A Conceptual Framework for Simulation in Healthcare Education

Submitted by
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ABSTRACT

The purpose of this research was the development of a conceptual framework for simulation in healthcare education. A social constructivist perspective guided this study.

It entailed the identification of the current number of conceptual frameworks and theoretical models cited in the literature which inform and guide simulation interventions; identifying whether those conceptual frameworks and theoretical models actually guided the design, delivery and evaluation of simulation interventions. Through evaluation research and the utilisation of a modified Delphi technique, the development of a conceptual framework that will inform and guide the design, delivery and evaluation of future simulation interventions has been developed.

The review of the literature and the collected data demonstrated the need for such a conceptual framework and contributed to its design. The model which has emerged as a distillation of the findings of the study is the "Conceptual Framework for Simulation in Healthcare Education".

The conceptual framework model, is web-based and can be accessed via personal computer, laptop, tablet or mobile phone. Using a recurring set of questions embedded in each theory presentation, it encourages the user to consider the use of a number and mix of education theories and models when designing, delivering and evaluating a simulation activity. Activity templates are also presented. Research around its application is recommended.

Statement of Authorship

Declaration

“I, Irwyn Shepherd declare that the Doctor of Education thesis entitled A Conceptual Framework for Simulation in Healthcare Education is no more than 60,000 words in length including quotes and exclusive of tables, figures, appendices, bibliography, references and footnotes. This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work”.

[redacted]

Irwyn Shepherd
2017

Dedication

I would like to dedicate this dissertation to my late parents Ena and Jack Shepherd who worked extremely hard all their respective lives in providing for and raising my four siblings and myself. We have all prevailed and gone on to achieve and succeed in our endeavours.

I would also like to dedicate this culmination of education work and personal achievement to Kate, Nick and Alex who have been supportive as a family as I faced the challenges of working, a minor health challenge, study, research, reviewing, critiquing, writing, space and time management.

Finally I would like to dedicate the concept and the application of a Conceptual Framework for Simulation in Healthcare Simulation to all those in the simulation community who can appreciate both the journey and effort required to help ensure that simulation will become completely embedded into the culture of teaching, learning and assessment of healthcare professionals in the future.

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I would like to acknowledge the participants from the simulation centres and the experts involved in the Delphi study, who volunteered to respond to the questionnaires and thus supported this study. They took valuable time out of their professional working life to answer the study's questions and provide valuable feedback and thus help me acquire and accumulate the data I needed.

Prologue: Researcher's perspective

As the researcher, the motivation for undertaking this study has emerged from the aggregate of my professional experiences and postgraduate studies, which have contributed to an appreciation of simulation as a learning and teaching method.

During my professional nursing practice, health care professions have increasingly identified the value of scenario-based simulation activities to reinforce concepts and practices. That is, simulation provides students with an interactive, immersive learning approach that facilitates the application of theory to practice in a safe setting.

As a consequence, it became an imperative for me to look for and use simulation-based training equipment and techniques that would enhance the learning opportunities for students. From these early activities, which included use of various task trainers, simulators and simulated patients, I have subsequently developed significant understanding, experience and expertise in the use of simulation as a teaching, learning and assessment method.

Early in my professional evolution as a simulation educationalist I recognized, that for simulation as a teaching, learning and assessment education method to be as effective as it could be, there were fundamental educational requirements that needed to be addressed. I identified and have continually advocated that simulation as a teaching, learning and assessment education method requires an education framework underpinning its design, development, application and functionality.

Since then I have been constantly reviewing the literature and while there is significant evidence of various education theories – inclusive of teaching and learning theories and models - being taken into consideration, there appears to be minimal research that demonstrates the design, application and outcomes of an over-arching conceptual theoretical framework for simulation.

This has led to this research journey and the development of a Conceptual Framework for Simulation in Healthcare Education that will potentially assist simulation education. This activity is answering, in part, the repeated call in the literature for further research into simulation.

Chapter 1

Introduction to the Research

Introduction

This chapter identifies the background of the study in relation to research in simulation, as it relates to healthcare workforce education and clinical practice, and the significance of the study. A particular focus on education theory and its relationship to simulation along with the aims, goals and research questions are provided, along with the direction of the study. As part of the discussion, a number of definitions pertinent to simulation are provided, along with the rationale for using simulation in healthcare education, the motivations for the development of simulation education, and the use of simulation as a teaching and learning method. A return on investment perspective is also provided.

Background of the study

The contemporary investment in and the use of simulation as a teaching, learning and assessment method in healthcare education is expanding rapidly at an international level. In many countries simulation is increasingly penetrating and influencing the preparation, professional development and continuing education requirements of most disciplines of the healthcare workforce.

Significant triggers for this were a series of landmark research publications in the United States and Australia around patient safety issues regarding human factors and systems failures that recommended that simulation be used as a proactive educational strategy to mitigate risk, reduce adverse events and improve patient outcomes (Chamberlain, 2003; Kohn, Corrigan & Donaldson, 1999; Wilson, et al, 1999). There was a subsequent response to this across the globe.

Evolving awareness

The increased use of simulation in healthcare education is now well documented (Raemer, 2006; Katz, Peifer & Armstrong, 2010; Milkins, Moore & Spiteri, 2014). The current, ever-expanding simulation literature covering medical, nursing, allied health plus other healthcare disciplines is testament to that. There is an extensive range of commentaries, reports and research publications in an evolving range of journals plus an emerging body of reference books all contributing to the mounting wealth of knowledge and practice that is healthcare simulation (Donaldson, 2008; Ker & Bradley, 2010; Health Workforce Australia, 2010; Department of Health, 2011; Levett-Jones, 2013; Wall, et al., 2014).

Evolving acceptance

From a synoptic perspective Raemer (2006) reports that the majority of disciplines in healthcare are embracing a range of simulation methods to help improve education outcomes, mitigate risk and have a positive influence on patient safety. This is reinforced by significant review, commentary and recommendations in the United Kingdom Chief Medical Officer's Annual Report (Donaldson, 2008) regarding the value of and need for increased investment in simulated learning technologies into the future. Focusing thematically on safer medical practice and the place simulation can play, the report embraces and analyses a range of issues. These include, through the providing of authentically replicated clinical practice settings, the development of simple to complex or new skills training and assessment; the better preparation of personnel for rare, risky and time-critical events; the supporting of experiential learning to better prepare for real life practice and providing positive learning and practice experience through rehearsal in a controlled, planned and safe learning environment.

Further issues include the provision of clinical error reduction strategies by allowing for mistakes to occur as a learning activity; using simulation in developing, improving and sustaining performance; using simulated real time and motion to proximate real time clinical practice, reduce knowledge gaps and increasingly the development of teamwork, communication skills, crisis resource management skills, situation awareness and human factors. The Donaldson report also recognizes that simulation provides researchers opportunities to identify common mistakes and recommend change so as to encourage safe habits and generate a culture change; improve the usability, safety and effectiveness of policies and protocols; identify and address the impact of adverse environmental factors; guide the standardization of complex clinical procedures; and establish a culture of evidence-based and best practice through simulation (Donaldson, 2008). The report does indicate the need for simulation to be integrated into healthcare services and it identifies that simulation in its many forms will be a vital driver in helping develop a safer healthcare system (Donaldson, 2008).

As a continuation on the subject in 2009, the United Kingdom Chief Medical Officer's (CMO) Annual Report (Donaldson, 2009) provides further reinforcement of the value of medical simulation in that it offers an important pathway to safer patient care. Donaldson (2009) comments favourably on the activities of other health committees that also call for improved clinician training with regards to patient safety and that simulation was explicitly selected as a potential means to achieve this. Donaldson (2009) also reports on the value of simulation conferences showcasing the frontline use of simulation in medical education, and the establishment of further simulation centres to help facilitate the development of safer patient care.

Increasing investment and activity

Concurrent with, and since these reports, there has been significant investment in simulation around the world in many countries with the number of centres and services now collectively in their thousands. In the United Kingdom to Europe, Africa, Asia, Australia, Canada, United States, Mexico, and South America, simulation has emerged as a legitimate teaching, learning and assessment method. This is reinforced by Milkins, Moore and Spiteri (2014) who, in a recent published Health Education and Training Institute (HETI) document, have presented a clear, unambiguous comment from commissioned work by Nestel et al. (2014) about where simulation now sits from a contemporary perspective and the importance of it being used in ways that benefit the future health care workforce. They state; 'simulated learning technologies are here to stay and we have an obligation to use them optimally in supporting health professional students in meeting the needs of the health care workforce' (Milkins, Moore and Spiteri, 2014, p.6).

Certainly from a medical and nursing profession perspective there is ongoing developing evidence. From an early product-based review of usage by Nehring and Lashley (2004) to more robust studies by Katz, Peifer and Armstrong (2010) and Hayden (2010) and beyond by others, the evidence of use of simulation in healthcare education has increased dramatically.

Besides its use educationally, its further use as a quality and safety process is increasingly being advocated. In an editorial by Gaba and Raemer (2007) the editors charge all members of the simulation community to rise to the occasion and through a leadership role ensure that simulation plays a strategic role in realizing safer patient care. This is certainly happening on a large scale now internationally[1], which warrants the need for quality processes to be in place to ensure maximization of both the educational impact and the maximization of patient safety.

[1] http://www.bmsc.co.uk/ World-wide simulation database.

Increasing evidence

The evidence is building that through simulation, powerful learning and reflective practice opportunities in a safe environment, where mistakes can occur and be addressed in a positive way can be offered (Blum et al., 2010; Bogossian et al., 2014). The challenge is to provide timely realistic simulated experiences for students and other participants of an educational and evidence quality that helps prepare them to be ‘work ready and ‘work safe’ for entry into or sustaining of, the healthcare workforce (Shepherd et al., 2007). Simulation education, using an appropriate conceptual framework and focusing on evidence-based practice plus the use of simulators, task-trainers and/or simulated patients in an appropriate context makes an important contribution in this regard (Jeffries & Rogers, 2007; Shepherd et al., 2007).

Simulation allows for flexibility and repetition of uncommon and/or complex scenarios where high stakes are involved and there is never any danger to those patients. The delivery of critical or challenging events can be used to allow discussion, debriefing and reflection on those events and any actions (Decker et al., 2008; Fuhrmann et al., 2009; Berragan, 2011; Cooper et al., 2011; Ziv, 2011; Bensfield et al., 2012; Scholes at al., 2012; McIndoe, 2012; Cooper et al., 2013; Willhaus et al., 2014). There are criticisms of how valid and reliable simulation might be in some assessment circumstances (Banks, 2011; O'Leary, 2015). It could be argued that if the construct and delivery of the simulation activity is supported by a relevant education framework then issues of validity and reliability can be addressed.

The healthcare workforce has repeatedly identified the need for more research around the use of simulation, with a number of experts identifying that simulation-based research should be grounded in a theoretical or conceptual framework (Issenberg et al., 2011). This has generated research around the application of various education theories to support particular simulation–based activities (Doerr & Murray, 2008; Humphreys, 2013; Jeffries & Rogers, 2007; Kayes, Kayes & Kolb, 2005; Keskitalo, 2015; Parker & Myrick, 2009; Sowerby, 2015; Zigmont, Kappus & Sudikoff, 2011). There has also been research and publication of a theoretical framework for simulation design for the discipline of nursing (Jeffries, 2007; Jeffries & Rogers, 2007) which has received significant publicity but, with a comprehensive search of the literature, there appears to be limited subsequent uptake through contextual application and evaluation of this framework. While this framework supports simulation design it does not appear to encourage the consideration and application of appropriate educational theory underpinnings.

In the healthcare simulation literature there is a significant and strategic publication by Issenberg, Ringsted, Østergaard and Dieckmann (2011) that provides a range of recommendations for research activity in simulation-based healthcare education. There are specific recommendation in this particular publication for further more robust research related to how education theories can best support simulation-based healthcare education (Issenberg et al., 2011). A further strategic publication recommends more robust education framework development (Harris, Eccles, Ward & Whyte, 2013). The development and evaluation of a conceptual framework that facilitates simulation to be used to inform simulation education implementation and assessment of student learning appears to be a logical progression for the simulation community.

Hence the focus of this study is to identify existing conceptual frameworks and models of simulation education, review their applicability to simulation and develop a framework for healthcare simulation education activity that will make a contribution to the professional knowledge of simulation education.

Significance of the study

In this study a theoretical model will be designed to contribute to 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. Simulation educators will be able to employ the conceptual framework to guide curriculum, program and scenario development, delivery and evaluation. It could be further argued that the development of a conceptual framework will eventually lend support to the construction of the instructional design of the curriculum, and thus ultimately lead to empirically-based studies that will hopefully demonstrate, from an educational fidelity perspective, that the use of simulation enhances learning.

Research aims

The aim of this research is to identify the conceptual frameworks and theoretical models which inform simulation interventions; identifying the extent to which those conceptual frameworks and theoretical models actually inform and guide the design, delivery and evaluation of simulation interventions; and by evaluation research (Powell, 2006) and a modified Delphi Technique (Green, 2014; University of Illinois, 2013; Yousuf, 2007; Hsu & Sandford, 2007), develop a conceptual framework that will contribute to the design, delivery and evaluation of simulation interventions.

Research questions

The following three research questions have been identified for this study:

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

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

3. What constitutes a best practice conceptual framework that will contribute to the design, delivery and evaluation of simulation interventions?

Direction of study

The starting point for this study is the first question: How do the current simulation conceptual frameworks and theoretical models inform and guide the design, delivery and evaluation of simulation interventions? From this analysis, various features of current practice will be identified that contribute to the design of a best practice framework that in turn will guide the use of simulation for healthcare professionals. The data required to facilitate this analysis will be ascertained through a comprehensive literature review.

The second question addresses whether the work of researchers and practitioners is referred to - that is, to what extent have they contributed to the understanding of education theories and models in relation to simulation education? How might underpinning theoretical models and conceptual frameworks that identify appropriate education theories, contribute to the development of a 'best practice' simulation in healthcare? The data required to answer this question will be retrieved through a questionnaire directed towards a number of key leaders in simulation education.

Finally the third question, explores what constitutes the design of a conceptual framework that will contribute to the design, delivery and evaluation of simulation interventions. The interventions will include development of a new conceptual framework and distillation of existing frameworks and models into this new framework and peer review analysis to further refine the new conceptual framework.

Thus this research includes the important primary activity of gathering and interpreting data from the literature and a questionnaire, then the development and critiquing of the new conceptual framework design. It is envisaged that in turn, the outcomes of this research will make a substantial contribution to the discipline and professional practice of simulation in healthcare education.

The key to this study is the consideration of what is a conceptual framework and the context in which it is being designed for. The following definitions are provided to ensure there is clarity of understanding and purpose.

Definitions

Conceptual framework

The Free Dictionary by Farlex (2013) defines a conceptual framework as:

> ‘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 such as communication theory and general systems theory.’ (p.1)

This is congruent with the intent and focus of the study, which will be reviewing existing frameworks pertinent to the study, then constructing a particular framework in the same context.

Simulation

In the context of this research a number of definitions pertinent to healthcare education are provided. There is also an element of time to the various definitions as the exposure, knowledge, experience and expertise in the use of simulation in healthcare education has increased. In turn more people and organisations are now involved, with perspectives changing and maturing, including simulation-based and adjunct technology development and the broadening of its applications contributing to the evolution of the definitions.

A definition provided in the healthcare simulation literature by Maran and Glavin (2003) provides an early healthcare simulation education perspective in indicating simulation is; ‘an educational technique that allows interactive, and at times immersive activity by recreating all or part of a clinical experience without exposing patients to the associated risks'(p.22). Maran and Glavin (2003) were investigating the potential use of simulation as an extension of medical education, in light of an increasing number of training challenges facing the preparation of medical students and practice issues around patient safety. This is reinforced by Beaubien and Baker (2004) who also identified simulation as a process of approximating a real world setting and clinical activity in a safe, controlled environment for the purpose of teaching and learning.

However the definition most widely used in the literature and other public forums is provided by Gaba (2004) who states, 'simulation is a technique – not a technology – to replace or amplify real patient experiences with guided experiences, artificially contrived, that evoke or replicate substantial aspects of the real world in a fully interactive manner' (p.i2). This is an important definition for while it does not explicitly indicate its educational dimensions it implies that it is an educational process that facilitates and generates identified desired outcomes in a particular way.

As with Marin and Glavin (2003) and Beaubien and Baker (2004), Gaba (2004) developed this definition during those foundational years of simulation development in healthcare where computer, software programs and manikins were beginning to interface and provide technological feedback for training purposes. This level of technology was not previously available to clinicians. The levels of interactive technology were increasing and it was recognized by these early users that it was important to differentiate the simulation technology aspects from the simulation education activity. This was to ensure that the pedagogy was the education driver and the technology was the delivery platform. As an early user and mentor to others, Gaba's (2004) definition has become embedded in the literature as the seminal definition, as others entering into the simulation developer, user, research and publishing community have referred to this definition

Other early users who describe simulation more in operational terms include Benner (1984) who in the seminal years contextualised simulation from a pedagogical perspective, Seropian et al. (2004) and Jeffries (2007) from a fidelity perspective, and Hayden, Jeffries, Kardong-Edgren and Spector (2009) who describe simulation as, 'an activity or event replicating clinical practice using scenarios, high-fidelity manikins, medium fidelity manikins, standardized patients, role playing, skills stations, and computer-based critical thinking simulations' (s42). This definition, taken from an unpublished research protocol of the National Council of State Boards of Nursing (NCSBN), Chicago, USA, was reported by

Hayden, Smiley, Alexander, Kardong-Edgren, and Jeffries (2014) in their recently published NCSBN national simulation study.

Humphreys (2013), while discussing the developing of an educational framework for the teaching of simulation, defines simulation as;

> an approach to facilitating learning through which participants develop and demonstrate skills and behaviours in a controlled environment which affords opportunities for exploration and rehearsal. It utilises engineered situations designed to be sufficiently authentic to promote the acquisition and development of skills, behaviours and understanding required for effective working (p.364).

While the information in this definition is relevant the author does not demonstrate how this definition informs the education design discussed further in her paper.

However as more people with differing perspectives have become involved with simulation activities and strategies, further definitions have evolved. The following definition has been adopted by the State of Victoria, Department of Health (2011) in its state-wide strategy report for the Development of Simulation-Based Education and Training (2012 – 2015). In this report simulation is simply defined as, 'any educational method or experience that evokes or replicates aspects of the real world in an interactive manner' (p.3).

While that definition appears simply put and pragmatic, Alinier and Platt (2013) have recently looked at international simulation education initiatives from a clinical education perspective, and have provided a quite extensive definition of simulation, as being;

> a technique that recreates a situation or environment to allow learners (in the widest sense of the term) to experience an event or situation for the purpose of assimilating knowledge, developing or acquiring cognitive and psychomotor skills, practising, testing, or to gain understanding of systems or human actions and behaviours. Simulation is a 'process' which is not to be confused with the 'tool' or 'means', called the 'simulator' (whether it is a model, part-task trainer, mannequin, computer software or a simulated patient), used to achieve the intended learning outcomes or for evaluation or assessment purposes of cognitive, behavioural or/and psychomotor skills and clinical competencies (p.1-2).

As such, while Alinier and Platt (2013) have provided a further level of complexity to the definition, they have also increased the awareness of the educational imperative of simulation. This is an important factor with regards to this study. Milkins, Moore and Spiteri (2014), have also alluded to the education perspective, and have provided further dimensions to the potential strategic uses of simulation. The authors refer to the Society for Simulation in Healthcare definition of simulation which is; 'the imitation or representation of one act or system by another. Healthcare simulations can be said to have four main purposes - education, assessment, research and health system integration in facilitating patient safety' (p.4). In this sense this demonstrates a maturation of definition where it is seen to have increasing, significant and specific value.

