CONCEPTUALIZING SIMULATION RELATED RESEARCH

Adam Dubrowski
Parson Hicks
Overview

- Workshop 1: Conceptualizing simulation research
- Workshop 2: Methods used in simulation research
- Workshop 4: Outcomes, evaluations and assessments
- Workshop 4: Data collection and analyses
- Workshop 5: Dissemination
- Workshop 6: Funding
- Workshop 7: Becoming familiar with BCHSP’s Research process
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Today

- Introductions 1300-1315
- Becoming familiar with technology 1315-1330
- Brief history of simulation research 1330-1400
- Asking a structured question 1400-1415
- Independent work: Generating a question 1415-1430
- Presentations and critique 1430-1500
- Break 1500-1515
Today

- Role of theory in simulation research 1515-1545
- Domains of literature 1545-1600
- Independent work:
  - Looking for domains of literature and theory 1600-1620
- Presentations and critique 1620-1655
- Wrap up 1655-1700
Introductions

• Name
• Clinical background
• Experience with research
• Why are you here?
• Tell us something personal/unique about yourself.
• Over the course of these workshops we will work with 3 of my friends. All of them are at the beginning of their journeys as researchers in simulation. However, all have worked with simulation as educators.

• We will help them develop their skills and move their interests in the use of simulation in training into research projects and programs.
Andrew is a new faculty member in our university. He is an urologist by training. Last year he completed a MEd degree, which was a course based and part time program. Currently, his responsibility is to “develop simulation capacity” in one of the teaching hospitals, but he also needs to show research productivity for tenure and promotion.

Andrew has worked with an engineering department in the hospital to build a pediatric version of a laparoscopic skills trainer (Fundamentals of Laparoscopic Surgery - peds: FLSpeds). He wants to evaluate the effectiveness of this tool.
Sarah is an emergency room physician. She has no formal, graduate level training in education or research. She is currently working in a large teaching hospital and is appointed to the university at a level of lecturer and simulation educator. Although she is not expected to conduct research, she plans to apply for a position of assistant professor and to do so, she will need to document her ability to secure funding, as well as peer reviewed presentations and publications.

She is really interested in how to provide feedback to learners during clerkship surgical simulation training.
Norman is a nurse. He has a graduate level MEd training. He is a full time nursing faculty member at the university, and as such does not do any clinical work. He uses simulation in preparing nursing students for their clinical placements.

He is interested in evaluating the effectiveness of this approach.
Technology
A Brief History of Simulation Research
MATURING FIELD

Description
“What we did”

Justification
“Did it work?”

Clarification
“How does it work?”

Cook, Bordage & Schmidt, 2008
1990s-mid 2000s

- Struggle: resources, access, time funding, etc...
- Position papers & advocacy
  - Ziv, Gaba, Reznick, etc..
- Climate of scepticism
Wolbrink TA, Kissoon N, Burns JP.

The Development of an Internet-Based Knowledge Exchange Platform for Pediatric Critical Care Clinicians Worldwide.

Research was identified as a very important step in the acceptance
- Acceptance by trainees, trainers and patients
- Ability to assessments
Simulation vs. didactic learning

Grober, Hamstra, Wanzel et al. (2004)
It’s no longer a question of

IF
But a question of "How & Why"
“The field of patient simulation has gotten to where it is now because it makes sense, but we need more science behind it to guide its use.”

Jim Gordon
Distributed vs. Mass Practice

- 4 sessions in 1 day
- 1 session/week over 4 weeks

Moulton et al., 2006

Description
“What we did”

Justification
“Did it work?”

Clarification
“How does it work?”

Moulton et al., 2006
- Acceptance by trainees, trainers and patients
- Ability to assessments

- Enhanced learning
- Enhanced transfer to clinical setting
Examples of questions when simulation is the object of research

Description
“What we did”

Justification
“Did it work?”

