HPS on nursing students’ critical thinking abilities compare to the effect of an educational intervention using a written case study?

• What is the nursing student’s perspective of the educational intervention?
Research Design

Research Methodology

- Quasi Experimental 2 Group Pretest/Posttest
- Sample / Setting
- Instrumentation
  - Customized HESI Exam
  - Pretest:
    - PBCC Ave: .13
    - Diff Ave: .70
    - Rel: 0.93
  - Posttest:
    - PBCC ave: .15
    - Diff Ave: .69
    - Rel: 0.94
- Researcher Developed Questionnaire
  - Face Validity
  - Content Validity
  - Internal Consistency (Cronbach’s alpha 0.87)

- Data Analysis
  - Descriptive statistics for survey
  - ANCOVA to determine significant differences between pretest and posttest for groups
# Simulation Day
(Repeated 6 times)

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Pre-Test using specialized HESI exam on MI / CVA content</th>
<th>Simulation Experience</th>
<th>Post-Test Administer questionnaire</th>
<th>Offer Case Study Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 2</td>
<td>Pre-Test using specialized HESI exam on MI / CVA content</td>
<td>Case Study Experience</td>
<td>Post-Test Administer questionnaire</td>
<td>Offer Simulation Experience</td>
</tr>
</tbody>
</table>

### WISER
Symposium on Nursing Simulation
Sample: Age (n=49)

<table>
<thead>
<tr>
<th>Age</th>
<th>18-24</th>
<th>25-31</th>
<th>32-38</th>
<th>39-45</th>
<th>45+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sim</td>
<td>5</td>
<td>9</td>
<td>4</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Case</td>
<td>4</td>
<td>9</td>
<td>8</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>20%</td>
<td>36%</td>
<td>16%</td>
<td>20%</td>
<td>8%</td>
</tr>
<tr>
<td></td>
<td>16.7%</td>
<td>37.5%</td>
<td>33.3%</td>
<td>8.3%</td>
<td>4.2%</td>
</tr>
</tbody>
</table>

Chi Square: p=.550
**Sample: Nursing Program (n=49)**

<table>
<thead>
<tr>
<th></th>
<th>BSN</th>
<th>Second Degree Accelerated</th>
<th>Diploma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sim</td>
<td>8</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>32%</td>
<td>20%</td>
</tr>
<tr>
<td>Case</td>
<td>5</td>
<td>8</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13%</td>
<td>26.5%</td>
</tr>
</tbody>
</table>

Chi Square: p(.495)
Sample: Gender (n=49)

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sim</td>
<td>7</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>28%</td>
<td>72%</td>
</tr>
<tr>
<td>Case</td>
<td>2</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>8.3%</td>
<td>91.7%</td>
</tr>
</tbody>
</table>

Chi Square: p(.076)
Results Research

Question 1

• How does the effect of an educational intervention using the HPS on nursing students’ knowledge of medical surgical nursing compare to the effect of an educational intervention using a written case study?
Results of ANCOVA on Posttest Using HESI Conversion Score

<table>
<thead>
<tr>
<th>Group</th>
<th>Simulation</th>
<th>Case Study</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Pretest (Covariate)</td>
<td>67.25 %</td>
<td>11.11</td>
</tr>
<tr>
<td>Observed Posttest</td>
<td>73.16 %</td>
<td>10.47</td>
</tr>
<tr>
<td>Adjusted Posttest</td>
<td>74.34 %</td>
<td>--</td>
</tr>
</tbody>
</table>

For test of equality of adjusted means

F(1,46)=6.02, p=.018
Results of ANCOVA on Posttest Using HESI Conversion Score
### Results of ANCOVA on Posttest Using HESI Score

<table>
<thead>
<tr>
<th>Group</th>
<th>Simulation</th>
<th>Case Study</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Pretest (Covariate)</td>
<td>713.12</td>
<td>153.56</td>
</tr>
<tr>
<td>Observed Postest</td>
<td>738.00</td>
<td>131.01</td>
</tr>
<tr>
<td>Adjusted Posttest</td>
<td>750.42</td>
<td>--</td>
</tr>
</tbody>
</table>

For test of equality of adjusted means

F(1,46)=4.63, p=.037
Results of ANCOVA on Posttest Using HESI Score
Results Research Question 2