There are a number of variations to these definitions and their impact on how simulation is perceived and used that are considered. A number of terms repeatedly permeate the literature and in most cases the terms are self-evident – such as simulation-based learning experience, simulated clinical experience (Pilcher et al., 2012) and especially the experiences generated and outcomes measured with the use of either low, medium or high-fidelity simulation. Indeed there is significant literature focused on the various fidelity aspects of simulation, as users were striving to develop their own skills in and understanding of the capacity and capability of simulation. (Weller et al., 2003; Wilson et al., 2005; Alinier et al., 2006a and 2006b; Lasater, 2007; Fritz, Gray & Flanagan, 2007; Shepherd et al., 2007; Sleeper & Thompson, 2008; Parker & Myrick, 2009; Smith & Roehrs, 2009; Weaver, 2011; Norman, Dore & Grierson, 2012; Yuan et al., 2012; Meakim et al., 2013; Qualls-Harris, 2015).

Simulation fidelity

There remains an ongoing discussion and debate around the concept, definitions and applications of simulation fidelity. As such the constant referral to low, medium and high fidelity in simulation demands a need to provide substantive definitions; as these terms and their meanings have significantly influenced the design, construct, delivery and evaluation of countless simulation scenarios, sessions, courses, programs, simulation centre funding and design, simulation education workshops, training sessions, and the undergraduate, graduate and postgraduate preparation of healthcare professions world-wide.

Evidence supports the reality that humans use simulation in myriad ways in a range of human activities and have done for millennia. There is significant literature and stories; many objects; equipment; images; drawings; sounds; smells; techniques; plans; stories; scripts; roles; videos and film that demonstrate humans are actively using simulation for a whole host of reasons – past and present (pacifiers, dolls houses, costumes, gaming).

Simulation fidelity from a healthcare education perspective has a particular purpose and that is to try and provide the best opportunity for learning using simulation (replicating reality) as a method of teaching and learning. There are many ways simulation can be provided, however it is the level of complexity or the fidelity of the simulation intervention that requires more focus. Table 1 has been constructed to provide an overview of the various definitions.

Definitions of fidelity in simulation

Fidelity	Strict conformity to fact / precision in production (technical) (Oxford Dictionary)
	The term 'fidelity' is used to designate how true to life the teaching / evaluating experience must be to accomplish its objectives (Miller, 1987).
Simulation Fidelity	Fidelity is the extent to which the appearance and behaviour of the simulator/simulation match the appearance and behaviour of the simulated system (McGaghie, 1993, 1999; Maran & Glavin, 2003)
	The degree of similarity between the training situation and the operational situation that is being simulated….simulator fidelity is a crucial element in maximising the transfer of skills learned in the simulator to the operational context (Rosen et al., 2006)
	The physical, contextual, and emotional realism that allows persons to experience a simulation as if they were operating in an actual healthcare activity (SSIH Simulation Committee, 2007)
	The extent to which a simulation mimics reality (Jeffries, 2007)
	The level of fidelity can be described where all relevant stimuli are made available for recognition and practice and where such stimuli change realistically with variations in the inputs and response to and from (the participant). The fidelity of any simulation device is limited by the weakest component producing stimuli (p.45). (Page, R. in Riley, R.H. (Ed.) (2008)
Low-fidelity simulators	Focus on single skills and permit learners to practice in isolation (Munshi et al, 2015)
Medium-fidelity simulators	Provide a more realistic representation but lack sufficient cues for the learner to be fully immersed in the situation (Munshi et al, 2015)
High-fidelity simulators	Provide adequate cues to allow for full immersion and respond to treatment interventions (Yaeger et al., 2004)
Environment Fidelity (Setting /Context)	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)
Equipment Fidelity (Physical/Engineering)	The degree to which the simulator duplicates the appearance and feel of the real system (patient / bowel / spine / haptic) (Dahl et al., 2010)
Psychological Fidelity (Functional)	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)
Educational Fidelity	Striving to design and deliver as precise as can be attained, educational outcomes using appropriate education theories / frameworks, learning models and instructional design models to achieve identified learning objectives / learning outcomes (observable and measurable knowledge / skills / attitudes / values) (Shepherd, 2008)
Fidelity Configuration	Combination of environment / equipment / psychological fidelity – plus educational fidelity (Shepherd, 2014)

Table 1: Definitions of fidelity in simulation

The level of that detail considered, from an environmental, equipment, psychological and educational perspective will impact on fidelity levels (Dieckmann, Gaba & Rall, 2007). How well prepared and realistic these are will determine how much participant engagement and immersion into the activity is generated. The briefing and orientation to the simulation session or program also sets the tone and parameters of the fidelity levels. This provides educators the opportunity to enter into a 'fiction contract' with participants. That is, the participants agree to immerse themselves in the fiction of the simulation and accept that it is, for all intent and purposes, a real activity.

These definitions on fidelity contribute to the development of a conceptual framework. As one considers the components of the framework, their rationale and their application, how those conceptual framework components may influence the development and functionality of these various fidelities does need consideration (Figure 1).

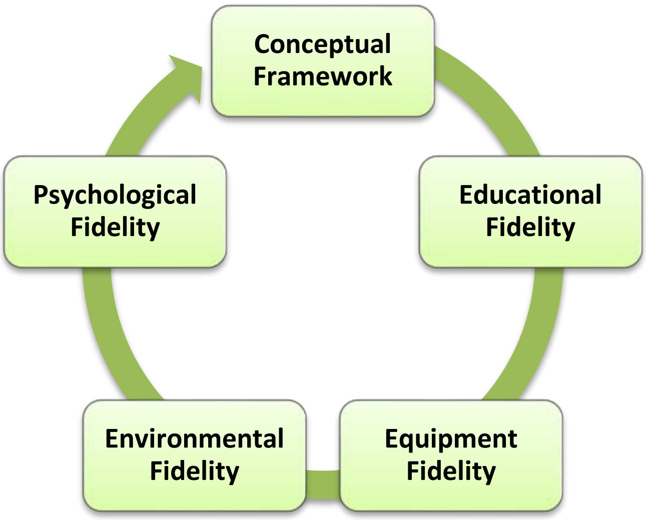

Figure 1: Conceptual Framework - Fidelity Complexity

Beyond definitions

Providing context

While these various definitions provide the basis for simulation education development, the challenge is to provide timely realistic simulated experiences of a quality that helps prepare healthcare professionals to be work ready and work safe for when they enter the workforce and beyond (Spetz, Chu, & Blash, 2016). From the perspective of this study these definitions, given that they all indicate that simulation has an educational role, thus provide significant context and support towards the focus and directions of this study.

Simulation-based preparation, focusing on evidence-based practice and using an appropriate education framework makes an important contribution in this regard.

Drivers for the development of simulation education

The mission and focus of simulation is to increase and improve learning opportunities through a more dynamic, immersive, experiential, interactive, learner-focused process; addressing healthcare workforce education issues that have been identified as needing to be addressed; to encourage meaningful and reflective cognitive, affective and psychomotor uptake of knowledge, skills and attitudes, whilst addressing the impact of human factors; to facilitate a closer theory to practice connectivity with the ultimate outcome being improvements in patient care and safety. In essence - to address the many drivers identified.

This is reinforced by the work of Ker and Bradley (2010) who have identified a number of key drivers for the development of simulation and encapsulate these in the following diagram (Figure 2):

Figure 2: Ker and Bradley (2010) Simulation in Medical Education, showing the key drivers for the development of simulation (Ker & Bradley, 2010, p. 165)

Key Drivers

While there are a number of key drivers identified by Ker and Bradley (2010) those pertinent to contemporary healthcare education include, failure of traditional learning models, changing clinical experience, shorter time in training and an increasing patient safety agenda**.** Underpinning these are other drivers such an increasing healthcare industry need and demand for work ready and work safe personnel and a projected demand for these healthcare workers to be employed in acute and sub-acute areas. This increased demand for more skilled workers has led to an increased demand for more clinical places, leading to a reduction in clinical placement opportunities and capacity – which has included increased pressure by those healthcare facilities to supply more appropriate and relevant placements (National Review of Nursing Education, 2002; James, 2005; Shepherd et al., 2007; Shepherd, 2008; Health Workforce Australia, 2010).

A further pressure point is the capacity and capability of the existing workforce to support these increased demands and in some instances a decrease in motivation to do so, due to increased workloads. Such pressure points have also led to deficits in theory to practice transfer, skills acquisition, interdisciplinary team interactions and prescriptive activities (National Review of Nursing Education, 2002; James, 2005; Shepherd et al., 2007; Shepherd, 2008; Health Workforce Australia, 2010).

Other impacting factors

Other impacting factors include a range of patient and healthcare environment demographics such as increased patient acuity (more complex care profiles); decreased lengths of stay; increases in patient throughput; rapid changes in technologies and treatment regimes; changes in health care services / clinical support resources / clinical teaching resources and mismatches between patient acuity and the existing supply / skill mix. The increasing patient safety and risk management focus is reducing student exposure to patients leading to less clinical learning opportunities (National Review of Nursing Education, 2002; James, 2005; Shepherd et al., 2007; Shepherd, 2008; Health Workforce Australia, 2010).

Simulation as a teaching and learning method

From the initial focus on what simulators were (Gordon et al., 2001; Good, 2003; Cooper & Taqueti, 2004) to whether simulators were user-friendly or not (Wilson et al., 2003; Good, 2003; Wilson et al., 2005) and the early forecasts (Gaba, 2004; Bradley, 2006) healthcare simulation is now well identified in the literature as a valid teaching and learning method across disciplines (Beyea & Kobokovich, 2004; Beyea, von Reyn & Slattery, 2007; Binstadt et al., 2007 and Blackstock & Jull, 2007). It is also seen as an appropriate education intervention to help address a whole range of learning, clinical, clinical placement, healthcare personnel capacity and capability needs (Overstreet, 2008; Burns et al., 2010; Wotton et al., 2010; Leonard et al., 2010, Shinnick et al., 2011; Sharpnack et al., 2012; Oldenburg et al., 2012). Thus simulation has the potential to deal with a wide range of clinical, non-technical and contextualised factors via a very dynamic process, while addressing delivery and opportunity issues (Ypinazar & Margolis, 2006; Endacott et al., 2010, Hill et al., 2010; Schlairet & Pollock, 2010; Pilcher et al., 2012; Goldsworthy, 2012).

Healthcare simulation also adds to one's professional capacity in diverse ways, including increased levels of critical thinking, reflective practice and self-efficacy compared to traditional education interventions (Good, 2003; Marin & Glavin, 2003; Schumacher, 2004; Wayne, et al., 2005; Girzadas et al., 2007; Shepherd et al., 2007; McCallum, 2007; von Lubitz et al., 2008; Corbridge et al., 2010). The use of standardised, validated and repeatable simulation interventions reduces the theory to practice gap while increasing the confidence and competency of the participants (Gordon et al., 2001; Kneebone et al., 2004; Lasater, 2007; Schlairet, 2011; Kelly & Jeffries, 2012). This strategy provides the healthcare service with a more work-ready and work-safe person who is more likely to be more effective not only clinically but also in the clinical human factors domain (O'Donnell et al., 2007; Draycott et al., 2008; Hunt et al., 2008; Trayner et al., 2010; Kinsman et al., 2012).

Return on investment

There are significant returns on investment benefits to be derived from the use of simulation in healthcare. The potential macro benefits of healthcare simulation include resource savings, capability enhancement, risk mitigation and safety enhancement (Frost & Sullivan, 2014; Young, 2014).

As one begins to focus on these benefits, from a cost savings perspective, simulation costs are less to operate and maintain than the real system; with operational efficiency savings, efficient operating practices can be explored, tested and trained; with reductions in training time there is no lost time in setting up and repeating learning activities; with simulation one can control the environment; and with regard to asset optimisation, critical operational assets are not taken out of service for training and business equipment wear is reduced (Gabriel, 2012; Patel, 2012; Frost & Sullivan, 2014). Nursing has capitalised on this by developing and using extensive simulation centres with replication of all forms of clinical settings.

From an enhanced capability perspective, simulation provides the opportunity to focus training on situational awareness, where critical factors are visualised and understood. Here simulation provides opportunities for extension of experiences thus preparing for all eventualities; it allows for analytical assessment where all possibilities are explored and tested; and 'mission rehearsal' or practice can be carried out, which helps improve rates of success (Wright, Taekman & Endsley, 2004; Smith & Sessions Cole, 2009; Gabriel, 2012; Patel, 2012; Wassef et al., 2014; Gasaway, 2015).

Risk reduction activities can be practiced using simulation, where the awareness of risk is highlighted through experience in dealing with a range of hazards. Dangerous activities can be trained in a safe environment so that hazard avoidance is profiled and physical and mental harm to staff is minimised. Thus the principles and practices around safety can be carried out so helping in improvements in staff safety and health outcomes. A further consideration is the use of simulation to minimize environmental damage, so that fragile environments are not compromised by training activities or real time adverse events (Hogan et al., 2006; Nemeth, 2008; Hänsel et al., 2012; Gasaway, 2015; Graafland et al., 2015; Boyce, 2015).

There is demonstrable support for this in a report on medical simulation training by Frost and Sullivan (2004), which has been republished on-line in 2014 as a return on investment study for medical simulation training. One purpose of the study was to determine what factors contribute to a return on investment on a number of commercial simulators associated with operating room (OR) and procedural training, so that organisations considering purchasing such simulators could review other organisations' experiences and decide on their investment costs, returns and opportunities (Frost & Sullivan, 2014).

Frost and Sullivan (2014), while reporting on the costs of deploying a simulator, list an array of financial and non-financial benefits and potential benefits to patients. The financial benefits include savings in OR times or procedural times, instructor time, error reduction thus mitigating complications and cancellations, faster times to competency, equipment repair and spoilage, alternate training costs and potential value-add revenue from offering practice time on the simulator to others. The non-financial benefits identified include recruiting as potential employees see the value of the organisation that provides this simulation service, the ability to evaluate trainees, credentialing strategies, trainee satisfaction and a better quality of care as a result. While the report did not provide quantitative data it did indicate that the benefits to patients from a qualitative perspective include shorter operating, anaesthetic delivery and recovery times reducing harmful effects, inconvenience and complications (discomfort, pain management, infection, emergency surgery).

The report by Frost and Sullivan (2014) and other similar reviews demonstrate that it is important to consider the return on investment perspective. However that cannot be undertaken in isolation as there are other considerations. It also reveals the need for the educational aspects of this investment in simulation technology and application be similarly scrutinised. To date the literature is continuing to provide some evidence, from an educational perspective, that healthcare simulation is a near-perfect setting / process to facilitate adult learning, heutagogy and lifelong learning; interactive and experiential learning; critical thinking / clinical reasoning / clinical judgement; guided reflection; self-efficacy and attitudes and performance - to address psychomotor skills; cognitive skills; meta-cognitive skills; non-technical skills (clinical human factors) and organisational / systems processes / issues.

It is important to reiterate here also that, unlike in the real clinical setting where the opportunities for learning, while dynamic are sometimes challenging, demanding, untimely or even inappropriate – and often serendipitous - simulation allows for the repeated use to a standard of a safe, organised environment and immersive, interactive, experiential and reflective learning to encourage long lasting knowledge, skills and attributes to deal with the normal and the abnormal …sometimes under pressure (Shepherd, 2007). There is now considerable evidence that contextually healthcare simulation allows the repetitive delivery of standardised and validated programs that offer consistency, while focusing on predetermined outcomes. It is also a platform for vertical integration across curricula and can address the novice to expert concept in each setting and for all disciplines (Benner, 1982; Benner & Wrubel, 1982a; Benner & Wrubel, 1982b; Benner, 1984). That being the case there is compelling evidence that investing in simulation will offer significant returns if not only the business model is addressed but also included in that strategy is the addressing of all aspects of the education requirements. This includes appropriate conceptual frameworks guiding the design, delivery and evaluation activities of simulation.

Conclusion

This chapter has addressed the basis for the study. This includes an introduction to the research; the background to the study; the significance of the study; the research aims, goals; the research questions and the direction of the study. These were followed by a series of definitions, including the definition of a conceptual framework, a number of definitions of simulation as were definitions and an inclusive review of the various aspects of fidelity in simulation. Drivers for the development of simulation education were identified as was the evidence supporting the use of simulation as a teaching and learning method. The need to consider the return on investment in simulation as a teaching technique – given the infrastructure, organisational and human capital requirements, also provide a comprehensive platform of information to guide the research activity.

In Chapter 2 the literature review will be undertaken to address the first and second research questions. They are;

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

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

The literature will be reviewed to explore the development and utilisation of conceptual frameworks for simulation activities thereby providing a basis a consideration of the third question which is:

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

Chapter 2

Literature Review

Introduction

The approach taken for the literature review is to first identify the strategies and boundaries to the literature search. This is followed by a brief history of simulation. This provides a resumé of the development and use of simulation over time with a focus of the contemporary applications in education and in the healthcare domain. Literature will then be identified in relation to the use of simulation in the tertiary health education environment and on the development and utilisation of conceptual frameworks in simulation, within the healthcare education environment. Literature that explored a relationship between these two search foci will be also sought.

A review of simulation research and frameworks

It is important to acknowledge here that while there is evidence in the literature of simulation use in a number of universities, colleges and programs (Katz, Peifer & Armstrong, 2010; Hayden, 2010) a limitation in the literature search is finding evidence of the use of education frameworks in simulation centres, universities, colleges and programs that is not being reported in the public domain. Attempts to identify and access this potential but still circumstantial evidence was considered logistically problematic, given the literature review process did not expose such information. The literature search timeline boundaries were contained to the last 15 years to ensure there was primarily a contemporary view presented. However pertinent literature outside this timeline was also reviewed and considered.

Search process

The review of the literature was undertaken employing selected key words and MeSH search terms were utilised and a range of electronic databases and search engines were accessed. These included; Cumulative Index of Nursing and Applied Health Literature (CINAHL), CINAHL Plus, Educational Resources Information Centre, PsycINFO, Medline, ProQuest Dissertation and Theses for empirical reports, Google and Google Scholar, Health Source: Nursing/Academic Education, and Gaming. Grey literature was also accessed and scrutinised.

One search obstacle was identified. While there is evidence in the literature of simulation use in a significant number of universities, colleges and programs in many countries around the world (Katz, Peifer & Armstrong, 2010; Hayden, 2010) finding evidence of the use of education frameworks in simulation centres, universities, colleges and programs that is not being reported in the public domain was considered logistically problematic and so was not pursued. The literature search focused on systematic reviews, focused studies, meta-analyses, integrative reviews and expert opinions from the fields of nursing and medical research. Historical information was also sought.

The history of simulation

Simulation in its simplest form is the use of imagination to reproduce or imitate that which is real[2]. Historically human beings have been using simulation to replicate and replace reality since antiquity (Owen, 2012). From prehistoric times to indigenous cave drawings representing activities and temple artworks with story lines[3,4], to modern day baby pacifiers ('dummies') feeding bottles, children's toys, to modelling (bodies, cars, trains, planes and others), television, movies and gaming[5]. Soldiers learnt how to ride on make believe horses and even today the 'bucking bull' or 'bronco' is a simulated activity[6].

Then as technology has developed, especially in the early twentieth century, such as with the advent and development of manned flight, crude simulators made from wine barrels and wings attached were built to help prepare pilots. In 1929 the Link flight trainer simulator paved the way for pilot training on instruments (Link Trainer). As aeroplanes became more complex so did the flight simulators. Today flight simulation is pivotal to pilot and crew training, skill maintenance, upskilling and risk management (Flight Simulator).

From these early beginnings simulation has now developed to high levels of technical sophistication in those high-stakes industries needing to minimise risk and deliver high levels of safety such as car racing, aero-space, professional sports, airlines, rail, shipping, oil and petroleum, mining, nuclear power and the military services. Simulation comes in all guises from the simple to the most complex. It is used in historical fairground rides to Disneyworld and from an array of National Aeronautical Space Administration (NASA) simulators such as

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2 https://en.oxforddictionaries.com/definition/simulation
3 http://www.kimberleyfoundation.org.au/kimberley-rock-art/research-history/
4 http://australianmuseum.net.au/art-in-ancient-egypt
5 https://www.edutopia.org/online-games-simulations-teaching-tools
6 http://www.funtimehire.co.uk/rodeo-rides-simulators/

the 'vomit comet' (vomit comet, (n.d.)) used to simulate weightlessness in space, to simulated space flight, travel and moon landings, simulation has been the substitute for, or the precursor to, reality.