Clarification
“How does it work?”
Operational

- How do we reduce the costs / resources of simulation?
- How do we obtain large scale data?
- How do we create effective research collaborative?
- What balance is optimal between simulation and bedside learning?
Education: How to optimize learning?

- Feedback (when? how? what type?)
- Practice (what kind? how often?)
- Inter-professional education
- CE & maintenance of competencies
- Match between skills and modality
Assessment: Development and validation of assessments tools and metrics

- Individuals and teams
- Assessing communication and “non-technical skills”
- Predictive validity

Description
“*What we did*”

Justification
“*Did it work?*”

Clarification
“*How does it work?*”
New and emerging research questions:

- Means to research: Rich environment to study performance & systems
Cognitive & Behavioral Science
• How do people learn?

Human-Machine Interactions
• Testing new equipment

Teamwork
• What makes teams efficient?

Performance Shaping Factors
• What can harm or enhance clinical performance?

Systems-based
• Implementation of new protocols
5 min “Think - Pair – Share”

Where do you see yourself and the questions you are asking?

Description
“What we did”

Justification
“Did it work?”

Clarification
“How does it work?”
• Wants to evaluate the effectiveness of FLSpeds.

Andrew

Description
“What we did”

Justification
“Did it work?”

Clarification
“How does it work?”
• Interested in how feedback should be delivered in training of surgical skills to 3rd year undergraduate medical students.

Sarah

Description “What we did”

Justification “Did it work?”

Clarification “How does it work?”
• Interested in evaluating the effectiveness of simulation training on preparing junior nursing students for clinical placement.
You need to generate an answerable question
Types of Questions

Education/Simulation

- Determining the effect of *educational* interventions
- Optimizing the intervention
- Developing supportive technologies
- Developing measurements
Matching Question to Study Design

- Quantitative studies are most useful for answering questions of “how many” or “how much”
Matching Question to Study Design

- Quantitative studies are most useful for answering questions of “how many” or “how much”.

- Qualitative studies are most appropriate for exploring situations and developing explanations; “why did X occur” or “what contributes to Y.”
Quantitative Questions (PICO)

- Population
- Intervention or exposure
- Comparison
- Outcome
Quantitative Questions (PICO)

The Population

- Who are the trainees?
- Why are they enrolled?
- Is there a grouping?
- Is there a particular profession?
- What else?

This is important for generalizability.
Quantitative Questions (PICO)

The Intervention

• The intervention needs to be described in a way to allow others to replicate it.
• Only “active” ingredients need to be described.
• Avoid descriptions of institutional/local factors as they are part of the setting.
Quantitative Questions (PICO)

The Comparison

• What are the current educational practices or what are other possible educational practices that we are interested in comparing?
The Outcome

• What are the relevant consequences of the intervention in which we are interested?

  • Satisfaction
  • Performance
    – Individual
    – Team
    – Patient
  • System changes
  • Economics
Asking Questions: Qualitative Approach
Quantitative Theory

Hypothesis → Data → Conclusions

Qualitative Observations

Data → Descriptions → Patterns → (Theory)

<<<<<<<<<<<Extended Period of Time>>>>>>>>>>>>
Asking Questions: Qualitative Approach

Step 1: Select research topic
Step 2: Determine research question
Step 3: Generate a list of preliminary questions

Questions can be changed or modified

Naïve
Less Important

Data Collection & Analysis

Relevant
More Important
Asking Questions: Qualitative Approach

What is it?
Interrogative sentence asks a question about something to be explored

What are the subject areas?
- Processes
- Issues
- Phenomena

What are the characteristics?
- General
- Open-ended
- Overarching

How do I begin?
- Create your statement of purpose
- Draft your research question
- Develop more specific sub-questions
Example

Statement of Purpose: The purpose of this study was to explore how frequent exposure to medical simulation influenced trainee interactions with live patients.

Research Question:

“How does medical simulation influence trainees’ interactions with live patients?”

Follow-up:

1. The **first aim** of this study was to determine how medical simulations affected trainees live patient interactions.
2. The **second aim** of this study was to identify what about simulation influenced trainee interactions.

