A Conceptual Theoretical Framework for Simulation Education

Dr Irwyn Shepherd. EdD, EdM. BAppSci, PGcertICU, RN, FACN
Education Technology (Simulation) / Assessment Specialist
Monash Education Innovation
Portfolio of the Deputy Vice Chancellor - Education
Executive Summary

• Outcomes of a Doctor of Education study

• Research generated from expert recommendations
  o Social constructivist perspective
  o Evaluation paradigm

• The combined data (literature, questionnaires, modified Delphi technique):
  o Demonstrated need
  o Informed design

1. Victoria University Human Research Ethics Committee. Approval HRE14-060
Acknowledgements and Declarations

- Dr. Trish Burton, PhD (Principle Supervisor)
- Dr. Margaret Malloch, PhD (Associate Supervisor)
- Mr. Mark Sugarman (Information Technology guru)

- Participants from the simulation centres (Volunteers)
- Experts involved in modified Delphi study (Approached)

**No Conflicts of Interest to declare**
Background Premise:

Facilitators without formal preparation more likely to rely on previous simulation teaching and learning experiences to guide their own practice.

This approach seen as:
- Ad hoc
- Atheoretical
- Devaluing complexity of teaching and learning in simulation

Imperative that simulation programs be a component of a broader teaching / learning activity that is underpinned by an explicit philosophy and theoretical framework of teaching and learning.

(Wilson, Shepherd, Sage & Flanagan, 2005)
Outcomes 1

Pre and post-interview results indicate program is achieving aims

- Candidates have clearer understanding of role

- Teaching / learning framework provides clearer direction for Facilitators and Learners alike

- Imperative that there is a common philosophy of teaching and learning
Outcomes 2

- Participants bring wealth of personal and professional experience to situation

- **Key ingredient:** A framework that acknowledges different entry levels and different roles, whilst valuing the role each person involved in the simulation

- **Also necessary:** Recognition of preferred individual learning styles / preferences / choices

- **Important:** Facilitators have rudimentary understanding of learning theories and how they can be used in practice
This Study ..... 

A Conceptual Theoretical Framework for Simulation Education

- 1: Adult Learning Theory
- 2: Self-determined Learning
- 3: Tacit Knowledge
- 4: Learning Styles / Characteristics / Preferences
- 5: Experiential Learning
- 6: Critical Thinking / Clinical Reasoning / Clinical Judgement
- 7: The Reflective learner / Guided reflection
- 8: Skill Development and Clinical Competence
- 9: Self-efficacy
- 10: Deliberate Practice and Acquisition of Expert Performance
Two Pivotal Papers Underpinning This Study*


Research Questions—Learning Acquisition, Retention of Skills, and Cognitive Load

*How do theories of learning and teaching inform the design of simulation interventions (eg, frequency, timing, and deliberate practice)?*

****** ****** ******


*We propose that a theoretical framework for simulation .... must first include, as a basis, a theoretical understanding of human performance and how it is enhanced.*
Kaakinen & Arwood (2009) support hypothesis that use of theories to underpin research in simulation is **not at all optimal**

Rourke et al. (2010) determined that of the papers that matched their inclusion criteria, **45% made no use** of theory, **45% made minimal use** and **10% made adequate use**.

Murdock (2012) identified majority of studies (n=11/17) did not present evidence of an underlying education model or learning theory in the design of the teaching/learning approaches or choice of outcome measurement tools (*initial article capture: n = 375*).

---


‘A group of concepts that are broadly defined and systematically organized to provide a focus, a rationale, and a tool for the integration and interpretation of information.

Usually expressed abstractly through word models, a conceptual framework is the conceptual basis for many theories … ’ (p.1)

The Free Dictionary by Farlex (2013)
Educational philosophy underpinning Conceptual Framework

• Simulation - a constructivist-based teaching and learning change agent

• Supported by elements of:
  o Behaviourism (clinical actions)
  o Cognitive-based learning (provided knowledge)

• The constructivist theory of learning assumes that learners construct knowledge to make sense of their experiences and interpretations

• As learners we are actively seeking and understanding in our lives

• Theory intended to foster development of:
  o critical thinking
  o relationships between skills development, collaboration and inquiry
Education Theories

• A scientifically supported set of principles designed to:
  o *explain* an educational occurrence
  o *provide* a framework for interpretation of observations
  o *function* as a link between research and practice

• Education theories underpin all educational:
  o design, content, delivery
  o evaluation, assessment
  o practice, performance and attitude
A Conceptual Framework for Simulation in Healthcare Education

A theoretical model designed to ensure the efficacy of simulation as a teaching, learning and assessment method.

It is the construct of a framework that will encourage development of a standard in how simulation education may be best used (Shepherd, 2014).
Research Questions

- What conceptual frameworks and theoretical models are cited in the literature that inform simulation interventions?

- Do the identified conceptual frameworks and theoretical models actually inform and guide the design, delivery and evaluation of simulation interventions?