The education profession has benefited from simulation in the preparation of teacher students. De Jong, Lane and Sharp (2012) report on the value and relevance of simulation as an educational pedagogy in the preparation of student teachers in how to normalise their emotions in the classroom. Meanwhile Adams et al., (2008) in a two part presentation on a study of educational simulations, discuss educational simulations, issues of engagement and learning and interface design, and note evidence indicates simulation must function intuitively or the student's attention is focused on the simulation, rather than on the topic (Adams et al., 2008).

From a healthcare perspective there is also evidence that for many hundreds if not thousands of years, simulators and simulation activities have been in use. Meller (1997) identifies this, noting that historically many cultures have used models of humans made of clay or stone that portray features of diseases. Bradley (2006) reinforces this perspective in indicating that for centuries there have been simulation-based activities such as models that have been used for lessons in anatomy. Bradley (2006) goes on to describe possible future directions in simulation in healthcare.

More recently Owen (2012) has published an article on the early use of simulation in medical education. This is reinforced by the various examples Alinier and Platt (2013) provide such as the midwifery training activities and outcomes in 18th century France, the 19th century nursing simulation activities reported by Nehring (2010) and the development of 'Resusi-Anne' by Tor Laerdal in Norway in 1961 to provide cardiopulmonary resuscitation training and 'Harvey', the manikin developed for cardiac assessment skills (Hovancsek, 2007). Padua University (Padua University) has a number of examples of simulation activities used in earlier centuries for medical training purposes.

From a nursing perspective during nursing training in the twentieth century the use of an orange to practice delivering injections was a common practice, as was the cleaning, wrapping and placing of bandages on each other to develop skills and expertise. As early as 1911 with the development of 'Mrs. Chase' a life-sized manikin, (Nehring, 2010) and the use of other simple manikins to prepare nurses how to wash, sit, make beds, carry out basic life support (cardiopulmonary resuscitation) and lay them out in death have long been part of nursing training. Anatomical models were also extensively used.

In contemporary times, over the last forty years, the development of patient simulation - especially in part-task training and manikin production - has been expanding in capacity and capability with the advent of new information-based technologies. These developments have provided rapid delivery of interactive information, increased user-friendliness and buy-in regarding their use. The array of simulators and their various complexities now allow for significant interactivity and thus immersion in simulated activities that are getting closer and closer to real activities and outcomes (http://www.laerdal.com/au/ / http://www.cae.com/).

This development of, improvement in, and wider production of, interactive part-task trainers and computer-based information technology assisted manikins, simulated patients, hybrid simulation and other simulation innovations is well reported (Bradley, 2006; Shemanko, 2008; Ker & Bradley, 2010; Kahn et al., 2011). The main benefit is that they increasingly provide amplified effectiveness in levels of equipment, environmental, action, temporal, perception and psychological fidelity and authenticity (Page, 2008; Khan et al., 2011).

Such development has allowed healthcare educators to explore a range of teaching and learning opportunities not available before. It has provided healthcare educators a platform to strengthen the correlation between the various fidelity and authenticity factors and the other variables needing consideration when preparing learners (Kozlowski & DeShon, 2004; Dahl, Alsos & Svanæs, 2010; Rogers, 2007; Page, 2008; Khan et al., 2011). These include learner sophistication, the context of the learning and training, the stage and level of learning and training, the nature of the task and thought processes, and the specific motor, perceptual, cognitive and other skills and clinical human factors required to achieve the identified learning and practice outcomes (Kozlowski & DeShon, 2004; Dahl, Alsos & Svanæs, 2010; Rogers, 2007; Page, 2008; Khan et al., 2011).

From a historical viewpoint to the present, simulation has had and continues to have a presence and a pivotal place in the armoury of teaching and learning strategies and tools humans have developed and applied to help transfer and increase knowledge, skills, behaviours to, and attitudes in, others. Whether that has been from an ethnic, cultural, religious, play, work, communication, interpersonal, perception, reflection or entertainment perspective, simulation has in one form or another been a process, a technique, a facilitator, a re-enforcer, a method of teaching and learning that encourages aural, visual and kinesthetic sensory input, feedback, reflection, primary and repeated practice and the embedding of long-term memory.

Simulation in education

There is evidence of a growing realisation as to the value and use of individual education theory early in the development and delivery of simulation interventions as the use of simulation has spread. Experiential learning has been identified by many although there is little evidence of overt application of the theory in the development and delivery of the programs. Rubino and Freshman (2001) review and report on the value to students of actively participating in simulations and role-plays, as well as the challenges in running such exercises. Evidence of the theory driving the development of the utilisation of simulation in courses is discussed by Bradley (2006) and Clement (2000). Bradley identifies key learning theories, which inform simulation. Morgan et al. (2002) and Underberg (2003) also make mention of experiential learning as does Sewchuk (2005) who discusses the application of experiential learning as a theoretical framework for perioperative education.

Kayes, Kayes and Kolb (2005) identify an application process for simulation. They report that while teamwork exists in organisations, their functionality and effectiveness is problematic due to a combination of negative factors. Drawing on significant research and theoretical underpinnings, they discuss the application, addressing and effectiveness of, experiential learning via a simulation-based learning experience (the Kolb Team Learning Experience). The authors identify and address those aspects of effective team development - purpose, membership, role leadership, context, process, and action – and report that after the simulation activity, the team has increased knowledge, contextualised experience regarding specific team function, and as a result of the cyclical modes of learning, are more aware of learning and progress.

As simulation development has progressed the literature continues to provide ongoing evidence that education theories are being increasingly considered. Larew et al. (2005) discuss the application of Benner's application of the novice to expert theory in a simulation activity, Medley and Horne (2005) make mention of the benefit of simulation through experiential learning and interactive critical thinking and Lunce (2006) identifies the beneficial impact of simulation on situated learning. Meanwhile Waldner and Olson (2007) describe the development and use of a theoretical framework for simulation in nursing education that includes the application of two education theories, and Lasater (2007) discusses the development of an outcome of an education theory - clinical judgment - using high-fidelity simulation.

Several studies acknowledge the importance of educational theory to their research and development work. The theories provide a framework, or underpinning basis. However following this through into the actual programs and activities is more challenging. Miller et al. (2008) particularly identify simulation as a method of experiential learning to promote safety and team behaviour as framing their research study. A number of other publications too also discuss the various outcomes from clinical simulation activities which can be attributed to underpinning education theories but there are no demonstrable connections that made better linkage. These include clinical judgement (Bambini et al., 2009), self-efficacy (Pike & O'Donnell, 2010) and critical thinking (Kaddoura, 2010).

Weller et al. (2012) in their paper on simulation in clinical teaching and learning make mention of education theory informing the use of simulation and reflect on the fact one of the challenges with teaching and learning in clinical settings is that it is often opportunistic and unstructured. However after introducing the educational strategy of deliberate practice and feedback – which does have theoretical underpinnings – apart from commenting on the need for integration into curriculum and discussing outcome evaluation strategies, there is no more discourse or analysis of education theory.

Ker and Bradley (2010) offer significant insight on the use of simulation in medical education, and while they do not discuss use of a framework, they do make informed comment on the theoretical basis for simulation. The authors indicate the significance of these guiding theories and foundational philosophies in stating, 'a number of theories of learning and instruction underpin the design and delivery of the simulated clinical experience, and these can be used not only to affirm educational credibility but also to develop appropriate research questions' (p. 168). This statement is important as it validates the importance of conceptual frameworks in simulation education. Ker and Bradley (2010) offer brief descriptions about behaviourism, cognitivism, social constructivism, situated learning and cognitive apprenticeship, experiential learning, activity theory, novice to expert theory, feedback, reflective and transformative learning and also alert the reader to both the limitations and the future of simulation. As a treatise it highlights the importance of underpinning education theory in simulation education.

Further reasons as to why a framework is important is a comprehensive publication on the development of an education framework for the teaching of simulation within nurse education provided by Humphreys (2013). Within the paper Humphreys (2013) reviews and analyses experiential learning theory, Benner's model of skill acquisition, learning styles, learner centeredness, reflective practice along with identifying that the educational philosophies of both constructivism and behaviourism can offer a foundation for the integration of simulation into the nursing curriculum. Humphreys goes on to present an operational model to enhance learning within simulations. While this framework has theoretical underpinnings it does not overtly provide direction to introducing the education theories into the teaching and learning process.

One of the first purposeful studies describing the level of simulation use in nursing programs and simulation centres was by Nehring and Lashley (2004). This essentially was attempting to ascertain who had a particular type of simulator and what were they doing with them. This was followed soon after by more in-depth investigations, commencing with an often cited systematic review by Issenberg et al. (2005), a commissioned report by Flanagan, Clavisi and Nestel (2007), an attempted meta-analysis by Laschinger et al. (2008), a literature review by Leigh (2008), systematic reviews by McGaghie et al. (2009), Okuda et al. (2009), and Kaakinen and Arwood (2009).

A number of different types of reviews followed. These include systematic reviews by Harder (2010) and Lapkin et al. (2010), a systematic research review by Carey, Madill and Manogue (2010), a systematic review by Cant and Cooper (2010), a literature review and meta-analysis by Cook et al. (2011), a further meta-analysis by McGaghie et al. (2011), a literature review by Ross (2012), a systematic review by Cooper et al. (2012), Yuan et al. (2012), Norman (2012) and Kim, Park and Shin (2013), an integrative review by Weaver (2011), Shearer (2013) and Foronda, Liu and Bauman (2013), a systematic review and meta-analysis by Ilgen, Sherbino, and Cook (2013) and Cook et al. (2013), a best practices review by Murdoch, Bottorff and McCullogh (2013) and recently a further meta-analysis by Shin, Park, and Kim (2015).

In the space of a decade the rapid expansion of these reviews, reports and meta-analyses, plus many other publications are informing their readers in various formats of the developing currency of simulation education, its potentials and limitations. The numbers and various foci of the reviews demonstrate that there are increasing levels of evidence that supports the use of simulation - within certain boundaries and within existing approaches. However many of the reports also repeatedly identify that there is a general lack of appropriately powered, rigorous studies and that there is need for further research in this area – especially concerning the how and why, the when and where simulation works.

This need is supported by Shearer (2013) who reports that while providing evidence of its usefulness in contributing to knowledge uptake, skills acquisition, increased confidence and improvements in safety, it also demonstrates the need for further research on the recontextualisation of these outcomes into the clinical environment (Evans et al. 2010). This includes research to identify the existence and use of conceptual frameworks and theoretical models to inform and guide the design, delivery and evaluation of simulation interventions.

The systematic review by Kaakinen and Arwood (2009) requires further comment as it demonstrates a gap in the understanding of the use of education theories and frameworks. It is an important systematic review as it specifically analysed the nursing simulation literature between 2000–2007 in attempts to ascertain to what level learning theory was used to design and assess learning that occurs in simulation activities. Subsequent to their initial search strategy, while identifying there was discussion on the use of simulation as a teaching method or strategy, they also identified a significant lack of any referencing or mention of learning theory in the simulation design or assessment of student learning. Out of the 120 papers included in the review, there was a small number (n = 16) who purported to use learning or developmental theory in their design and delivery to set up the simulation, yet the review indicated flaws in that belief.

Kaakinen and Arwood (2009) report that, of 16 papers that indicated use of a learning type of foundation, only 2 identified learning as a cognitive task. In essence the review demonstrated that simulation was being used primarily as a teaching modality rather than a learning paradigm. They suggest the need for a fundamental shift from a teaching paradigm to a learning paradigm, that a foundational learning theory should be used to design and evaluate simulation and that it was recommended that more research is required that investigates the efficacy of simulation for improving student learning.

The work undertaken by Kaakinen and Arwood (2009) is reinforced by Parker and Myrick (2009) who report that despite the increased use of simulation in nursing education programs there is little evidence of research into a pedagogy or educational philosophy that would suitably lead the development of simulation-based learning. They undertook a critical review of the use of behaviourist and constructivist theory to guide the development, delivery and outcome evaluations of high-fidelity scenario-based simulation sessions.

There has been positive research and work undertaken on the theoretical basis of simulation with the National League for Nursing (NLN) / Jeffries simulation framework (Jeffries, 2007). The NLN / Jeffries simulation framework contends that student-learning outcomes are influenced by the concepts of teacher, student, educational practices and simulation design characteristics. Meanwhile Huang et al. (2008) describe outcomes of a summit where discussions focused on standards for simulation-based applications. A subsequent preliminary draft of a guideline for simulation-based education was developed and this has since become a published taxonomy. Such seminal work is important for the development of conceptual frameworks.

Sadideem and Kneebone (2012) discuss how educational theory may be applied to promote effective learning while Waldner and Olson (2007) describe the theoretical application of theoretical frameworks in simulation. Paige and Daley (2009) discuss the use of situated cognition as a learning framework to support and guide high fidelity simulation; and Levett-Jones et al. (2010) contend that clinical reasoning is a pivotal education model in learning – one of the education theories to be considered in the context of this research. Meanwhile Waxman and Telles (2009) discuss an application of one theory into a framework while Harris et al. (2013) call for more robust framework development.

Pollard and Nickerson (2011) note the need to identify the key components of educational theory specific to simulation. They then describe, using diagrams, a model for simulation in staff development which is an adaptation from the Theoretical Framework for Simulation Design by Jeffries and Rogers (2007). This theoretical framework is for a reflective simulation program, and while this framework refers to a number of essential theory 'ingredients', the framework does not appear to capture the essence of a comprehensive theory mix. Namely a conceptual framework that when applied guides the use of simulation which leads towards to more effective and measurable educational outcomes.

The National League for Nursing (NLN) / Jeffries Simulation Framework has been utilised by Young and Shellenbarger (2012) who describe a positive outcome from their exposure to and application of this model. They detail how components of The NLN / Jeffries Framework can help guide simulation design, and that by adapting framework components, helps provide future educators with experience using simulation to develop their core competencies. Young and Shellenbarger (2012) support the use of simulation in providing graduate students experience in the educator role, and that simulation helps develop the practice of teaching in an interactive manner in a dynamic setting. This demonstrates in part that this particular framework was used appropriately and effectively although the criteria they used is not evident.

A recent publication demonstrates once again the focus on elements of a conceptual framework however it does not consider a number of important educational theories. Hicks et al. (2013) propose the use of a template in a framework that would support integration of content knowledge, clinical reasoning, and reflection on authentic professional nursing concerns.

Meanwhile Alinier and Platt (2013) make reference to a United Kingdom Department of Health publication in 2011 that reports on the development of a strategic framework to provide direction in the use of technology such as simulation in the delivery of quality, cost-effective education, training, and continuous healthcare workforce development. This education framework warrants further in-depth review and critique. In the United Kingdom the Department of Health has published a framework designed to facilitate the use of technology enhanced learning. According to Davies (2011) the framework (Figure 3) has been designed to provide:

> guidance to help commissioners and providers of health and social care deliver high quality, cost effective education, training and continuous development to the workforce for the benefit of patients through the effective use of technology as part of a blended learning process (p.6).

On inspection it is an overarching framework designed to extract best-learning and practice value from simulation and other learning technologies, grounded in six principles. These six principles include being patient–centred and service-driven, needing to be educationally coherent, innovative and evidence-based, being able to deliver high quality educational outcomes, deliver value for money and to ensure there is equity of access and quality of provision (Davies, 2011). Importantly the framework also has recommendations linked to these principles (Davies, 2011).

These recommendations (Davies, 2011) lend support to appropriate access to, and the use of, simulation as a teaching, learning and assessment method of ensuring healthcare professionals are well prepared for and can sustain clinical practice. There is also support to the ensuring that any technology enhanced learning is used appropriately, that a good business case supports such use, that there is access and equity, and most importantly there are confirmable advantages to patients and service.

One of the principles proffered (Davies, 2011) is that curriculum development and other education development activities should be 'educationally coherent' (Figure 3) and that a strategic role and lead for technology enhanced learning such as simulation should be identified. The report recommends inter alia, that 'the use of simulation, e-learning and other technologies should be achievable and clearly mapped to specific learning outcomes in identified areas of the curriculum or learning framework'(p.8). This is an important principle as it implies the need for educational fidelity if such technologies are to support evidence-based, good practice learning and assessment. To help achieve this of course the report indicates the need for those using this technology should be competent in the use of the simulation resources and any other technological tools.

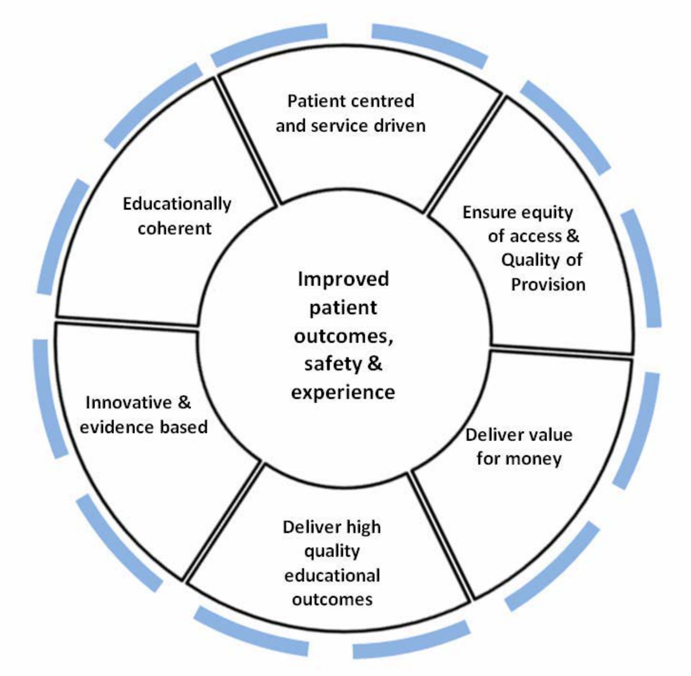

Figure 3: A Framework for Technology Enhanced Learning in Davies (Dame) (2011), p.3.

When investigating various components of the framework there are further interesting points to review. On reflection, this framework, while acknowledging that it has been well developed by an experienced and expert panel, and while remaining informative and strategic, would appear to have an operational focus. These components are relevant but an important omission is the referral to, and linking in, of education theories and models pertinent to simulation.

There is also evidence that there are a number of other frameworks that are in use and could be of use with simulation, thus needing further consideration. These include the:

- National Patient Safety Education Framework (2005) (All healthcare disciplines and workers); (Australian Commission on Safety and Quality in Health Care, 2005).
- National Patient Safety Curriculum for Junior Doctors (2006) (integration of simulation into medical curriculum)(Graham et al., 2006); and,
- Program for Nursing Curriculum Integration (PNCI) (2007) (integration of simulation into undergraduate nursing curriculum).

However on review, while certain theories are alluded to, they do not appear to contribute to an over-riding conceptual framework guiding their design and use. They are more process oriented - as demonstrated in their checklist-like constructs.

Williamson et al. (2008) present a five stage framework that they call The Curriculum Procedures Frames Simulation Framework – for trainers, researchers and developers- which is an operational and workflow process. It has a vertical and horizontal axis which encourages the reader / user to look at three elements on the vertical and work through five stages. Within the matrix are a number of considerations to work through. However there does not appear to be any linkages made to underpinning teaching and learning theories. They then go on to demonstrate a number of process templates (session / post activity feedback maps) and follow up with a clinical simulation worksheet - which they note is adapted from the 'Validation Methodology for Medical Training' Framework developed by Howell and Higgins (2004).