Begin formulating your interview questions
Andrew

Wants to evaluate the effectiveness of FLSpeds.

Does training on FLSpeds lead to improved performance on FLS in junior urology residents?

Description
“What we did”

Justification
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Clarification
“How does it work?”
Sarah

How feedback should be delivered in training of surgical skills.

When teaching 3rd year medical students intubation skills in simulation, is feedback about performance more effective than feedback about outcomes?

Description “What we did”

Justification “Did it work?”

Clarification “How does it work?”
Effectiveness of simulation training on preparing junior students for clinical placement.

What is the effectiveness, acceptability and feasibility of simulation training in preparing junior nursing students for clinical placements?
Research Question(s)

a. If quantitative try to specify:
   - P
   - I
   - C
   - O

b. If qualitative what is your lead question? What would be the follow up questions?

c. Write it down your question (in Google docs):
Break
Theory
What is theory and how does it help us with our research?
• Can you name a theory?
• What IS a theory?
• What makes something a theory?
What is a theory?

• Provides complex, well-worked out conceptual understanding of things that cannot be simply and easily pinned down
  – How the world works: atoms, cells, animals, societies, solar systems
How can theory help us in research?

It's no longer a question of IF
How can theory help us in research?

But a question of

HOW & WHY
Three ways of thinking about theory

• That which may inform our understanding of the phenomenon under investigation
  – Theory as a ‘lens’
• That which underpins research design
  – Theory as paradigm
• That which may emerge from our study
  – Theory as new knowledge
How can theory help us in research?

Theories provide different ‘lenses’ through which to look at complicated problems.

Crucial to:
• Make predictions
• Inform next questions
• Generalize
Theory-based Research: When done right...

- Leads to sustained and coordinated program of research
- Each study will build upon the results of previous work
Theory-based Research: When done wrong...

Without basic understanding and theories to guide us:
− Isolated & duplicated efforts
− Studies that “prove” what we already know
− Risk of “me too” studies
− Local rather than general answers

“Accumulation of bricks without building the house”
A simple classification of theories

Theories can be classified:

– By “scope”: Macro (grand), Meso, Micro
– By “function”: Predictive (experimental), explanatory (correlative), descriptive (qualitative)

They can be found in various domains of literature:

– Education
– Human performance
– Program evaluation
– Psychology
Scope

Theories can be classified by the scope, or universe they are meant to apply to:

- **Grand**: Universal, societal level theories
- **Meso**: Local, recognition of cultural or context variation
- **Micro** (or practice/applied): Individual level, interaction and local context key
Scope

As applied to simulation research:

- **Grand:** People learn through experiences (Constructivism)
- **Meso:** Deliberate practice and repetition is necessary for learning (Ericsson)
- **Micro:** Distributed practice is more beneficial than massed practice (Moulton)

Scope

Utility and applicability of the theory is typically inversely proportional to its scope.

“Smaller may be better”
Function

• **Predictive** (Experimental): X causes Y
  – Students randomized to terminal vs continual feedback perform better on technical skills retention tasks (Walsh)

• **Explanatory** (Correlative): X associated with Y
  – Scores on medical school OSCEs predict prescribing (Tamblyn)

• **Descriptive** (Qualitative): X occurs/is experienced
  – Standardized patients may have residual symptoms from playing roles (role adherence, McNaughton)
Domains of literature

• There are many domains of literature
• When searching for a theory, search out the root theory
Domains of literature

Step 1: Search in simulation research literature

Step 2: Identify theory and original domain

Step 3: Search in the original domain

Step 4: Read the original theory
“There’s nothing so practical as a good theory”

Kurt Lewin
Wants to evaluate the effectiveness of FLSpeds.

1. Scope: Mid range
2. Function: Predictive
3. Domain: Kinesiology
Type of feedback delivered (outcomes vs. performance).
1. Scope: Micro
2. Function: Explanatory
3. Domain: Education/cognitive psych

Sarah

Description
“What we did”

Justification
“Did it work?”