- How does the effect of an educational intervention using the HPS on nursing students’ critical thinking abilities compare to the effect of an educational intervention using a written case study?
### Results of ANCOVA on Posttest Using Critical Thinking Scores

<table>
<thead>
<tr>
<th>Group</th>
<th>Simulation</th>
<th>Case Study</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Pretest (Covariate)</td>
<td>700.72</td>
<td>156.64</td>
</tr>
<tr>
<td>Observed Posttest</td>
<td>737.56</td>
<td>131.57</td>
</tr>
<tr>
<td>Adjusted Posttest</td>
<td>747.71</td>
<td>--</td>
</tr>
</tbody>
</table>

For test of equality of adjusted means

\[ F(1,46)=4.03, p=.051 \]
Results of ANCOVA on Posttest Using Critical Thinking Scores

- Pretest
- Observed Posttest
- Adjusted Posttest

[Graph showing pretest, observed posttest, and adjusted posttest scores for Sim and Case conditions.]
Results Research Question 3

- What is the nursing student’s perspective of the simulation educational intervention?
  - 1 = strongly disagree
  - 4 = strongly agree
<table>
<thead>
<tr>
<th></th>
<th>Simulation</th>
<th></th>
<th>Case</th>
<th></th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helped to stimulate critical thinking abilities</td>
<td>3.84 .37</td>
<td>3.50</td>
<td>.83</td>
<td>1.8</td>
<td>.070</td>
<td>**</td>
</tr>
<tr>
<td>Was a valuable learning experience</td>
<td>3.80 .41</td>
<td>3.13</td>
<td>.68</td>
<td>4.2</td>
<td>*</td>
<td>.000</td>
</tr>
<tr>
<td>Knowledge gained from the experience can be transferred to the clinical setting</td>
<td>3.80 .41</td>
<td>3.46</td>
<td>.78</td>
<td>1.9</td>
<td>.059</td>
<td>**</td>
</tr>
<tr>
<td>Should be included in our undergraduate education</td>
<td>3.76 .44</td>
<td>3.29</td>
<td>.751</td>
<td>2.6</td>
<td>.010</td>
<td>*</td>
</tr>
<tr>
<td>Helped me better understand concepts</td>
<td>3.72 .46</td>
<td>3.25</td>
<td>.74</td>
<td>2.6</td>
<td>.010</td>
<td>*</td>
</tr>
<tr>
<td>Experienced nervousness during the educational intervention</td>
<td>3.56 .51</td>
<td>1.67</td>
<td>.82</td>
<td>9.7</td>
<td>.000</td>
<td>*</td>
</tr>
<tr>
<td>Were realistic</td>
<td>3.56 .51</td>
<td>3.46</td>
<td>.72</td>
<td>.57</td>
<td>.569</td>
<td></td>
</tr>
<tr>
<td>Because of the educational intervention, I will be less nervous in the clinical setting when providing care for similar patients.</td>
<td>3.00 .82</td>
<td>2.58</td>
<td>.78</td>
<td>1.8</td>
<td>.074</td>
<td>**</td>
</tr>
<tr>
<td>Can be a substitute for clinical experiences in the hospital.</td>
<td>2.56 .92</td>
<td>1.92</td>
<td>1.10</td>
<td>2.2</td>
<td>.027</td>
<td>*</td>
</tr>
</tbody>
</table>

* Significant at p<.05    **Significant at p<.10
Student Evaluation Surveys

*Significant at p<.05
**Significant at p<.10

![Bar chart with performance metrics such as Sim CT**, Valuable*, Transfer to Clinical**, UG Ed*, Understand*, Nervous*, Realistic, Less Nervous**, and Sub for Clinical*.](chart.png)
You are caring for a 60yof admitted with SOB, DOE, and Orthopnea in the ED. She has a h/o heart failure and HTN.

- “Help me...I’m having trouble... catching... my breath”

- Simulation Demonstration
Implications for Nursing Education

• HPS is an effective method for nursing education
• HPS can stimulate CT abilities
• Strong significant differences between the groups with respect to:
  • Understanding concepts
  • Valuable learning experiences
  • Substituting clinical experiences
  • Inclusion in undergraduate education
  • Invoking nervousness
What’s the future?

• Needed:
  • Outcome Studies
  • Reliable and Valid Measurement tools
  • Comparison Studies

Evidence Based Nursing Education
The End!

Any Questions?