With this education framework, Howell and Higgins (2004) indicate that they have identified a key set of underlying principles of learning science that have been demonstrated to enhance learning and are relevant to the training of medics and surgeons. The framework is comprised of twelve components that incorporate these key principles. Throughout this white paper, besides the mention of instructional design theory, there are comments that would indicate there are educational theories considered but there is no clear and precise terminology used to ensure there is. They have relied heavily on research literature to develop this framework.

Doerr and Murray (2008) discuss the use of a simulation learning pyramid to guide simulation activities. While this is not a framework they do overtly allude to Knowles adult learning principles and Kolb's experiential learning theory as applied to their pyramid of learning principles to simulator session design. Bordage (2009) meanwhile discusses the use of conceptual frameworks in medical education. He reports on three individual education theories as being conceptual frameworks to consider, provides examples of application and more importantly identifies key points pertinent to this study:

- Conceptual frameworks help understand (illuminate) problems.
- Different conceptual frameworks emphasise (magnify) different aspects of the problem or elements of the solutions.
- More than one conceptual framework may be relevant to a given situation.
- Any given conceptual framework, or combination of frameworks, can lead to a variety of alternative solutions (p.315).

There are emerging calls for more robust research activity (Issenberg et al., 2011) and more robust framework development (Harris et al., 2013) in efforts to generate evidence that demonstrates the use of such a methodology leads to desired and demonstrable learning outcomes. Harris et al. (2013) propose that in efforts to improve on theory and practice delivery, a better understanding of human performance and how it is enhanced is required.

This is further supported by the outcomes and recommendations of a strategic Utstein style meeting that focused on the setting of a research agenda for simulation-based healthcare education in 2010. Here a significant number of international experts which included a mix of academics, clinicians, researchers and technical experts gathered and discussed a range of issues related to simulation education and desired educational outcomes, with recommendations (Issenberg et al., 2011).

Issenberg et al. (2011) espouse the need for further research on the impact of simulation-based education, arguing that while there is significant growth in the use of simulation in healthcare, research that demonstrates preferred and verifiable learning outcomes is still in its beginnings. The authors indicate that it is important that the effective use of this method of teaching and learning should be transparent to decision makers and other stakeholders. This includes its role in the clinical experience component of training.

While there are a substantive number of questions provided by Issenberg et al. (2011), on review of the questions there are specific areas and questions that relate to this study in terms of context and relevance. These include research questions around learning acquisition, retention of skills, and cognitive load, research questions around impact on learning theory and translational research questions (Issenberg et al., 2011).

A recent publication has provided further evidence of the need for a conceptual framework that offers developers and teachers the right and best opportunity to design and deliver, assess and evaluate simulation education interventions. LaFond and Van Hulle (2013) has recently carried out a critique of the NLN / Jeffries Simulation Framework. They carried out an extensive literature search to identify a number of publications (n = 16) where the framework was tested or used to guide research. Increased student satisfaction, confidence, and improved skill performance were outcomes reported in these publications.

LaFond and Van Hulle (2013) applied Fawcett's criteria for theory analysis and evaluation (Fawcett, 1980; Fawcett, 2005) to the NLN/Jeffries Simulation Framework, reporting that the framework would appear to support guidance in the design and delivery of simulation interventions that result in positive outcomes for students. They identify areas where the framework could be modified or strengthened, such as empirically supported definitions of concepts, and recommend further validity and reliability testing on concept relationships and concept variables (in the framework), plus further studies in other contexts for relevancy.

LaFond and Van Hulle (2013) then acknowledge that as there is already a widespread use of simulation in the preparation of nurses globally, so they contend that there is a need for a sturdy framework to guide educators in developing and facilitating these experiences effectively. Further support comes from Lambton and Prion (2009) who recommend that faculty need to possess not only clinical and technical but also educational expertise.

A further comment comes from Alinier and Platt (2013) who recommend that instead of focusing on the simulator, that more attention should be given to how the learners are educated using simulation, and there needs to be a fundamental shift. They report that it is become increasingly important to shift the emphasis towards improved educational preparation and development of simulation education personnel to ensure simulation activities have greater education rigour; that is, the activities are more effectively designed, delivered and measured.

It appears that while there is activity in the area under review, there is evidence to suggest further work is necessary. A recent publication by Coffman, Doolen and Llasus (2015) describes the development of a high fidelity simulation program within a Baccalaureate Nursing Program, using what they term the 'concierge model' – a faculty approach - and its evaluation, is a case in point. The research and outcomes provide valuable data to the building evidence for simulation but there is no mention of the underpinning education modelling required to support the outcomes, educationally. This point is reinforced through research by Azadeh et al. (2016) who present outcomes of the application of simulation interventions modeling human error, using a simulation model. However, while it is detailed in its research methodology and reporting, there is no evidence of any underlying pedagogy supporting this approach. It would be beneficial to not only identify and measure the triggers for human error, but also identify and apply the underpinning education theories while developing the scenarios, to increase the educational fidelity of the activities.

Fidelity in simulation

The relevance of the various fidelity aspects to simulation warrants reporting as there is a strong relationship identified in the literature. The following review of publications over a decade or more where the authors have been investigating the relationships between various fidelities of simulation and their educational impact demonstrates this focus. However it is important to first point out as background that there were only a very small number of interactive manikins before the year 2000 that were being identified and used as high-fidelity simulators. In healthcare, the development of patient simulators began in the 1960s with SimOne being the first computer-generated manikin developed in 1967 (Abrahamson & Denson, 1969). This was followed by the development of the Harvey cardiology simulator in 1968 (Issenberg, Pringle, Harden, Khogali, & Gordon, 2003; Abrahamson et al., 2004; Cooper & Taqueti, 2004). These were being designed initially to be used in medical education, especially in anaesthesia and cardiology (Abrahamson & Denson, 1969; Doyle, 2002; Abrahamson, Denson & Wolf, 2004; Cooper & Taqueti, 2004; Gaba, 2004; Blum et al., 2004; Bradley, 2006).

Nevertheless other medical services, nursing and some other disciplines quickly began to see the value of contextualising this emerging educational activity for their benefit. From 2000, in the short space of four years there was a significant increase of publications as more and more people began to explore the possibilities of simulation. Applications include nurse anaesthetists (Fletcher, 1995 and 1998); health assessment and performance (Barach, Satish & Streufert, 2001); prehospital and hospital-based health care (Bond et al., 2001); medical education (Shapiro & Simmons, 2002); nurse education (Ravert, 2002); communication (Berman, 2003); clinical learning (Bradley & Postlethwaite, 2003); surgical training (Kneebone, 2003); neonatal nursing (Yaeger et al., 2004); operating room nursing (Beyea & Kobokovich, 2004); medical students (Flanagan, Nestel & Joseph, 2004); undergraduate nurses (Feingold, Calaluce & Kallen, 2004); nursing clinical practice and education (Peteani, 2004); critical care nursing (Rauen, 2004) and teamwork skills (Beaubien & Baker, 2004). While these presenters were demonstrating much enthusiasm about simulation and its potential, there was significant variation in the robustness of the research evidence in these publications – that is the reviews and reporting techniques varied considerably - so the outcomes while meaningful, were inconsistent. The recommendations were however positive.

Coinciding with this activity there were an increasing number of low and medium fidelity manikins beginning to be developed by many simulation producers and coming onto the market. This opened up the possibility for an even wider application of simulation for more disciplines and more end-users, and as a result there began an investment in and exploration of the use of these different orientations of fidelity (Bradley, 2006; Cook et al., 2011; Gaba, 2004; McGaghie et al., 2010; Rosen, 2008; Shepherd et al., 2007; Wilson et al., 2005).

Wilson et al. (2005) reviewed and published the outcomes of a low-fidelity manikin for its user-friendliness and thus viability as a teaching and learning tool. This was followed by a study into the effectiveness of intermediate-fidelity simulation in undergraduate nursing education (Alinier et al., 2006), the use of high-fidelity simulation with novice nursing students (Bremner et al., 2006), the development of clinical judgement using high-fidelity simulation and students' experiences (Lasater, 2007), low-fidelity simulation graduate nurse health assessment knowledge and skills preparation by Shepherd et al. (2007), and undergraduate student nurses' perceptions of high-fidelity simulation-based learning (Reilly & Spratt, 2007).

Further studies included the use of high-fidelity patient simulation to train nurses in emergency care (McFetrich & Price, 2006) and nursing students' self-efficacy (Leigh, 2008), Low-fidelity simulation and emergency decision-making (Wiseman & Snell, 2008), nursing pedagogy and high-fidelity simulation (Parker & Myrick, 2009), nursing student satisfaction and self-confidence using high-fidelity simulation (Smith & Roehrs, 2009). Meanwhile Ackerman (2009) undertook an investigation of learning outcomes for the acquisition and retention of cardiopulmonary resuscitation knowledge and skills using high-fidelity simulation as the teaching and learning platform.

Blum, Borglund and Parcells (2010) looked at the impact of high-fidelity nursing simulation on student self-confidence and clinical competence, Burns, O'Donnell and Artman (2010) write about teaching problem solving to first year nursing students using high-fidelity simulation and Gantt and Webb-Corbett (2010) discuss teaching undergraduate nurses about patient safety behaviours utilising simulation.

Kameg et al. (2010) discuss the effect of high-fidelity simulation on self-worth of communication skills, while Weaver (2011) carried out an integrative review on high-fidelity patient simulation in nursing education and Maneval et al. (2012) reported on the use of high-fidelity patient simulation and its impact on the critical thinking and clinical decision-making skills of new graduate nurses.

There has continued an ongoing focus on simulation fidelity. Smith et al. (2012) looked at the use of high-fidelity simulation to explore ethico-legal concepts, while Yuan et al. (2012) undertook a systematic review, analysing the evidence in the literature in regard to using high-fidelity simulation to improve knowledge and skills. Sharpnack and Madigan (2012) reported on the effectiveness of use of low-fidelity with second-year nursing students in a baccalaureate nursing program, while Norman, Dore and Grierson (2012) considered what the minimal relationship needed to be between the concept and provision of simulation fidelity to the effective recontextualisation of learning. A further study by Tosterud, Hedelin and Hall-Lord (2013) looked at nursing students' perceptions of the use of high-and low-fidelity simulation as learning methods.

The use of high-fidelity simulation to teach about patient safety and its impact has become a factor being increasingly reported in the literature. Blum and Parcells (2012) undertook a comprehensive review looking at the relationships between high-fidelity simulation and patient safety in undergraduate nursing education, while Shearer (2013) carried out an integrative review looking at the use and effectiveness of high-fidelity simulation and patient safety. As an extension of these reviews, Bogossian et al. (2014) described the use of high psychological fidelity simulated environments to measure undergraduate nursing students' performance in recognising and responding to patients suddenly deteriorating.

Recently Ozekcin et al. (2015) demonstrated that through the use of a high-fidelity simulation intervention, acute care nurses improved both their recognition of a deteriorating patient situation and their communication skills. They decreased the time to application of the correct critical intervention and decreased the time to escalate the appropriate care across two scenarios. Thus their supposition that earlier response to clinical deterioration may result in improved patient outcomes was supported. These sorts of interventions and the resultant studies are being generated in response to an ongoing world-wide deteriorating patient issue (Hughes, 2008; ACSQHC, 2010; Jones et al., 2012; Ramsay Health, 2014; Sulistio, 2015).

Conclusion

From this review of the literature, it is argued that it is timely and relevant to develop a conceptual framework for simulation activities that builds on and potentially compliments existing activities. As there is little evidence of conceptual frameworks being implemented on the information gathered, it is important to determine what best constitutes the design of a conceptual framework that will inform and guide the design, delivery and evaluation of simulation interventions. There is a challenge to develop a conceptual framework in which relevant and pertinent educational theories are overtly identified and transparently applied to guide development, delivery and evaluation of training, including the use of simulation.

That being the case it is argued that contemporary simulation use is beneficial when it is supported by a sound educational underpinning. The development and use of a conceptual framework for simulation would thus appear to be an important foundational tool to guide simulation intervention development, delivery, evaluation and assessment across all healthcare disciplines and as a consequence ensure that the simulation intervention generates the desired educational impact - based on the identified learning outcomes. Thus the development of a conceptual framework germane to simulation that draws on education theories could contribute to the healthcare education field.

From the literature review, a number of education theories were repeatedly documented as being pertinent to simulation. In Chapter 3 those key education theories identified that could potentially lead to the development of a conceptual framework for simulation in healthcare education are presented, analysed and reviewed. After a precursor commentary, a number of definitions to establish the boundaries of this project are provided and to ensure that, as the conceptual framework is considered, these definitions maintain the boundaries.

Chapter 3

Education theories contributing to the Conceptual Framework

Introduction

In this chapter those education theories repeatedly identified in the literature as being particularly pertinent to simulation and thus will contribute to the development of a Conceptual Framework for Simulation in Healthcare Education, are presented, analysed and reviewed. Following a precursor commentary, a number of definitions to establish the boundaries of this project are provided and to ensure that, as the conceptual framework is considered, these definitions maintain the boundaries.

Commentary

Education theories underpins all of educational design, content, delivery, evaluation, assessment, practice, performance and attitude. As an extension in the healthcare setting the application of theory to facilitate evidence and best practice is pivotally important to guide quality, safety and improved outcomes. It is fundamental in making sense of and being prepared for the real world of practice. There is a constant narrative and debate about how best to reduce the 'gap' between theory and practice (Ajani & Moez, 2011; Chang et al., 2002; Dadgaran, Parvizy & Peyrovi, 2012; Hatlevik, 2012; Landers, 2000; Scully, 2011; Wilson, 2008). There is also ongoing research being undertaken, with resultant publications, recommendations and application processes introduced in efforts to meet that challenge (Ajani & Moez, 2011; Scully, 2011; Shepherd et al., 2007; Wall, Andrus & Morrison, 2014; Wilson, 2008).

In that sense it is first important that all possible and potential theories available should be explored in efforts to establish the best possible outcomes in the jurisdiction of teaching, learning, assessment – and practice. However this position is sometimes questioned:

"I repeat, as long as you have studied the theory hard enough —"
"And what good's theory going to be in the real world?" said Harry loudly, his fist in the air again.
Professor Umbridge looked up.
"This is school, Mr. Potter, not the real world," she said softly. (J.K. Rowling)[7]

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[7]Quote from: Open Educational Resources of UCD Teaching and Learning, University College Dublin Reproduced under the Creative Commons Attribution 3.0 Unported License
http://www.ucdoer.ie/index.php/Education_Theory

Nevertheless it is essential to ensure that any educational activity that is designed to prepare an individual to be equipped for the real world has its groundings, its basis, in education theory. This is especially relevant in the educational development of healthcare professionals and it is an imperative to continue this effort, especially in the context of the developing province of simulation-based education.

Education theory

Education theory is a scientifically supported set of principles designed to explain an educational occurrence, providing a framework for providing interpretation of observations and functioning as a link between research and practice. The research around the theory commonly occurs as a consequence of a hypothesis or an assumption being generated. As the research unfolds, the theory is supported and strengthened (or not) from the data being generated and that research may entail revision of the theory if the data does not provide support to the hypothesis.

The Open Educational Resources of the University College Dublin Teaching and Learning state;

> Education theory is the theory of the purpose, application and interpretation of education and learning. It is largely an umbrella term, being comprised of a number of theories, rather than a single explanation of how we learn, and how we should teach. Rather, it is affected by several factors, including theoretical perspective and epistemological position. There is no one, clear, universal explanation of how we learn and subsequent guidebook as to how we should teach. Rather, there are a range of theories, each with their background in a different psychological and epistemological tradition. To understand learning then, we have to understand the theories, and the rationale behind them (Source: UCDOER web page).

Applying that definition, the conceptual framework has been developed with those concepts and directives in mind. The education theories included in the conceptual framework are representative of those education theories most repeatedly referred to in the overall published literature and web-based resources with respect to simulation in healthcare. It is those theories that have a logical connection to one another, that have been grouped together in sequence to provide a conceptual framework approach in the study and a guide process for those seeking to increase the educational validity or authenticity of their future simulation education strategies.

This is supported by Hamdy (2016) who in the context of describing authentic learning environments – such as high fidelity simulation – indicates that providing levels of authenticity in the simulation learning space that are relevant to the learner is pivotal to achieving lasting behavioural outcomes such as attitude and competence. Coincidentally Hamdy (2016) goes on to discuss a number of education theories underpinning authentic learning including constructivism, social constructivism, adult learning, experiential learning, cognitivism, guided discovery and self-efficacy.

This recent area of work by Hamdy (2016) in medical education becomes important as it adds authority, credence and weight to this particular project and its goals, for many of those theories are referred to in this conceptual framework. For while it is a model and strategy in itself to help guide simulation education development, the other goal is to encourage and help establish a standard in the educational approach to that development.

Conceptual framework

The aim of this study is to develop a conceptual framework and the definition for the conceptual framework is an abstract model that brings together a number of related theories and views pertinent to the area of study or activity. The model, usually in the form of an instrument, is designed to provide rationale, evidence and guidance to the user in their endeavours to develop and deliver education or other processes. This is supported by Jabareen (2009) who defines a conceptual framework as a 'network, or "a plane," of interlinked concepts that together provide a comprehensive understanding of a phenomenon or phenomena. The concepts that constitute a conceptual framework support one another, articulate their respective phenomena, and establish a framework-specific philosophy' (p.51).

Definitions

These are additionally supported with the definition provided by the free dictionary where a conceptual framework is seen as; 'a group of theories and concepts that are broadly defined and systematically organized to provide focus, a rationale and a tool for the integration of information. Mostly communicated through the use of abstract word models, a conceptual framework is the conceptual basis for curriculum design, development and evaluation' (The Free Dictionary web page). A further definition by Miles and Huberman (1994) identifies a conceptual framework as a product that 'explains, either graphically or in narrative form, the main things to be studied - the key factors, concepts, or variables - and the presumed relationships among them' (p. 18).

These definitions are important as they also help establish the arena and design for the development of the conceptual framework. When considering how to go about bringing together a number of pertinent education theories and concepts it made sense to utilize a framework approach. The conceptual framework model chosen allows for the linking together of theories using an operational template. This is especially relevant in the domain of healthcare simulation education. As indicated earlier the literature has consistently demonstrated a paucity of frameworks that not only do not provide the background educational theoretical basis for its design and use in a cohesive approach, but also not in a user-friendly application that is designed to generate heuristic thought, discussion, debate and choice.

The educational philosophy underpinning the conceptual framework

In exploring the underpinning educational philosophy that allows for the materialisation of the conceptual framework for simulation in healthcare simulation, based on extensive reading, simulation is fundamentally a constructivist-based teaching and learning change agent. There may be elements of behaviourism (Skinner, 1978; Watson, 1924) such as conditioning through a positive-reward feedback strategy that can be identified in some specific simulation-based activities such as cardiopulmonary resuscitation (CPR) practice (Ackermann, 2009) and elements of Piaget's (McCarthy & Reid, 1981) and Bruner's (Bruner, 1966) cognitivism–based learning-through assimilation or accommodation - that gives meaning and organisation to the knowledge provided in a simulation scenario. However social constructivism and constructivist learning espoused by Vygotsky and others more strongly aligns with simulation (Jarvis, Holford & Griffin, 2004). The other theorists to consider in relation to social constructivism include Dewey, Piaget, Bruner and von Glasersfeld.

Social constructivism

Social constructivism is a sociological theory of knowledge that applies the general philosophical constructivism into social settings such as Communities of Practice[8] – in this case the Simulation Community of Practice (SCoP). Examples of this include the Victorian Simulation Alliance[9] and the

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[8] Communities of Practice: Lave and Wenger (1991; 1998): https://www.learning-theories.com/communities-of-practice-lave-and-wenger.html

[9]Victorian Simulation Alliance: http://www.vicsim.org.au/

California Simulation Alliance[10] – both of which have developed a simulation community of practice locally but now have set up a Trans-Pacific Alliance. Both Alliances have other links to other communities on these websites. These Alliances are contemporary examples where individuals and groups construct knowledge for one another, collaboratively creating new shared beliefs, values, mores (a new culture) with shared meanings. When one is immersed within such a dynamic activity, one is learning all the time about how to be a part of that culture in different ways and from different perspectives.