Clarification
“How does it work?”
Effectiveness of simulation training on preparing junior students for clinical placement.

1. **Scope**: Mid
2. **Function**: Predictive
3. **Domain**: Program evaluation

**Norman**

**Description**

“What we did”

**Justification**

“Did it work?”

**Clarification**

“How does it work?”

Effectiveness of simulation training on preparing junior students for clinical placement.

1. **Scope**: Mid
2. **Function**: Predictive
3. **Domain**: Program evaluation

**Norman**

**Description**

“What we did”

**Justification**

“Did it work?”

**Clarification**

“How does it work?”
Where are you?

1. Scope:
2. Function:
3. Domain:

Description “What we did”

Justification “Did it work?”

Clarification “How does it work?”
Yikes! - do I need to do a PhD?
Living in Pasteur’s Quadrant
Pasteur’s Quadrant

- **Pasteur's quadrant** is a label given to a class of scientific research methods that both seek fundamental understanding of scientific problems, and, at the same time, seek to be eventually beneficial to society.
Quadrant model of research

- Pure basic research (Bohr)
- Use-inspired basic research (Pasteur)
- Pure applied research (Edison)
Left to their own devices, PhDs are at risk of conducting research with little applicability
Left to their own devices, Clinicians are at risk of conducting research that meets only local needs, with little impact on field.
Collaborative effort: Negotiation between useful and knowledge generating
EXAMPLE
Randomised, controlled study investigating the optimal instructor: student ratios for teaching suturing skills

Adam Dubrowski & Helen MacRae

INTRODUCTION Recently, there has been a shift away from practising procedures on patients for the first time and towards bench model teaching of clinical skills to undergraduate medical students. However, guidelines for the most effective instructor: student ratio for technical skills training are unclear. This has important implications for staffing laboratory based teaching sessions. The purpose of this study was to assess the optimal ratio of teachers to learners during the teaching of a simulated wound closure.

in learning, and lower ratios of instructors to students resulted in significantly less learning. These findings are in keeping with current motor learning theories.

KEYWORDS randomised controlled trial (publication type); humans; *suture techniques; clinical competence/*standards; teaching/*methods; education, medical, undergraduate/*methods; analysis of variance.

Medical Education 2006; 40: 59–63
**Feedback**

Frequency and amount

**Scheduling of faculty**

How many for optimal learning?
Ratio
1:12
Ratio
1:4
The purpose was to investigate the optimal teacher to students ratio, from low, to medium, to high, in order to optimize the amount of feedback that junior medical students receive to improve suturing proficiency.
The purpose was to investigate the optimal teacher to students ratio, from low, to medium, to high, in order to optimize the amount of feedback that junior medical students receive to improve suturing proficiency.

Feedback
Testing the role of feedback in learning of complex psychomotor skills.

1:4 most optimal ratio

Scheduling of faculty
Best practice guideline for scheduling faculty.
Are you in this quadrant?
Overall Objective
Hands-on

• Independent work:
  Looking for domains of literature and theory 1600-1620
• Presentations and critique 1620-1655
Andrew

Theory
Transfer of learning/Learning specificity theory


Description
“What we did”

Justification
“Did it work?”

Clarification
“How does it work?”
Theory
Knowledge of performance vs. knowledge of outcomes.

Theory

Utilization focused evaluation


Norman

Description
“What we did”

Justification
“Did it work?”

Clarification
“How does it work?”
Theory

a. Search pubmed/google scholar for articles looking at similar questions

b. How many did you find?

c. Review 1 or 2 of the papers with the best fit. Can you find theory (do not be disappointed if you can’t)?

d. Are the authors making references to original theory?
   • If yes, look it up in the reference section and find it.
   • If not, repeat steps a-c.

e. What is the theory?

f. Is the scope appropriate?

g. What is the main domain of literature where it came from?

h. Does it match your question?

i. Can you use it to make predictions?