- What best constitutes the design of a conceptual framework that will contribute to the design, delivery and evaluation of simulation interventions?
The study entailed:

- Identification of current conceptual frameworks and theoretical models which inform / guide simulation interventions

- Identifying and analysing whether those conceptual frameworks and theoretical models actually informed and guided the design, delivery and evaluation of simulation interventions

- Use of evaluation research using questionnaires and a modified Delphi technique

- Development of a conceptual framework that will contribute to simulation – based education by informing and guiding, the design, delivery and evaluation of future simulation interventions.
Phases of Data Collection

Phase 1

a. Systematic literature search and review \( (n = 500) \)

b. Questionnaire: *Education Frameworks in Simulation Centres*
   
   **Sent:** Thirty \( (n=30) \) randomly selected simulation centres (international / national)
   
   **Returns:** \( (n = 19 / 63.33\%) \) / broad/ diverse site responses (reduced locale bias)

Phase 2

a. Design and development of a draught Conceptual Framework

b. Use of a web-based functioning framework graphic

Phase 3

a. Questionnaire(s) with first draft / revised Conceptual Framework
   
   **Participants:** six \( (n =6) \) Experts (100% response)

2. Copyright permission obtained from government agency
An overview of the forty-five (45) publications retrieved make mention of education theories and/or identify the concept of a framework / or apply a framework.

In twenty-five (n = 25 / 55.56%) there was no identification of a guiding Conceptual Framework.

Of the other twenty (n = 20 / 44.44%) the minimal information documented was restricted to author mention of the application of a Conceptual Framework within the context of the publication.
A number of systematic reviews, meta-analyses and other like reports (n = 25) retrieved have occurred over the last decade.

While there is some mention and discussion of education theories and underpinnings permeating this literature set, there is no presentation of an actual conceptual framework that addresses the application of many of the education theories identified in the literature and reported on previously.
Data Collection: Modified Delphi technique (evaluation research)

- A well-used and accepted group-oriented process in gathering information in a constructive way from expert participants

- The two pivotal elements that make up the Delphi Technique are;
  - Sequential questionnaires; and
  - Regular feedback to participants

- Agreement, disagreement and insights from the same pool of expert participants. Responses collated and summarised

- Consensus gained in and merging of, opinions and recommendations, following initial assessment, exploring of alternatives and assumptions

- The process goes on until no new opinion emerges
Data Analysis

Phase one

• **Significant high level literature support:**

Ongoing gap in the literature continues to suggest that the users of simulation currently are not commonly or regularly making the link between Conceptual Frameworks (that encompass educational theories, learning models and learning outcomes) and simulation education activity.

Phase two

• **Questionnaire to Simulation Centres: Need and support for CF**

These collective data and themes demonstrated there remains a need for and supports the development of a Conceptual Framework.

Phase three

• **Evaluation of Delphi technique data**

The total mean scores and the mean scores demonstrate an overall Medium to High levels of appraisal of the Conceptual Framework for Simulation in Healthcare Education. These data provide strong confirmation for the design and intent of the Conceptual Framework for Simulation in Healthcare Education.
# Evaluation of modified Delphi technique data

<table>
<thead>
<tr>
<th>Question</th>
<th>Area of Evaluation</th>
<th>Type of Evaluation</th>
<th>Degree of Evaluation</th>
<th>H</th>
<th>M</th>
<th>L</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q.1</td>
<td>Framework</td>
<td>Face validity</td>
<td>Medium to high</td>
<td>16.7</td>
<td>83.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q.2</td>
<td>Framework</td>
<td>Content validity</td>
<td>Medium to high</td>
<td>33.3</td>
<td>66.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q.2.1</td>
<td>Philosophy Theory</td>
<td>Content validity</td>
<td>Medium to high</td>
<td>50.0</td>
<td>50.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q.3</td>
<td>Framework</td>
<td>Construct validity</td>
<td>Medium to high</td>
<td>16.7</td>
<td>83.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q.3.1</td>
<td>Theory 1</td>
<td>Construct validity</td>
<td>High to medium</td>
<td>66.7</td>
<td>33.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q.3.2</td>
<td>Theory 2</td>
<td>Construct validity</td>
<td>Medium</td>
<td>16.7</td>
<td>66.6</td>
<td>16.7</td>
<td></td>
</tr>
<tr>
<td>Q.3.3</td>
<td>Theory 3</td>
<td>Construct validity</td>
<td>Medium to high</td>
<td>33.3</td>
<td>50.0</td>
<td>16.7</td>
<td></td>
</tr>
<tr>
<td>Q.3.4</td>
<td>Theory 4</td>
<td>Construct validity</td>
<td>Medium</td>
<td>33.3</td>
<td>33.3</td>
<td>33.3</td>
<td></td>
</tr>
<tr>
<td>Q.3.5</td>
<td>Theory 5</td>
<td>Construct validity</td>
<td>High to medium</td>
<td>66.6</td>
<td>16.7</td>
<td>16.7</td>
<td></td>
</tr>
<tr>
<td>Q.3.6</td>
<td>Theory 6</td>
<td>Construct validity</td>
<td>Medium to high</td>
<td>50.0</td>
<td>50.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q.3.7</td>
<td>Theory 7</td>
<td>Construct validity</td>
<td>High to medium</td>
<td>66.7</td>
<td>33.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q.3.8</td>
<td>Theory 8</td>
<td>Construct validity</td>
<td>Medium to low</td>
<td>33.3</td>
<td>33.3</td>
<td>16.7</td>
<td>16.7</td>
</tr>
<tr>
<td>Q.3.9</td>
<td>Theory 9</td>
<td>Construct validity</td>
<td>Low</td>
<td>33.3</td>
<td>50.0</td>
<td>16.7</td>
<td></td>
</tr>
<tr>
<td>Q.3.10</td>
<td>Theory 10</td>
<td>Construct validity</td>
<td>High to medium</td>
<td>50.0</td>
<td>50.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q.4</td>
<td>Framework</td>
<td>Inter-rater reliability</td>
<td>Medium</td>
<td>20.0</td>
<td>40.0</td>
<td>40.0</td>
<td></td>
</tr>
<tr>
<td>Q.4.1</td>
<td>Framework</td>
<td>Test - retest</td>
<td>Medium to low</td>
<td>40.0</td>
<td>40.0</td>
<td>20.0</td>
<td></td>
</tr>
<tr>
<td>Q.4.2</td>
<td>Framework</td>
<td>Internal consistency</td>
<td>Medium</td>
<td>40.0</td>
<td>40.0</td>
<td>20.0</td>
<td></td>
</tr>
</tbody>
</table>