According to Schmietenknop (2013), 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. The theory is intended to foster the development of critical thinking, the relationships between skills development, collaboration, and inquiry. The learners are members of the team developing goals, seeking experiences to guide learning for students. Our lives up until this moment are our foundation for future knowledge acquisition. Based on the work of Schmietenknop (2013), using a proof of concept perspective, this researcher continually sought out, constructed and synthesized knowledge; developed new knowledge; shared this knowledge and ultimately used the knowledge to guide further knowledge development within the context of the study area.

Social constructivism and the study

A specific number of constructivist models helped guide this study. The model offered by Rolloff (2010) used for teaching evidence-based practice provided sound background as did the reality and knowledge socially constructed Interpretive Framework developed and used by Burton (2005) during her PhD dissertation. There was a level of congruity between this project and her work, as Burton included three pivotal theorists and their theories (Dewey (1938) Theory of experience; Schön (1983) Reflective Practitioner; and Benner (1984) Model of Skill Acquisition) in her framework which was titled the Professional Transition Model. Along with other theorists, these three theorists are closely aligned to this study.

The application of a Constructivist approach in this research the work from Kala et al. (2010). They identified similar issues and made appropriate comment on this. Both the lack

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[10] California Simulation Alliance: https://www.californiasimulationalliance.org/

of integration of education theories into simulation-based programs plus the link to a constructivism approach in developing such links is supported by Kala et al. (2010). They indicated that constructivism could be of value in supporting development of technology-based learning experiences and outcomes, such as knowledge acquisition and decision-making. This researcher constantly reviewed these three models to help guide and influence the study as they offered three pertinent and interconnected perspectives. While gathering the best available evidence to help guide the research, this researcher also reviewed and considered both core and contextual theories in the research activity - and given the technology base of simulation - ensured that this researcher developed the research within this context.

Conceptual framework for the study

While Constructivism was identified as the overarching and underpinning philosophical driver, it was projected that the conceptual framework would incorporate the inter-related education theories most commonly but often disparately identified in the literature, which include, Andragogy; Heutagogy; Tacit Knowledge; Learning Styles and Characteristics; Experiential Learning; Critical Thinking / Clinical Reasoning / Clinical Judgement; Debriefing and Guided Reflection; Novice to Expert; Acquisition of Expert Performance; and Self-efficacy. It was deemed that these ten education theories, from a socio-cultural perspective[11], demonstrate a robust and mutual connectivity, complementing one another in a collaborative process and collectively compounding the desired educational outcome of offering educational fidelity.

Context

The research-based conceptual framework would then allow educators, as they plan and design, to consider the following from a learner’s perspective:

- The curriculum;
- The cohort of learners, including the learning perspectives and tacit knowledge;
- The experience (based on learning outcomes designed using Bloom’s Taxonomy[12]);
- How they should think through and respond appropriately to the experience (encouraging how to critically think and reason);
- How they should reflect on the experience (making sense of the experience);

[11] Vygotsky: http://www.ceebl.manchester.ac.uk/events/archive/aligningcollaborativelearning/Vygotsky.pdf
[12] https://cft.vanderbilt.edu/guides-sub-pages/blooms-taxonomy/

- To what level of competence is the experience aiming for (based on the learning objectives);
- How does the experience plus further similar experiences contribute to development of expertise; and,
- How do these experiences and reflections feed the efficacy element of human behaviour and attitude (so cognitively and skills wise they are prepared for the task and variations on the task [be they clinical skills or/and contextual]).

Rationale

Social philosophy has humans continuingly interacting in a social context. Embedded in that interactivity are changes in knowledge, attitudes and behaviours and social change, at an individual, collective, cultural, societal and civilisation level. Constructivist theory[13] has individuals as learners discarding, re-aligning or reconstructing 'old' knowledge, attitude and activities as they construct (build) new perceptions, thoughts, ideas, knowledge and actions as a result of an education / learning experience. This is supported by the work of Ernst von Glasersfeld who noted that constructivism is 'an unconventional approach to the problems of knowledge and knowing. It starts from the assumption that knowledge, no matter how it is defined, is in the heads of persons, and that the thinking subject has no alternative but to construct what he or she knows on the basis of his or her own experience' (Glasersfeld, 1995). Embedded in this activity is an individual's review and reflective thought processes that allows the individual to draw new conclusions, attach new meaning, understanding, memories and applications. New mental models are formed (constructed). New activities and outcomes occur.

Educationally constructivist learning can occur while under instruction, through facilitation, collaboratively or independently. This connects strongly with education and practice scaffolding strategies and techniques. Constructivism provides a sound educational foundation for other education theories to build on and relate to. As such Constructivist Learning resonates strongly with simulation, given simulation - as an education and learning method - provides opportunities for both deconstructing and reconstructing previous perspectives and practices, and/or the constructing of new viewpoints and practices.

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[13] http://www.vonglasersfeld.com/172

Application considerations

To ensure, as a standard (a required level to be achieved) that the conceptual framework takes the user from the theoretical aspects being provided to a processing and application approach, there are a number of pre-design and development questions needing to be considered and addressed. When developing a curriculum, a course, tutorial, workshop, scenario, learning objectives and outcomes where simulation will be embedded and is integral to the educational process, it becomes necessary to first consider:

- How and what Constructivism principles and constructivist learning will guide these developments?
- What Constructivist foundational factors are important to review and consider? This links to the other education theories identified.
- Where will Constructivist learning be of benefit?
- When will Constructivist learning be of benefit?

The next consideration is to ascertain where and how Constructivist learning intersects with, and augments, a range of other components of a conceptual framework. These have been included in Table 2.

Constructivism and ➡	⇨	The teacher / instructor / facilitator / technician
	⇨	Resources (educational, human, technical, infrastructure)
	⇨	The curriculum
	⇨	Groups of learners
	⇨	A learner's work experience
	⇨	Complexity (in learning and environment)
	⇨	Authenticity (in learning and environment)
	⇨	Fidelity (in learning and environment)
	⇨	Situated learning
	⇨	Contextual learning
	⇨	Scaffolded learning
	⇨	Identified learning objectives and outcomes
	⇨	Andragogy (see theory in this chapter)
	⇨	Heutagogy (see theory in this chapter)
	⇨	Tacit knowledge (see theory in this chapter)
	⇨	The individual learner's learning style and characteristics (see theory in this chapter)
	⇨	Experiential learning (see theory in this chapter)
	⇨	Critical thinking (see theory in this chapter)
	⇨	Clinical reasoning (see theory in this chapter)
	⇨	Clinical judgment (see theory in this chapter)
	⇨	Feedback and debriefing (see theory in this chapter)
	⇨	Reflective learning (see theory in this chapter)
	⇨	Competency attainment (see theory in this chapter)
	⇨	Self-efficacy (see theory in this chapter)
	⇨	Expert practice (see theory in this chapter))
	⇨	Education taxonomies and simulation

Table 2: Constructivism and the Conceptual Framework

These educational theories will now be discussed and how they can potentially inform a conceptual framework for simulation in healthcare education.

Theory 1: Adult Learning Theory or Andragogy

The first theory identified is Adult Learning theory or Andragogy. The term 'Andragogy' refers to 'the discipline which studies the adult education process or the science of adult education' (Nottingham Andragogy Group 1983: p.v). Thus andragogy is the art and science of adult learning and in the context of this research andragogy refers to any form of adult learning (Kearsley, 2010).

There are a number of theorists who support the notion of adult learning. These include Plato, Alexander Kapp, Eugen Rosenstock-Huessy, John Dewey, Eduard Lindeman and Malcolm Knowles. The connection between these theorists is through the work of Kapp in 1833 (Nottingham Andragogy Group, 1983) who developed the term Andragogy from elements of Plato's education theory (*andr–* meaning 'man' and *agogos*, meaning 'leading') (Davenport, 1993: p.114). Dewey (1933), Rosenstock – Huessy and Lindeman further supported the concept (Nottingham Andragogy Group, 1983); however from a contemporary perspective it is the works of Knowles that dominates the literature and in applications.

Rationale

Since the early identification that adults learn from a different perspective than children this theory has been widely applied. While there have been many variations offered, the central tenet remains. Initial work by Dewey (1916; 1933) and Lindeman (1926; 1956; 1987) based their work on both being an adult learner and being a teacher of adults. Some of the key assumptions about adult learners are that they are motivated to learn when they experience needs and interests; that adults' orientation to learning is life-centered; that experience is the richest source for adults learning; that they have a deep need to be self-directing; and that andragogy is based upon Lindeman's adult learning theories.

From the works of Knowles (1980; 1984; 1990) who is the more contemporary theorist, the underlying premise of andragogy is based on a range of quite specific assumptions about how adult learners learn. These are quite different from the assumptions about how children learn – on which the theory of pedagogy is premised – a theory not relevant to this framework. While there may be debate around the definitions and applications of these terms in recent times, where the term 'pedagogy' has become the catchphrase most commonly used from an educational theory perspective, there remains a consensus that the adult learning principles of andragogy remain a sound education theory.

Knowles (1984) characteristics of adult learners are identified as;

> self-concept, where as a person matures his or her self-concept moves from one of being a dependent personality toward one of being a self-directed human being; experience, where as a person matures he or she accumulates a growing reservoir of experience that becomes an increasing resource for learning; readiness to learn, where as a person matures his or her readiness to learn becomes oriented increasingly to the developmental tasks of his or her social roles; orientation to learning, where as a person matures his or her time perspective of learning changes from one of postponed application of knowledge to immediacy of application, and accordingly his or her orientation toward learning shifts from one of subject-centeredness to one of problem centeredness; and motivation to learn, where as a person matures the motivation to learn is internal (p.12).

These characteristics are important considerations from both a simulation education and healthcare education perspective as these are the characteristics that are desired of the students entering into the healthcare workforce and healthcare personnel who are expected to sustain their professional knowledge, skills, aptitude and expertise. These dynamics are required to ensure that any design, delivery and evaluation activities are appropriate, have validity, reliability and address curriculum requirements.

Knowles (1980; 1984; 1990) also identifies four principles that are applied to adult learning. These are;

- Adults need to be involved in the planning and evaluation of their instruction;
- Experience (including mistakes) provides the basis for learning activities;
- Adults are most interested in learning about subjects that have immediate relevance to their job or personal life; and,
- Adult learning is problem-centered rather than content-oriented. (Kearsley, 2010).

Given these perspectives, it can be argued that the majority of learners who will be exposed to the use of simulation as a teaching, learning and assessment method will be adults who will demonstrate these characteristics and principles. Therefore there is an expectation at least that these learners' needs and outcomes can be addressed by the andragogy model. Thus it can be further argued that the Knowles' principles strike an accord with simulation and therefore provide the adult learner with a relevant process and a spectrum of applications that will coincide with and be relevant to their learning requirements.

Theory 2: Heutagogy or self-determined learning

The second theory identified is Heutagogy or self-determined learning. The concept of self-directed learning as an extension of adult learning is attributed to Stewart Hase and Chris Kenyon (2001) and it is intimated that heutagogy addresses the learning characteristics and needs of learners in the twenty-first century, particularly in respect to the development of an individual's capability. It also provides a solution to contemporary vocational education and training, and education needs.

A number of external pressures are contributing. The rapid development and uptake of information technology with the increasing choices of its delivery systems being offered over the twenty-four hour time cycle is especially a pivotal factor (Blaschke, 2012). It is increasingly impacting on the more traditional modes of teaching and learning, as are globalisation of education, and the changing demands of modern life and workplaces. More and more, teaching and learning needs to be more strongly aligned and contextualised to what the learner is doing – or needs to do. Heutagogy offers new direction and opportunity to respond to those pressures.

Rationale

The concept of Heutagogy and the study of self-determined learning offers a number of principles and practices that could be seen as a response to current identified education issues, limitations, changes and challenges especially from a changing work environment and from emerging technologies perspectives. While Heutagogy has strong educational links to Andragogy in that it takes on board the assumptions and principles of adult learning (self-directed), then applies a holistic approach to developing learner capacity and capabilities (self-determined).

As in an Andragogical approach, in Heutagogy while the educator facilitates the learning process by providing guidance and resources, the educator then fully relinquishes ownership of the learning path and process to the learner, who negotiates learning and determines what will be learned and how it will be learned. With Heutagogy, learning is seen as a learner-led active and proactive process, with learners being the lead player in their own learning, centred on tacit knowledge and personal experiences. The purpose that underlines this approach is a need to move past the gaining of knowledge and skills as a learning experience – and for the learner to identify what is relevant and required for them (Hase & Kenyon, 2001).

According to Hase and Kenyon (2001) heutagogy ‘takes account of intuition and concepts such as ‘double loop learning’ that are not linear and not necessarily planned. It may well be that a person does not identify a learning need at all but identifies the potential to learn from a novel experience as a matter of course and recognises that opportunity to reflect on what has happened and see how it challenges, disconfirms or supports existing values and assumptions’(Hase & Kenyon, 2001; web page). Hase & Kenyon (2001) also indicate that heutagogy, 'includes aspects of capability, action learning processes such as reflection, environmental scanning as understood in Systems Theory, and valuing experience and interaction with others. It goes beyond problem solving by enabling proactivity’ (Hase & Kenyon, 2001; web page).

It is suggested that a heutagogical learning environment facilitates both the development of capacity and capability in learners, and development of learner competencies with the goal of learners being work ready and work safe and prepared for the complexities of the contemporary workplace. Thus this theory resonates strongly with Constructivism, Andragogy, facilitation, simulation, learning with technology, reflection, self-efficacy, and with the other theories in this conceptual framework.

Theory 3: Tacit knowledge

The third theory identified is Tacit Knowledge. The concept of Tacit Knowledge - also known as informal knowledge - was developed by Michael Polanyi [14](Smith, 2003). The definition provided on the Business Directory website describes Tacit Knowledge as the, ‘unwritten, unspoken, and hidden vast storehouse of knowledge held by practically every normal human being, based on his or her emotions, experiences, insights, intuition, observations and internalized information’ (Business Directory website, 2015).

A further supporting definition is provided by Gasaway (2013) who identifies tacit knowledge as; ‘the collection of life’s experiences, education and training that reside outside conscious awareness. It’s the knowledge one possess that helps guide intuition, a vital component to making high-stress, high-consequence, split second decisions’ (Gasaway, 2013; website). Both of these definitions indicate the need for this type of knowledge to be addressed as it will be an influence on all education activities including simulation.

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[14] Polanyi: http://infed.org/mobi/michael-polanyi-and-tacit-knowledge/

Examples of Tacit Knowledge are provided by Fowler (2015) who has posted ten (10) examples of Tacit Knowledge that allow readers to further understand the value of including Tacit Knowledge within a conceptual framework and addressing these influencing factors during simulation-based education activities. These examples include how to speak a language; innovation; leadership; aesthetic sense; sales; body language; intuition; humour; tasks that require physical coordination (such as snowboarding, riding a bicycle, delivering CPR) and emotional intelligence. The ability of timing (whether intuitive or learned) too is Tacit Knowledge – and timing in healthcare is essential.

Rationale

Every individual will bring to a new learning situation their background know-how. That is, their previous educational, social and cultural knowledge, experiences, beliefs, views, prejudices, perceptions and expectations. They also bring those accumulated unconscious and conscious environmental experiences gathered and stored on a daily basis that help develop and guide an individual's life. These stored memories and learnings have the capacity in various ways to impact either positively or negatively on a learning experience. They can be of benefit in acquiring new knowledge and expertise as they facilitate new learning. However they can also impede new learning so it is important at least to acknowledge this phenomenon as a moderating factor in designing and delivering education experiences (Gasaway, 2013).

Gasaway (2013) importantly notes that the development of tacit knowledge is reliant on being exposed to both new experiences and repeated contact with current experiences such as practice. Gasaway (2013) points out that the only way new learners – and these can be either novices or experienced personnel entering into a new environment - develop and unconsciously embed tacit knowledge is by being provided with authentic, realistic, repeated simulations, plus exposure to both positive and negative past outcomes. It makes sense then that as simulation-based healthcare education is developed this type of knowledge is at least acknowledged if not addressed in the design and development phases.

When designed and delivered effectively simulation can provide the type of teaching and learning experience which either exposes the learner to a new experience – or builds further tacit knowledge – or adds to previous experiences and tacit knowledge. Gasaway (2013) supports this by indicating that the tacit knowledge developed through simulation provides further conscious and unconscious experience that benefits the healthcare worker and patients. This notion of engaging current tacit knowledge and building on it through a simulation-based education experience resinates well with the development of a conceptual framework that will guide that process.

Theory 4: Learning styles / characteristics / preferences

The fourth theory identified is Learning Styles / characteristics / preferences. Learning Styles, Learner Characteristics and Learner Preferences all fall within this domain, as most people vary their learning styles depending on the learning circumstance and environment. There is significant literature demonstrating that the concept of Learning Styles is broadly accepted, with recent research by Thompson-Schill et al. (2009) even providing empirical evidence of Learning Styles. There is also evidence that there remains much debate around the most appropriate and effective way to measure Learning Styles (Coffield et al., 2004).

There are a number of definitions that provide a clear view about Learning Styles, Characteristics and Preferences. According to Clark (2014), ‘a learning style is a student's consistent way of responding to and using stimuli in the context of learning’ (Clark, 2014; website). Meanwhile Keefe (1979) adds a deeper dimension in defining Learning Styles as, ‘the composite of characteristic cognitive, affective, and physiological factors that serve as relatively stable indicators of how a learner perceives, interacts with, and responds to the learning environment’(Clark, 2014; website). While these two definitions indicate it is the learner’s propensity to respond in a certain way, Stewart and Felicetti (1992) shift the focus somewhat in defining Learning Styles as those, ‘educational conditions under which a student is most likely to learn’ (Clark, 2014; website). Collectively however they all indicate that learning styles are not really concerned with what learners learn, but rather how they prefer to learn. Thus it is important that teaching, learning and training programs reflect the learning styles, characteristics and preferences of individuals in order for them to be effective learners.

Rationale

While there are any number of theorists to consider for the development and context of the conceptual framework the following have been deemed to be the most appropriate. They include Kolb’s Learning Styles Inventory (LSI), Honey and Mumford’s Learning Styles Questionnaire (LSQ) and Fleming’s Visual Auditory Kinesthetic (VAK) model.

Kolb's learning styles inventory (LSI)

According to Kolb (1984) learning is, 'the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping experience and transforming it.'(p.41)

While there are scores of learning theories and models in the education literature the learning style theory and model that appears to dominate the simulation literature - from a reference perspective - but significantly less from a research perspective - is the work of Kolb (1984). According to Kolb (1984) effective learning involves the learner:

- feeling a concrete experience;
- undertaking reflective observation (watching the experience);
- generating abstract conceptualisation (thinking about the experience); and,
- undertaking active experimentation (generating activity – doing).

Kolb (1984) also identifies four types of learners:

- Divergers, who feel and watch the learning experience (tend to reflect and brainstorm);
- Assimilators, who think and watch the learning experience (tend to apply inductive reasoning, generate ideas, develop concepts);
- Converters, who think and get actively involved in the learning experience (learning by doing) (tend to problem solve, be decision making and utilise practical skills); and,
- Accommodators, who feel and carry out the learning experience (tend to use experience, carry out tasks, are adaptive and have intuitive skills).

This is demonstrated in the following graphics - based on the two intersecting cognition planes Kolb identified: the perception and processing continuums (Figures 4 and 5).

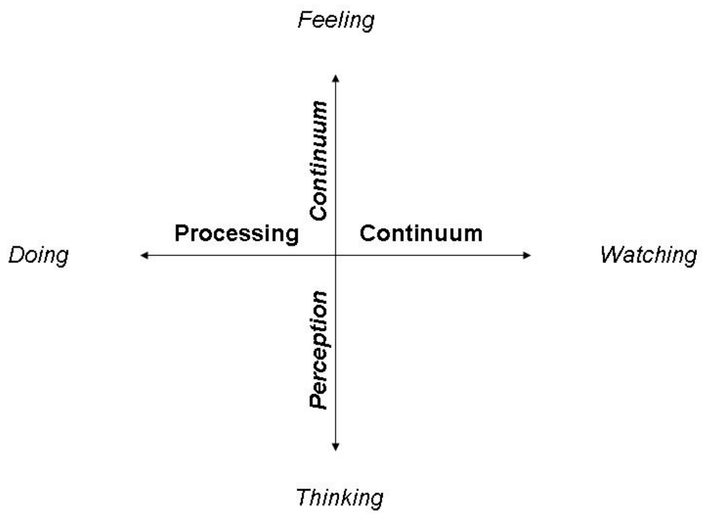

Figure 4: Kolb's Learning Model (Clarke, 2014)

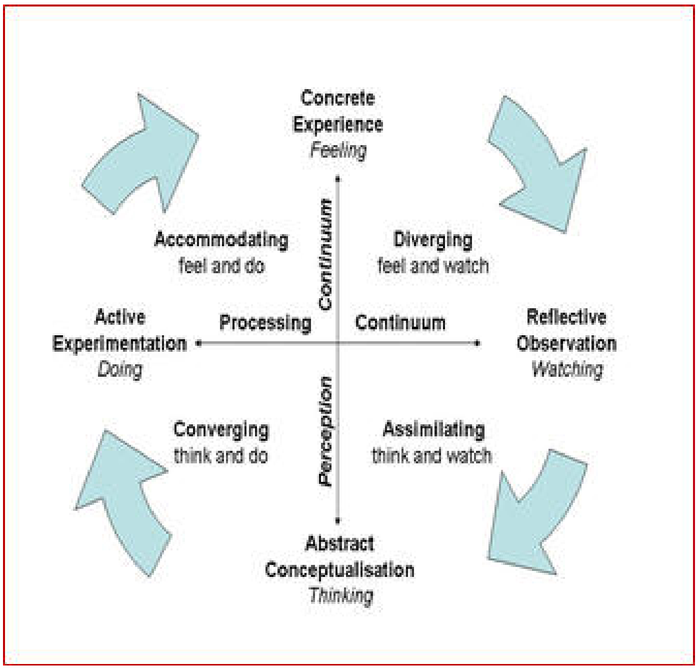

Figure 5: Kolb's Learning Style Inventory (Clarke, 2014)

It is suggested that this model is unlike many other learning models in that it provides mutually a means by which to understand individual learning styles and also a description of a progression of *experiential learning*[15] that applies to all learners.

[15] This graphic is also used to describe Experiential Learning theory. This learning styles inventory model is a variation on the Experiential Learning theory which will be discussed separately.

Honey & Mumford's learning styles model questionnaire (LSQ)

While Kolb has dominated the learning theory landscape, he has inspired many other theorists. Honey & Mumford and Clarke draw on Kolb's model but they differ in their inventory approach (Honey & Mumford, 2000; Clarke, 2014). While Kolb's inventory asked people directly how they learn (Clarke, 2014) the Honey & Mumford inventory (Honey & Mumford, 2000) seeks out general behavioural tendencies. They believe most people don't really think about how they learn and even move in and out of different learning styles - depending on the situation.

As a result, while their model is essentially the same as Kolb's model, Honey and Mumford (Honey & Mumford, 2000; Clarke, 2014) introduced some differences in terminology and meaning. They replaced the terms with their own terms;

- "reflector" for divergers (reflective observation);
- "theorist" for assimilators (abstract conceptualization);
- "pragmatist" for convergers (concrete experience);
- "activist" for accommodators (active experimentation).

Honey and Mumford's Learning Cycle (Clarke, 2014) also slightly differs from Kolb's. Honey and Mumford (Clarke, 2014) identifies learners as having an experience, reflecting on it, drawing their own conclusions (theorising) and then putting theory into practice. See Figure 6.

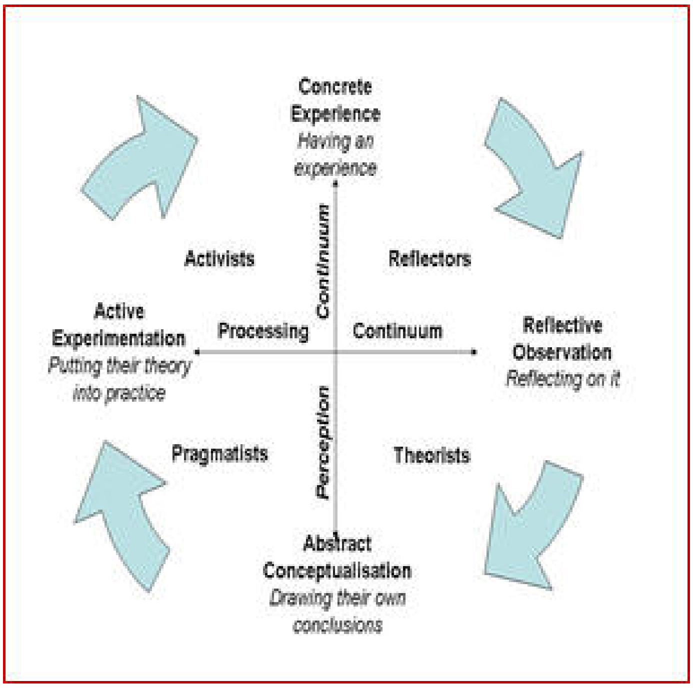

Figure 6: Honey and Mumford Learning Cycle (Clarke, 2014)

Honey and Mumford (Clarke, 2014) also acknowledge that learners could continually move around the cycle, step in any part of the cycle, and then step out when they considered they had achieved success by learning the theory / content and the task or skill.

When shown these models many healthcare professionals can identify their own learning preferences when consciously asked about them. Indeed this is a simple and useful exercise as it helps the teacher / facilitator to design / deliver / pace an educational activity to more effectively capture most learning styles.

Fleming's visual auditory kinesthetic (VAK) model

Fleming's Visual Auditory Kinesthetic (VAK) model also resinates well with the learning characteristics of healthcare workers (James Cook University, 2015). With this model, most people possess a dominant or preferred learning style; however some people have a mixed and evenly balanced blend of the three styles;

- Visual learners
- Auditory learners
- Kinaesthetic learners

A further learning style sometimes raised is Tactile learners (Clarke, 2014).

There are a significant number of preferences under each of these learner styles and while the preferences of these learners are too extensive to list in the actual conceptual framework they have been transposed into a table in efforts to demonstrate the diversity identified (Table 3). They can also be accessed on the James Cook University (JCU) website under JCU Workplace Educators Resource Package.

Visual Learners	Auditory Learners	Kinaesthetic learners
tend to:	**tend to:**	**tend to:**
Learn through seeing	Learn through listening	Learn through moving, doing and touching
Think in pictures and need to create vivid mental images to retain information	Have highly developed auditory skills and are generally good at speaking and presenting	Express themselves through movement
Enjoy looking at maps, charts, pictures, videos, and movies	Think in words rather than pictures	Have good sense of balance and eye-hand coordination
Have visual skills which are demonstrated in puzzle building, reading, writing, understanding charts and graphs, a good sense of direction, sketching, painting, creating visual metaphors and analogies (perhaps through the visual arts), manipulating images, constructing, fixing, designing practical objects, and interpreting visual images	Learn best through verbal lectures, discussions, talking things through and listening to what others have to say	Remember and process information through interacting with the space around them
	Have auditory skills demonstrated in listening, speaking, writing, storytelling, explaining, teaching, using humour, understanding the syntax and meaning of words, remembering information, arguing their point of view, and analysing language usage	Find it hard to sit still for long periods and may become distracted by their need for activity and exploration
		Have skills demonstrated in physical coordination, athletic ability, hands on experimentation, using body language, crafts, acting, miming, using their hands to create or build, dancing, and expressing emotions through the body.

Table 3: Learner Style Preferences

Modified from JCU Workplace Educators Resource Package
Website: http://www.jcu.edu.au/wiledpack/modules/fsl/JCU_090460.html

On the JCU Workplace Educators Resource Package web page they also provide a number of techniques that can be applied to facilitate students in developing, exploring and enhancing their learning strengths. It is suggested that the more a student learns via a combination of all the learning styles (visual, auditory and kinaesthetic) the more integrated and entrenched the learning will be. Table 4 offers Leaning Styles activities to encourage learners.

Visual Learners	Auditory Learners	Kinaesthetic learners
Encourage to:	**Encourage to:**	**Encourage to:**
use graphics to reinforce learning	read aloud	make models or role play to physically experience learning
colour code to organise notes and possessions	recite information to learn	skim through reading material before reading it in detail
use colour to highlight important points in text	use tunes or rhymes as mnemonic devices	annotate text and write questions while reading
take notes	read aloud and tape test questions or directions	translate information into diagrams or other visual study tools
illustrate ideas as a picture before writing them down	use verbal analogies and storytelling to demonstrate their point	recite a list of items by counting on fingers
ask for written directions		memorise or drill while moving e.g. when walking
use flow charts and diagrams for note taking		listen to music while studying
visualise spelling of words or facts to be memorised		

Table 4: Learner Style Activities

Modified from JCU Workplace Educators Resource Package
Website: http://www.jcu.edu.au/wiledpack/modules/fsl/JCU_090460.html

For those considering a simulation-based intervention, use of these two Tables may be of benefit to review before any planning and designing occurs.

Theory 5: Experiential learning

The fifth theory identified is Experiential Learning. There is significant literature on the subject of experiential learning both in mainstream education and in the simulation literature as many healthcare personnel and disciplines can relate to this underpinning and pivotal education theory.

Rationale

The educational concept of Experiential Learning is a well-established approach in adult education theory. There is frequent reference to Experiential Learning in mainstream education (Kolb & Kolb, 2005) and healthcare simulation education literature. A search of the simulation literature provides a number of publications related to Experiential Learning (Rubino & Freshman, 2001; Morgan et al., 2002; Underberg, 2003; Sewchuk, 2005; Kayes, Kayes & Kolb, 2005; Fowler, 2007; Waldner & Olsen, 2007; Miller et al., 2008; Kolb &Kolb, 2009; Ker & Bradley, 2010; Lisko & O’Dell, 2010; Humphreys, 2013; McLeod, 2013). This indicates that the literature is identifying and demonstrating the need for an education theory underpinning educational activities. However there are far less publications – in simulation education – where research has demonstrated how that recognition has been subsequently applied and measured in terms of outcomes.

Experiential learning as an education theory strongly resonates with simulation as a learning and teaching process - due to the very essence of most simulation-based learning being experiential in design and intent. But Experiential Learning is not just about the exposure to and the doing of an activity – it is also about how the participant reviews, processes, reflects and demonstrates an outcome as a result. It is not just the experience itself – although that provides the relevant context and trigger(s) for the learner to acquire or refresh and apply knowledge, feelings, attitudes and skills. Importantly it is Experiential Learning that addresses the needs and wants of the learner - and this requires the learner's personal involvement, that it is self-initiated; it is evaluated by the learner as to its relevance and that it has all-encompassing effects on the learner. Indeed Experiential Learning is providing a platform for Constructivist learning to occur.

There are many theorists who describe Experiential Learning from their different perspectives and their focus. It is not the intention in this conceptual framework to exposé them all but rather to give consideration to the most appropriate one(s) that suit the needs of simulation educators and users. Those noted here are the most reviewed and who have most impacted on the contemporary theory mentioned here.

While the founders of this approach include John Dewey, Kurt Lewin, Karl Rogers, Jean Piaget – whose works have all influenced David Kolb - it is Kolb's Experiential Learning Theory and four-stage model – based on Lewin's graphic - that dominates current approaches to experiential learning, and one that lends itself to healthcare simulation education.

Kolb's experiential learning theory and learning styles model

Kolb (1984) saw learning – the creating of knowledge, skill and attitudes – occurred as a result of an exposure to an experience and the transforming of that experience into the learning outcome. He also identified that learning is based on how learners prefer to learn. Kolb's Experiential Learning Theory establishes four distinct learning styles -or preferences - which are based on a four-stage learning cycle (courtesy of Lewin). Kolb's model offers both a way to understand individual learning styles, and also an explanation of a cycle of Experiential Learning that applies to all learners (Figure 7).

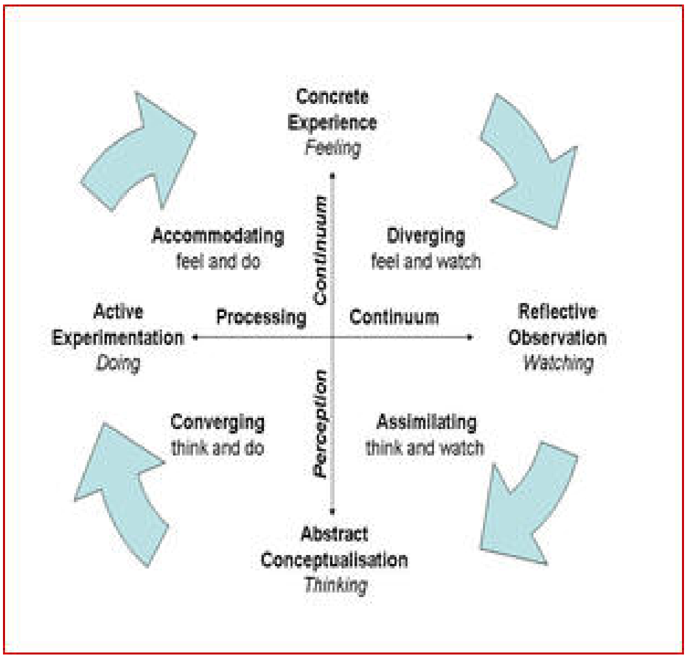

Figure 7: Kolb's Experiential Learning Cycle (Clarke, 2014)

While the Experiential Learning Cycle demonstrates the various experiential elements the following table (Table 5) helps contextualise how a learner in each of the elements perceives and behaves.

Concrete Experience (CE)	**Reflective Observation (RO)**	**Abstract Conceptualization (AC)**	**Active Experimentation (AE)**
Learner emphasises personal involvement with people in everyday situations	Learner understands ideas and situations from different points of view	Learning involves using theories, logic and ideas, rather than feelings, to understand problems or situations.	Learning takes an active form - experimenting with changing situations.
Learner tends to rely more on feelings than on systematic approach to problems and situations	In a learning situation the learner relies on patience, objectivity, and careful judgement would not necessarily take any action	Learner relies on systematic planning and develops theories and ideas to solve problems.	Learner takes a practical approach and concerned with what really works as opposed to simply watching a situation.
In a learning situation, the learner relies on ability to be open-minded and adaptable to change	Learner relies on their own thoughts and feelings in forming opinions		

Table 5: Kolb's four stages in the cycle of experiential learning
Modified from JCU Workplace Educators Resource Package
Website: http://www.jcu.edu.au/wiledpack/modules/fsl/JCU_090460.html

Kolb's learning styles contextualised within the experiential learning cycle

Kolb (1984) indicated that there is a level of connectivity between the Experiential Learning Cycle and Learning Styles. Kolb put forward the notion that the learning style of an individual is the combination of two pairs of preferences and it is that combination of these paired preferences that guides how an individual learns. This includes how a learner approaches an activity and how the learner responds to, embraces and understands the experience.

Kolb (1984) proposed that the combination of these preferences creates four main learning styles. Kolb placed these preferences as lines of axis, each with contradictory learning modes at either end. These are demonstrated as (Figure 8);

Concrete Experience - CE (feeling)	**vs**	Abstract Conceptualization - AC (thinking)
Active Experimentation - AE (doing)	**vs**	Reflective Observation - RO (watching)

Figure 8: Kolb's Four Main Learning Preferences (Clarke, 2014)

Kolb (1984) demonstrated the inter-relationship and tensions of these learning preferences through the use of a vertical and horizontal axis learning model (Figure 9) and when overlaying these on the Experiential Learning Cycle (Figure 7) the learner’s preferred Learning Style emerges.

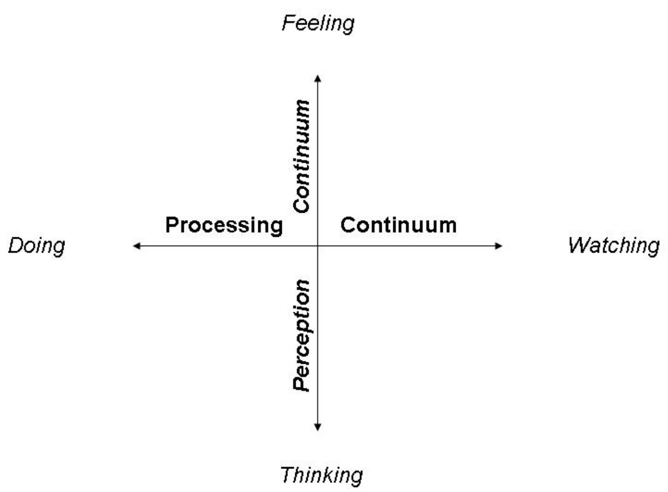

Figure 9: Kolb's Learning Model (Clarke, 2014)

Figure 9 demonstrates the connection between the two planes of perception and processing – and where the learner might be – depending on the experience itself, its context, their tacit knowledge and experiences – and their learning style. According to Kolb (1984) a learner with a dominant learning preference of ‘thinking’ and ‘doing’ thus has a ‘Converger’ learning style. A learner with a dominant learning preference of ‘watching’ and ‘thinking’ has an ‘Assimilating’ learning style. A learner with a dominant learning preference of ‘thinking’ and ‘watching’ will be more likely a ‘Diverger’ and a ‘feel’ and ‘do’ person will be an ‘Accommodator’.

Table 6 adds further ‘preferences’ under each of the four learning styles to assist in the understanding of how people perceive their learning strengths and weaknesses, capacities and capabilities. This informs the developer when designing simulations especially if the developer has a profile of the individuals within the learning cohort.

Diverging preference for feeling and watching - CE/RO	Assimilating preference for thinking and watching - AC/RO	Converging preference for thinking and doing - AC/AE	Accommodating preference for feeling and doing - CE/AE
prefers to watch rather than do	requires good, clear explanation rather than practical opportunity	solves problems	prefers learning that is "hands-on"
likes to gather information and brainstorm	prefers readings, lectures, exploring models and theories	uses learning to find solutions to practical situations	acts on "gut" and intuition rather than logic
will use imagination to problem solve	needs time to think things through	prefers technical tasks	takes a practical, experiential approach
is able to look at things from different perspectives	will have a concise, logical approach to learning	likes to experiment with new ideas, to simulate and to work with practical applications	is attracted to new challenges and experiences
generates ideas and prefers group work learning	will organise information clearly and logically	finds practical uses for ideas and problems	relies on others for information and problem solving rather than carry out own analysis
is sensitive, imaginative and emotional	considers ideas and concepts are important	prefers practical problem solving rather than dealing with social or interpersonal issues	prefers to work in teams
will have broad cultural interests	creates models/theories		sets targets and actively works to achieve them.
is interested in people	will have a preference for abstract ideas and theories - less focused on people		
will listen with an open mind			
will accept personal feedback			

Table 6: Learner style characteristics
Modified from JCU Workplace Educators Resource Package
Website: http://www.jcu.edu.au/wiledpack/modules/fsl/JCU_090460.html

This profiling of learning styles offers those designing, developing and delivering simulations opportunities to reflect on how teaching and especially learning can be better focused and placed according to preferred methods. However many people respond to all types of learning styles to some extent. By being cognizant of this information and addressing the differing learning style preferences, means being more appropriately prepared to contextualise and customise the simulation to gain maximum effect of the intervention. That is, providing the best learning preference-mix opportunity during the experiential cycle for learning outcomes to be noticeably achieved.