### Raw score (n = 19)
- Mean: 626.6
- Standard Deviation: 729.8
- Maximum: 213.4
- Minimum: 113.4

### Mean (n = 19)
- Mean: 32.97
- Standard Deviation: 38.41
- Maximum: 11.23
- Minimum: 5.96

### Mean of respondents evaluation (n = 6)
- Mean: 5.5
- Standard Deviation: 6.4
- Maximum: 1.9
- Minimum: 0.99
Use of the Conceptual Framework for Simulation

- The combined data (literature, questionnaire, modified Delphi technique) demonstrated the need for such a conceptual framework - and informed its design.

- The model which emerged as a distillation of the findings of the study is the “Conceptual Framework for Simulation in Healthcare Education”.

- The web-based conceptual framework model can be accessed via PC, Laptop, Tablet or Smart phone.

- It encourages the user to consider and apply a number and mix of education theories and models when designing, delivering and evaluating a simulation activity.
The 10 Education Theories / Models / Concepts in the Model

- Andragogy
- Heutagogy
- Tacit Knowledge
- Learning Styles and Characteristics
- Experiential Learning
- Critical Thinking / Clinical Reasoning / Clinical Judgement
- Debriefing and Guided Reflection
- Novice to Expert
- Self-efficacy
- Acquisition of Expert Performance
Web link:

- 1: Adult Learning Theory
- 2: Self-determined Learning
- 3: Tacit Knowledge
- 4: Learning Styles / Characteristics / Preferences
- 5: Experiential Learning
- 6: Critical Thinking / Clinical Reasoning / Clinical Judgement
- 7: The Reflective learner / Guided reflection
- 8: Skill Development and Clinical Competence
- 9: Self-efficacy
- 10: Deliberate Practice and Acquisition of Expert Performance
Scenario development / delivery / evaluation steps:

- Identify content in curriculum / subject for simulation
- Map what education theories needing to be met
- Identify required Learning Outcomes
- Identify / apply appropriate Taxonomy level (Blooms)
- Identify what Evaluation level to be measured
- Develop scenario using template
- Test for validity and reliability markers
- Deliver and evaluate
- Close quality action research loop
Conclusions

- Extensive precursor literature review set the context
- Internationalisation of simulation (positive, evolving, dynamic)
- Impact on preparation and implementation
- Judicious number of authors acknowledged presence, or need, or use of a variety of education theories in the context of their respective studies or reports … but ….
- Paucity of evidence demonstrating overt use of Conceptual Frameworks
- Implications of frameworks used - but modest demonstrable evidence
- Differences in understanding about education theories and their role*
- Paucity in knowledge about how to apply such theories*
- Recurring evidence of demand that such activity is required

- The study design produced rich data that answered the research questions and supported the aims of the study
Recommendations

- The journey begins
- Modifications to be considered
- Development / fine tuning of application tools that will allow users to translate the theoretical elements into contextual reality
- Research required to investigate its potential impact on learning outcomes in different settings
- Further enhancement - design and delivery adaptation
The iterative steps in the development of Educational Fidelity to deliver Authentic Simulation

Davies, A., Leigh, E., Shepherd, I. © 2018
The degree to which the trainee perceives the simulation to be a believable surrogate for the trained task. The trainee suspends disbelief and enters into fiction contract (Rehmann, Mitman, & Reynolds, 1995)

Environmental
The extent to which the simulator/site/other ancillary props duplicates motion cues, visual cues, and other sensory information from the task environment (High fidelity manikin/complete OR setting/monitor sounds/real ancillary equipment and consumables) (Dahl et al., 2010)

Engineering
The degree to which the simulator duplicates the appearance and feel of the real system (patient/bowel/spine/haptic) (Dahl et al., 2010)
Thank you!