The design and delivery issue of a course is one of accommodation. The nature and timing of many simulation activities means that to address a range of different learning preferences becomes problematic for the educator. However that does not mean it cannot be attempted in efforts to facilitate best learning. There will be learners with a strong preference for a particular learning style who will become frustrated because they are not capable of easily switching between different styles. Assimilators will be uncomfortable being placed in a challenging situation without some form of instruction, while Accommodators will be frustrated by lots of instructions and rules before getting into the challenging situation. So it beholds the educator to provide the best positive opportunities for students, while exposing students through simulation, how to develop skills in how to learn, across different styles of learning.

Situated cognition theory (situated learning)

This particular theory as espoused by Brown, Collins and Duguid (1989) would appear to 'sit' within the larger Experiential Learning theory. It has social, contextual and constructivist elements in that the learning of knowledge and skills occurs in various contexts that represent and reflect the way these will be applied in the real world. This theory encourages the immersion of learners in an authentic learning environment that approximates as closely as possible the situation in which the new knowledge, practice or attitude will be required. This practical approach reflects a situated perspective by seeking to contextualize learning – and this closely aligns with the intent of simulation.

Theory 6: Critical thinking / clinical reasoning / clinical judgement

The sixth education theory identified is the theory of Critical Thinking / Clinical Reasoning / Clinical Judgement. Theorist(s) to consider include John Dewey, Peter Facione, Noreen Facione and Carol Giancarlo and their work is regularly referred to and commented on. However from a contemporary perspective there is a developing body of report and research publications related to these inter-related concepts in the simulation literature as many healthcare personnel and disciplines increasingly realise the need to understand, address and attempt to more effectively measure this pivotal education theory.

Critical Thinking

It is reasonable to suggest that within the mix of those other education theories already mentioned addressing Andragogy, Heutagogy, Tacit Knowledge, Learning styles and Experiential Learning, there is a need to consider this education theory. Critical Thinking Theory also intersects with and facilitates the other theories and models also provided in this conceptual framework. They include the Reflective Learner, Skills Development and Clinical Competency Attainment, Development and reinforcement of Self-efficacy and ultimately Deliberate Practice towards Expert Performance. In that sense this theory has a pivotal interconnecting role within the conceptual framework in how the learner makes sense of the education intervention and subsequently uses that learning.

Rationale

Critical Thinking has its roots in history from Socrates onward and a brief expose is provided by the Critical Thinking Community[16]. However from a more contemporary perspective in earlier education theory development, John Dewey (1910; 1982), in his book *How We Think*, defined critical thinking as "reflective thought" indicating one needed to suspend judgment, maintain a healthy scepticism, and exercise an open mind, and that critical thinking has both an intellectual and an emotional component. Others have also indicated this.

There is any number of definitions of Critical Thinking and it becomes problematic to provide them all in this rationale. One quite succinct definition provided on the Critical Thinking web site (Lau & Chan, 2015) is;

“Critical thinking is the ability to think clearly and rationally. It includes the ability to engage in reflective and independent thinking. Someone with critical thinking skills is able to do the following:

- understand the logical connections between ideas;
- identify, construct and evaluate arguments;
- detect inconsistencies and common mistakes in reasoning;
- solve problems systematically;
- identify the relevance and importance of ideas; and,
- reflect on the justification of one's own beliefs and values.”

(Lau & Chan, 2015; Critical Thinking Web)

[16] https://www.criticalthinking.org/

A further perspective is provided by others to demonstrate the varying approaches to Critical Thinking Theory. Cognitive Technologies, Inc. argue that critical thinking has a multi-layered structure and demonstrate this in diagramatic form (Figure 10). They also raise the concept of mental model theory – which is in harmony with simulation – for it is a shared mental model that is an important driver of achieving effective simulation activities and outcomes. They also indicate that the concept of critical thinking or critical dialogue forms the necessary logic - or rationality bridge - between the component parts of the model. Indeed Cognitive Technologies, Inc. believes that critical thinking skill is exemplified by asking and answering critical questions about alternative possible states of affairs, with the intent of achieving the purpose of an on-going activity.

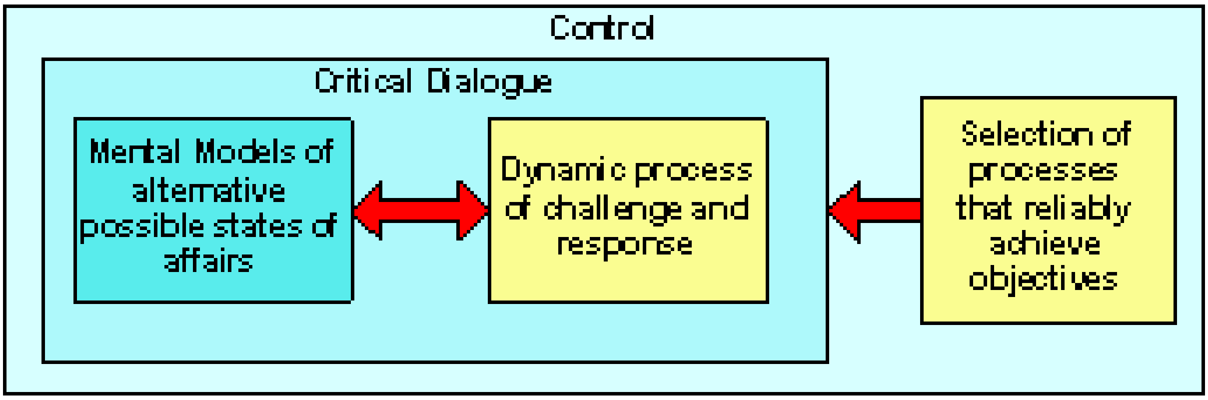

Figure 10: A model of critical thinking (Cognitive Technologies, Inc.).

However from a theoretical perspective the following expert consensus statement provided by Facione (1990) is offered to establish some boundaries for the theory in this context: 'Critical Thinking: A Statement of Expert Consensus for Purposes of Educational Assessment and Instruction: We understand critical thinking to be purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based. CT is essential as a tool of inquiry' (p.2). The consensus statement goes on to describe what they believe to be the ideal critical thinker – and thus the need to educate good critical thinkers would indicate a need and strategy to work toward this ideal. There is also provided a list of Critical Thinking cognitive skills and sub-skills of which the Delphi experts found significant consensus. These are embedded in the next comment.

Importantly Facione and Facione (2008) and Facione and Facione (1997) identify the strategic locus of critical thinking as a pivotal, essential cognitive and internally motivated reasoning disposition process for professionals. Facione and Facione (1997) state that;

> Professionals are expected to exercise sound, unbiased judgment in interpreting and analyzing information, determining the nature of problems, identifying and evaluating alternative courses of action, making decisions, and, throughout, monitoring the process and impact of their problem solving activity so as to amend, revise, correct, or alter their decisions, or any element that led up to those decisions, as deemed necessary. Judgment in professional practice, correctly exercised, is a reflective, self-corrective, purposeful thinking process which requires the professional to take into account content knowledge, context, evidence, methods, conceptualizations, and a variety of criteria and standards of adequacy. Professional judgment is what educators have called "critical thinking" but exercised in a practical, professional setting (p.1).

While this statement encompasses what is essential to know about the core cognitive activity that is Critical Thinking, it is also important to acknowledge there are other aspects to consider: namely how professionals, through knowledge and experience, develop and apply clinical reasoning; and through development of opinions, demonstrate clinical judgement which may also include creative and intuitive thought and behaviour.

Clinical Reasoning

Indeed the connectivity is aptly provided in the Lapkin et al. (2010) systematic review that looked at the effectiveness of using human patient simulation manikins in the teaching of clinical reasoning skills to undergraduate nursing students. Lapkin et al. (2010) note that, clinical reasoning is an essential element of competency in practice. It is an activity that encompasses both cognitive and metacognitive (or reflective thinking) and is dependent upon a critical thinking temperament.

While this rationale section is focused on indicating the need to consider the Critical Thinking Theory in relation to simulation education, it is recommended that significant focus is given to where Clinical Reasoning sits in this domain. Though there are many publications across many areas to consider, the reference work of Tracy Levett-Jones (2013) is of contemporary significance as the material in this reference book provides a bridge to applying theory to practice in a simulation setting. It provides an educational model (the clinical reasoning process) designed to help identify and manage clinical issues plus a number of well-designed focused scenarios that address Clinical Reasoning and help in triggering Critical Thinking and creatively in care provision. It is one of the few publications that offer an application process – based on sound educational theory.

Clinical Judgement

From a Clinical Judgement perspective there is one definition that has been referred to many times in the literature. Tanner (2006) has identified Clinical Judgement as, 'an interpretation or conclusion about a patient's needs, concerns, or health problems, and/or the decision to take action (or not), use or modify standard approaches, or improvise new ones as deemed appropriate by the patient's response' (p.204). Meanwhile Phaneuf (2008) after commenting on the difficulty of providing a definition that is unanimous, indicates that, from a nursing perspective, 'clinical judgement is the conclusion or enlightened opinion at which a nurse arrives following a process of observation, reflexion and analysis of observable or available information or data'(p.1). Phaneuf (2008) then goes on to provide a range of different ways in how to portray the differences and complexities of determining Clinical Judgement, makes comment of the use of simulation and learning exercises in helping develop Clinical Judgement skills and also provides an example comparison between the two main disciplines in healthcare (Table 7). Lasater (2007) also reports on how the various designed and delivered activities during the use of high fidelity simulation facilitates the development of Clinical Judgment.

Outcomes of Clinical Judgement in Nursing and in Medicine	
Medical Judgement leads to:	**Clinical Judgement in Nursing leads to:**
The identification of a disease	The identification and logical interpretation of symptoms
The development of an appropriate treatment	The planning of care to alleviate or prevent complications or relapses
A cure for symptoms	The nurse is doing what the patient would do for himself if he had the required strength or knowledge
The prevention of complications	Helping the patient satisfy his physical, psychological and spiritual needs at the same time
The prevention of relapses	Assisting the patient in passing away with dignity, if necessary
Limiting the side-effects or complications of a disease	(Phaneuf, 2008)

Table 7: Modified Clinical Judgement Comparison chart

Kienle and Kiene (2011) has indicated there is recently renewed interest in clinical judgement in medicine and its role in communication, diagnosis and decision making. Kienle and Kiene (2011) highlight that clinical judgement is a pivotal component of medicine, vital for how a clinician performs, crucial for other healthcare professionals and important from a management perspective. Kienle and Kiene (2011) go on to pursue a literature review and theory development and in doing so mention the pivotal role Tacit Knowledge and Reflection in Action play in how a doctor will come to a clinical judgement – two key elements of the conceptual framework platform.

Shaban (2005) also provides a timely review of the various theories of clinical judgement and decision-making in the literature. After reviewing a number of definitions, Shaban (2005) goes on to demonstrate that from a broad perspective, theories of human judgment and decision-making may be viewed from a range of different positions and philosophies. These include; the ‘classical’ decision-making paradigm; a naturalistic (or behavioural) decision-making paradigm; the descriptive (information processing) theory – often used in nursing and midwifery - also referred to as the hypothetico-deductive approach; normative theories (logical, rational procedures for decision-making that may be theorised); prescriptive theories (focus is to improve individual’s judgments); social judgment theory; intuition; cognitive continuum; and the expert-novice theory – which looks at metacognition outcomes - and is the one most widely used, especially across multiple disciplines and contexts in health.

Critical Thinking Theory including Clinical Reasoning and Clinical Judgement - and its relationship to and interconnectivity with the other education theories - is an important and strategic theory to consider when developing simulation activities – given the underpinning process of learning with simulation is to help trigger learners to develop those ideal critical thinking traits, to generate clinical reasoning, to make some sound and valued clinical judgements – and demonstrate competence in practice.

Theory 7: The reflective learner / guided reflection

The seventh education theory identified is the Reflective Learning Theory. Theorists to consider include John Dewey (1910;1933;1938), Donald Schön (1983;1987), Malcom Knowles (1980), David Kolb (2005) and Carol Rodgers (2002), and their work is regularly referred to and commented on along with an increasing number of interested parties who have been exploring this theory further. Indeed, as with Critical Thinking Theory, from a contemporary perspective there is a developing body of report and research publications related to Reflective Learning Theory as many healthcare personnel and disciplines increasingly realise the need to understand, address and attempt to more effectively measure this increasingly pivotal education theory. It is reasonable to suggest that within the mix of those other education theories already mentioned addressing Andragogy, Heutagogy, Tacit

Knowledge, Learning styles, Experiential Learning Theory and Critical Thinking Theory, there is a need to consider this education theory further.

Rationale

Reflection is the opportunity to re-examine the experience. It can be a chronological review where the experience of activities that occurred over a time-frame are thought about within the context of that timeline; or thinking upon what comes to mind first and working through the experience from that starting point. It is also a time to review the thinking processes that took place during the events of the experience.

There are three stages of reflection. These are awareness, critical analysis and new perspective. Reflection - as a metacognitive process (a thought 'toolkit') - is a pivotal and essential component of all those stages, allowing the learner to make sense and make decisions within all these domains (Collingwood, 2005). It is the musing, the contemplation, the ruminating and deliberation of information received –such as simulation-based education - that facilitates the outcomes; that is, the decision making and action(s).

Most of us can relate to the concept of reflective thought and the action and outcome(s) of reflection. We do it constantly throughout our lives. On a daily basis we receive various sensory inputs from the many environments that we interface with (e.g. emotional, human, social, cultural, communication, technology, work, political, climatic) and we receive physiological biofeedback from ourselves. We either make a series of unconscious, rapid heuristic decisions – based on repeated previous experiences (experiential learning) that we have already reflected on, problem-solved and found solutions – or we consciously reflect on that input to make sense of it and possibly come up with solutions – or not.

Reflection allows us to make sense of what we are 'learning' and how we might best use that 'learning' to our advantage. Sometimes it causes us to modify previous 'learning' and decisions. We construct or deconstruct and reconstruct our thoughts, attitudes, actions and outcomes depending on the input. Learning how to drive is a good example of, where over time and the build-up of experiences, informed, advantageous learning and skills are developed, with the ultimate outcome of a successful driving licence test being established.

If we apply critical thinking principles and practices – that is correct thinking in the pursuit of relevant and reliable knowledge - It is reasonable, reflective, responsible, and skilful thinking that is focused on deciding what to believe or do. A person who thinks critically can ask appropriate questions, gather relevant information, efficiently and creatively sort through this information, reason logically from this information, and come to reliable and trustworthy conclusions.

The importance of using reflective learning to teach learners to apply what they have learned from one situation to the next in the context of critical thinking and decision making is well documented (Decker et al, 2008; Dreifuerst, 2013; INACSL Standards Committee, 2016). So in that sense there is a strong correlation between critical thinking, reflection and problem-solving – and that activity is easily demonstrated as an action research type cycle in Figure 11.

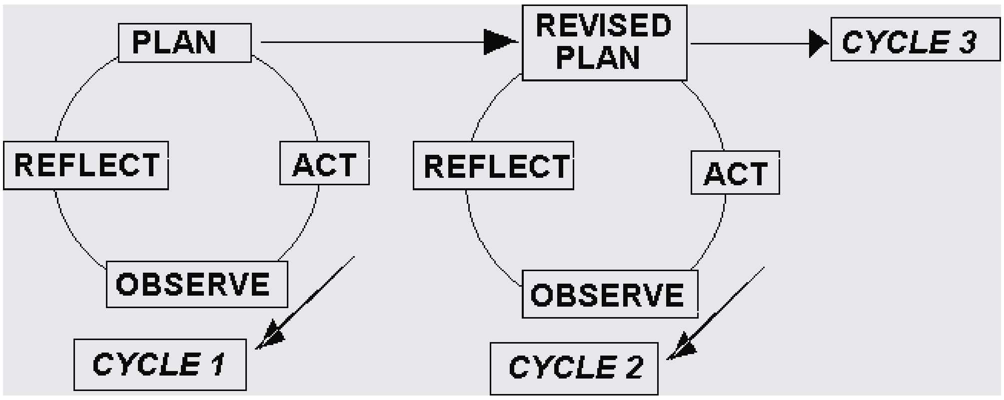

Figure 11: Problem solving action cycle (Riding, Fowell. & Levy, 1995)

Problem-solving requires conscious processing in a particular thought format (reflecting using critical thinking skills) to sort things out and come to new conclusions: a clear constructivist model.

Underpinning theories

From an education theory perspective the concept of reflection on an education experience as a process of improving knowledge, performance and changing attitudes is not a new concept. There have been significant writings and research in mainstream education, with many differing views about what reflection is and how it might be encouraged – and for what purpose.

Education theorist John Dewey (1933) reported on experience and reflection in his early publications. Dewey (1933) defined reflective thought as, ‘active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it tends' (p.118) and identifies five phases or aspects of reflective thought. These embrace; suggestions where possible solutions are thought of; intellectualization of the experience into a problem; the thinking through of sequential suggestions as a hypothesis to help guide further observations, activities or gather further facts; through reasoning the further development of the idea or supposition; and the validation of decided hypothesis by action(s) – be they actual or imaginative in nature (Infed.org website).

Dewey's theory of inquiry work was reviewed and built on by Donald Schön (1983; 1987) who introduced notions such as 'the learning society', 'double-loop learning', the 'reflective practitioner', 'reflection-in-action' and 'reflection-on-action', which have become part of the language of education and now increasingly in the simulation community (Infed.org website).

Andragogy and experiential learning – and reflection

The adult learning concept of Andragogy as developed by Malcom Knowles and reported early in this study requires the adult learner to identify their learning needs and requirements, their preferred ways and processes of learning, the relevance of their learning to their development - and reflect on these (see Theory 1). In David Kolb's Experiential Learning Theory, people learn in a cycle consisting of four stages; consisting of concrete experience; observation and reflection; forming abstract concepts; and the testing of those abstracts in new situations (see Theory 4). Both of these well developed, applied and reported theories support the need for reflection to be an essential component of the learning process.

Carol Rodgers (2002), who draws on the work of Dewey and others, takes reflection further suggesting it is important that educators need to be reflective in their own role and as a community of educators, to ensure educators develop the skills of establishing a student-focused learning environment. Using a four-phase reflective cycle, Rodgers looks at the roles of presence, description, analysis, and experimentation. Rodgers (2002) also encourages the use of structured feed-back to ensure educators are teaching appropriately and meeting student's learning needs. Rodgers (2002), referring to Schön and the reflective cycle, also recognizes reflection can happen in the midst of experience (reflection-in-action) or outside an experience (reflection-on-action) (Harvard Graduate School of Education website).

As such Reflective Learning Theory intersects with and supports healthcare simulation education. How the process of reflection is embedded in simulation is predominantly through the use of debriefing and feedback frameworks / models and processes.

Constructive feedback and debriefing – and reflection

Feedback and debriefing are education strategies that rely on the use of reflection to attain learning outcomes. The medical and nursing education and simulation literature is now increasingly suggesting that more significant learning occurs in the period immediately following the termination of the simulation scenario. Evidence of this is reported later in this section.

This is where constructive debriefing commonly occurs and it is during this phase of patient simulation where insight into the clinical issue is made explicit through reflection. It is also suggested that the value of the participant's learning is in the participant's ability to engage in reflection on practice, which in turn more importantly translates into actionable knowledge. Thus debriefing provides opportunities to foster reflective learning, encompassing the ability to think-in-action as well as think-on-action (Schön, 1983; 1987).

This action research format graphic demonstrates that during/post simulation reflection through debriefing leads to a cyclical constructivist change process (Figure 12).

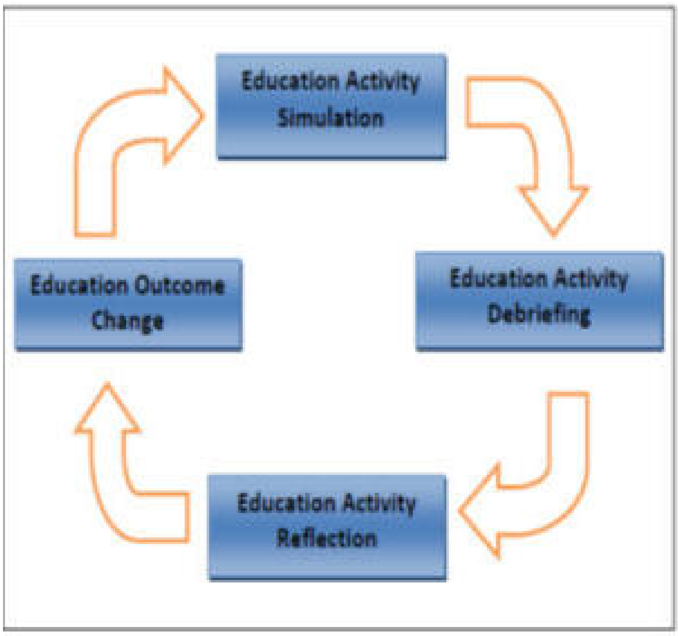

Figure 12: Simulation - Debriefing - Reflection - Outcome cycle

Reflection variables in simulation

There are four main variables repeatedly described in the textbook, journal and research literature. These are;

- Reflection in action: Facilitation with ongoing discussions during a session;
- Reflection on action: Facilitated group discussion after a simulation scenario;
- Reflection on action: Video assisted discussion following a simulation scenario;
- Reflection before action: Individual approach to same/similar clinical experience.

There is also an abundance of explanations in the literature as to why, when, where and how these applications may be used and for what reason (Decker and Dreifuerst, 2012; Dreifuerst, 2011; Dreifuerst et al., 2014; Hatlevik, 2012). While the applications seem self-explanatory it is important to consider these in the context of a total simulation program or an individual simulation activity. Consideration is needed regarding the complexity of those simulations, what the learner cohort may be and the intent of the learning objectives and desired learning outcomes. There may well be a need for a combination of reflection actions to be provided at different points in and after the simulation intervention. As such it is important to consider these applications with the use of a framework to ensure structure, purpose and outcomes are sustained.

Debriefing frameworks and models – and simulation

As simulation education develops and matures there is increasing interest in the development and application of a more strategic educational approach to facilitating reflection using debriefing. From the initial reporting in the simulation literature of a dearth of educationally driven debriefing occurring, there are now many different debriefing techniques available to consider and there is increasing research around and validated evidence-based models now in use (Table 8).

Area of focus	Authors
Key elements of debriefing	Rall, Manser & Howard, 2000
Anaesthetists' performance	Byrne et al., 2002
Rapid and sustained learning	Scherer et al., 2003
Promoting cognitive and metacognitive reflective reasoning skills	Kuiper & Pesut, 2004
Most important feature for effective learning	Issenberg et al., 2005
Post critical incidents for anesthetic trainees	Tan, 2005
Facilitating debriefing	Dismukes, Gaba & Howard, 2006
A theory and method for debriefing with good judgment	Rudolph et al., 2006
The value of debriefing during simulated crisis management	Savoldelli et al., 2006
Development of clinical judgement	Lasater, 2007
The role of debriefing in simulation	Fanning & Gaba, 2007
The importance of debriefing in clinical simulations	Cantrell, 2008
Oral debriefing versus standardized multimedia instruction	Welke et al., 2009
Using video-facilitated feedback to improve student performance	Grant et al., 2010
Self-debriefing versus instructor debriefing for simulated crises	Boet et al., 2011
Objective structured assessment of debriefing: bringing science to the art of debriefing	Arora et al., 2012
Comparison of simulation debriefing methods	Chronister & Brown, 2012
Integrating guided reflection into simulated learning experiences	Decker & Dreifuerst, 2012
Using debriefing for meaningful learning to foster development of clinical reasoning	Dreifuerst, 2012
Debriefing: An essential component for learning in simulation pedagogy	Dreifuerst & Decker, 2012
The effect of debriefing with good judgment on students' reflective ability and perspective transformation	Morse, 2012
Debriefing experience scale: Development of a tool to evaluate the student learning experience in debriefing	Reed, 2012
Video-assisted debriefing versus oral debriefing at improving neonatal resuscitation performance	Sawyer et al., 2012
Debriefing after resuscitation	Couper & Perkins, 2013
Standards of best practice: simulation standard VI: the debriefing process	Decker et al., 2013
TeamGAINS: a tool for structured debriefings	Kolbe et al., 2013
Post simulation debriefing to maximize clinical judgment development	Lusk & Fater. 2013
Comparison of debriefing with video and debriefing alone	Reed, Andrews & Ravert, 2013
Meaningful debriefing	Dreifuerst et al., 2014
Simulated patients as teachers: The role of feedback	Nestel, Bearman & Fleishman, 2014
Optimiser le débriefing d'une séance de simulation en santé *Optimising the debriefing of a simulation in healthcare session*	Policard, 2015

Table 8: Significant publications on debriefing and areas of focus (2000 - 2015)

Feedback and debriefing provide the following outcomes. It assists and augments the experiential element; reflective learning is recognized as a powerful education strategy; in the scenario setting it is the best facilitation process for individual reflection while also encouraging group reflection around the learning activity; it allows for constructive performance feedback; the review process allows review of learning objectives and identifying linkage to outcomes; it provides the linkage back to the reality of clinical practice, operational and systems processes, individual and organisational responsibilities and accountabilities; and it allows for reinforcement of evidence in practice.

Debriefing frameworks and models

The design of this conceptual framework is not to provide definitive debriefing frameworks / models but rather to recommend a review and reflection on how Reflective Learning can be best used in healthcare simulation education. However there are some activities / frameworks / models provided here as examples to demonstrate current developments.

The reporting of the use of an underpinning education theory by Waxman and Telles (2009) during the development of a simulation strategy in the USA is worth highlighting: The Use of Benner's Framework in High-fidelity Simulation Faculty Development: The Bay Area Simulation Collaborative Model. This is demonstrating the theory – design connection now being identified as important by others.

The recent Health Workforce Australia (HWA) national simulation strategy, known as the National Health Education and Training in Simulation (NHET-Sim) program, saw major investment in training for a significant number of education and clinical personnel in the essentials of simulation which includes debriefing strategies using various debriefing models. These include for example: Pendleton; Chronological Review; Simulation-Based Assessment; Interactive Feedback; Calgary-Cambridge Observation Guide; SET-GO; Advocacy Enquiry; Plus/Delta; Objective Structured Assessment of Debriefing (OSAD) and the SHARP mnemonic (Set learning objectives, How did it go, Address concerns, Reflect on key learning points, Plan ahead). Learners were exposed to these models in the workshops delivered nationally. The program, now a commonwealth health department initiative, continues on-line at present on the NHET-Sim website[17].

From a medical education perspective, the Imperial College in London has produced a handbook - The London Handbook for Debriefing: Enhancing Performance Debriefing in Clinical and Simulated settings - where two well-developed debriefing models are provided [SHARP and OSAD]. The OSAD tool is available on the Imperial College website and Ahmed et al., (2013) report on the outcomes of their research using the SHARP tool. There has also been significant work developed at the Centre for Medical Simulation (CSM) in the USA in the use of the Advocacy Enquiry debriefing model in initial Simulation Instructor

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[17] http://www.nhet-sim.edu.au/

training programs and the use of a tool to evaluate debriefers: The Debriefing Assessment for Simulation in Healthcare© (DASH©) tool(Centre for Medical Simulation website).

Others too are building on the Advocacy Enquiry model (University of Alberta website) and Kristina Thomas Dreifuerst (Dreifuerst, 2012) has developed and carried out doctoral research in efforts to improve the use of debriefing in simulation. Her framework, Debriefing for Meaningful Learning©: A Reflective Strategy to Foster Clinical Reasoning which looked at the development of clinical reasoning in nursing students (Dreifuerst, 2011) is now being applied in other education precincts and research (Mariani et al. 2013).

Any number of other examples of debriefing frameworks and models from around the world could be included in this section but that is not the intent. It is recommended however for those interested to follow up with further reading and review as to the most appropriate debriefing frameworks / models that can be of value to a simulation curriculum / course / scenario.

Theory 8: Novice to expert theory

The eighth education theory identified is the Novice to Expert Theory. It is this theory in conjunction with the other relevant theories that addresses skill development and clinical competence. Theorists to consider include David Kolb (1984), Donald Schön (1983, 1987), Stuart E. Dreyfus and Hubert L. Dreyfus (2004), Patricia Benner (1982) and George Miller (1990). Their work is regularly referred to and commented on along with an increasing number of interested parties who have been pursuing this theory further.

Indeed, as with Reflective Learning Theory, from a contemporary perspective there is a developing body of report and research publications related to Novice to Expert Theory. Many healthcare personnel and disciplines increasingly realise the need to understand, address and attempt to more effectively measure this strategically important education theory against practice outcomes. As indicated before, it is reasonable to suggest that within the mix of those other education theories already mentioned addressing Andragogy, Heutagogy, Tacit Knowledge, Learning styles, Experiential Learning Theory, Critical Thinking Theory and Reflective Learning Theory there is a need to consider this education theory regarding its relevance.

Rationale

From birth, humans are on a learning journey. From babyhood, through infancy, childhood, adolescence, onto adulthood and into our senior years we are constantly exposed to any number of social, cultural, educational, political and other learning activities. They may be simple or complex, academic or technical, mental or physical depending on the circumstances.

Out of those early pedagogical-based learning processes, with reflection and repeated responses and actions we move from novices to varying levels of expertise - walking, talking, reading, writing, and sports - and onto even more complex knowledge and skills development. As adolescent - adults we continue to move along the novice to expert continuum. More competitive sports, studying and training for careers, trades and professions all have us starting with little knowledge and skills, but over time and repeated experience, expertise – demonstrated as being competent or even expert – comes to the fore.

It is important to acknowledge here that Novice to Expert Theory intersects with and has connectivity with all the previous education theories covered in the conceptual framework: Andragogy; Heutagogy; Tacit Knowledge; Learning Styles; Experiential Learning Theory; Critical Thinking Theory and Reflective Learning Theory. Novice to Expert Theory requires these other theories to be present, underpinning and addressing educational activities relevant to their theoretical basis, so that learners are in the right 'situation' to benefit.

So when considering the professional development of healthcare personnel towards being appropriately prepared for engaging in their various disciplines it is acknowledged there will be also a continuum of learning: from initial knowledge, skill and attitudinal acquisition to increasing levels of maturity of thought, knowledge, skill, competence and advanced expertise (experts). Indeed there is significant education commentary and research literature and reference books on this education theory – and it goes beyond this framework to encompass this evidence. What is important is to comment on the pivotal theorists who have helped set the stage for this theory to be an important, strategic theoretical adjunct to be considered when developing simulation education activities.

First it is essential to revisit David Kolb's Experiential Learning Theory (1984) which establishes four distinct learning styles - or preferences - which are based on his four-stage learning cycle. Understanding Kolb's model allows us to understand that there are individual learning styles, and that the cycle of experiential learning applies to all learners – including novices to experts. It is also important to momentarily revisit Donald Schön (1983; 1987) who introduced notions such as 'the learning society', 'double-loop learning', the 'reflective practitioner', 'reflection-in-action' and 'reflection-on-action', for it is those processes that help a novice move forward along the continuum and indeed allow an expert to sustain or increase expertise.

However it is the works of Stuart and Hubert Dreyfus and the Dreyfus and Dreyfus Model of Skill Acquisition (Dreyfus, 2004) - a five-stage novice to expert model describing the mental activities of perception, learning and reasoning involved in directed skill acquisition - which has been established as a now well applied education theory that has been commented on, critiqued, documented, described and applied. Peña (2010) has provided a critical perspective that is worth reviewing as he offers critique by others and offers alternative views to their propositions. Peña (2010) has generated two summarised lists presented in boxes both of the Dreyfus model and statements produced after he reviewed various psychological, neuroscientific, and philosophical works as contrast.

Meanwhile Carraccio et al. (2008) report on the shift in focus of doctors' education to competency-based outcomes of learning, offering a challenge of meaningful assessment of learner competence which has in turn stimulated interest in the Dreyfus and Dreyfus Model novice to expert framework for assessing skill acquisition. Carraccio et al. (2008) indicate that while there is no documented consensus about its adaptation to clinical medicine, many educators have taken up this model.

From its original perspective the Dreyfus Model was taken up by Patricia Benner (Benner, 1982) and applied in the healthcare profession of nursing (Current Nursing.com website). The theory is focused on how nurses acquire nursing knowledge. Benner's nursing theory purports that expert nurses develop skills and understanding of patient care over time through an appropriate, planned and contextualised educational environment as well as an array of experiences (NursingTheories.Org website). Since the development and introduction of this theory there has been significant research, publication, commentary, challenge and contextualisation (Sunkes, (n.d.); Altmann, 2006). Yet it prevails as a validated and reliable education theory that guides curriculum and educational activities. It certainly has found its way into the simulation education arena and so it is reasonable to continue to consider it when developing simulation programs. Primarily it is important to understand where your learners are coming from – from a knowledge and practice perspective – and design appropriately.

As recognized in the Reflective Learning Theory, the reporting of the use of this underpinning education theory by Waxman and Telles (2009) during the development of a simulation strategy in the USA is worth highlighting: The Use of Benner's Framework in High-fidelity Simulation Faculty Development: The Bay Area Simulation Collaborative Model is reported. This is demonstrating the theory – design connection now being identified as important by others (Traynor et al. 2010). A further publication indicates similar thinking where they broach the same question regarding theoretical models and simulation education (Sadideen & Kneebone, 2012).

While considering this pivotal theory there is also evidence that novices learn differently to experts. So while it is important to have a good grasp of the Novice to Expert Theory it is also important to know that this is a theory constantly under review. Daley (1999) in her research, Novice to Expert: How do professionals learn? reports that novices learn in quite different ways to experts in saying;

> novice learning is contingent on concept formation and assimilation. Novice learning is also framed by the feelings novices experience in the context of practice. Expert learning, on the other hand, was identified as a constructivist process using active concept integration and self-initiated strategies. Additionally, novices and experts identified different organizational factors that facilitated or hindered their learning. Experts were able to articulate systemic issues that affected their learning, whereas novices identified disparate individual issues (p.137).

Being aware of and addressing these differences in learning factors are vital in any simulation planning. If research is advocating that a different approach to design and delivery is required for novices then that strategy needs to be attended to. The underpinning education theory and the evidence from other work should be guiding any new development. The same applies to how learners who may be experts already are approached. Other education theories encapsulated in this conceptual framework impact on these strategies also to differing extents. It becomes an educational manoeuvre as it were to become aware of and work through these influences as curriculum or course is developed.

Scaffolding

Of course it is here where scaffolding as a curriculum / program education strategy comes into play (Edglossary.org website). While scaffolding is not a stand-alone education theory it is an important educational process - a teaching method - that helps learners. Depending on where the learners are on the continuum as to how much or how little scaffolding is provided.

Another theorist needing mention in the context of moving from novice to expert, including attaining competency and achieving mastery is George Miller and his Pyramid / Prism of Clinical Competence (1990). George Miller (1990) proposed a framework for assessing levels of clinical competence that included the following;

- Knows [knows some knowledge]
- Knows how [knows how to apply that knowledge]
- Shows [shows how to apply that knowledge]
- Does [actually applies that knowledge in practise] (GP training.net website)

(Figures: 13 &14)

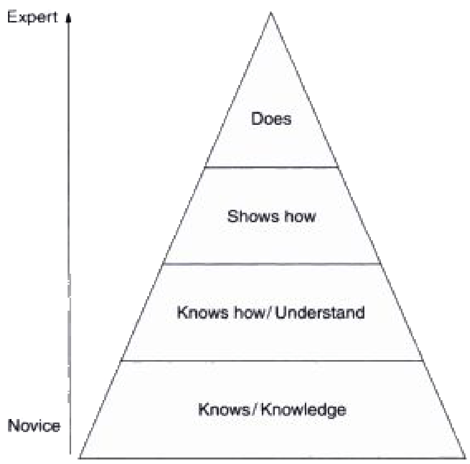

Figure 13: The Miller pyramid and prism

(Source: http://www.gp-training.net/training/educational_theory/adult_learning/miller.htm)

This is best demonstrated in the following graphic on the gp-training.net website (figure 14). It demonstrates the different levels of cognition and behaviour assessed and where that occurs on the novice to expert continuum.

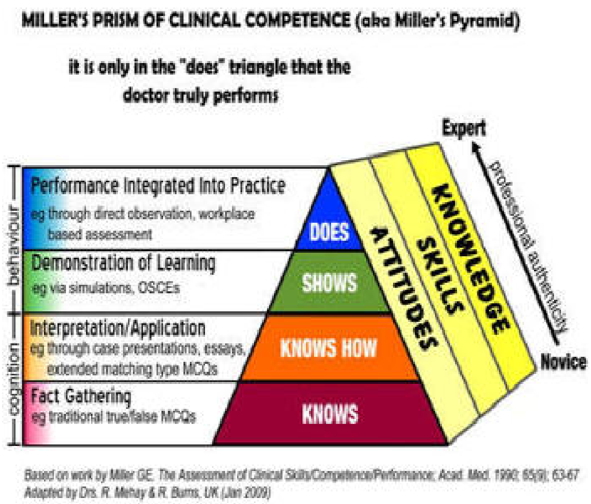

Figure 14: The Miller prism of clinical competence
(Source: http://www.gp-training.net/training/educational_theory/adult_learning/miller.htm)

Theory 9: Self-efficacy

The ninth education theory identified is the Self-efficacy Theory. It is this theory in conjunction with the other relevant theories that addresses how one sees oneself in terms of learning, understanding, achievements, actions and success. Thus it has the potential to influence and impact on a person's total 'being' positively or negatively. That being so, it is important in the context of using simulation as a teaching, learning and assessment method and delivery platform to guide a learner towards change, for educators to be cognizant of the theory of Self-efficacy. It also becomes an imperative to provide an environment that will facilitate Self-efficacy development in a learner so as to ensure positive reinforcement of learning occurs and levels of resilience are encouraged.

Rationale

Why is it important that humans need to feel 'good' about themselves and how they do things – whether thinking, relating, communicating, socialising, actioning and responding – to the environment and all that this implies? How is it that some humans seem to learn easily, take on complex information or tasks and achieve positive outcomes?

While these questions have a significant psychology orientation with a range of potential theoretical underpinnings – there is significant research and publications on personality factors, traits and a whole range of other psychological perspectives – more importantly the more pertinent questions to ask are: why is Self-efficacy an important education theory to consider? And why is this important from a simulation education perspective?

What is Self-efficacy? One of the most prolific authors in this area is Albert Bandura (1977, 1986). Of all the explanations one might garner, Bandura (1994) provides a sound definition;

> Perceived self-efficacy is defined as people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives. Self-efficacy beliefs determine how people feel, think, motivate themselves and behave. Such beliefs produce these diverse effects through four major processes. They include cognitive, motivational, affective and selection processes (University of Kentucky (UKY) education website).

Bandura (1994) explains that the positive traits, behaviours and outcomes of someone with a strong sense of efficacy or high assurance in themselves and their capabilities, which leads them to take on more challenges and recover more quickly from failure. Their sense of self-efficacy develops from ‘mastery experience’ (Bandura, 1977). Those however who have a lesser self- assurance, with self-doubt, lowered aspirations, and who believe they are deficient, as result do not achieve set goals. They also give up more easily and find it hard to recover their sense of efficacy.

Of course it is important to mitigate these issues where possible from any educational perspective. Further reading of Bandura’s work is of value especially where he comments on: sources of self-efficacy beliefs; efficacy-mediated processes; adaptive benefits of optimistic self-beliefs of efficacy; and development and exercise of self-efficacy over the lifespan (Bandura, 1997, 1986, 1994).

Indeed there has been a plethora of review and research around the work of Bandura and the Self-efficacy Theory. The publication by Ashton (1984) is significant, as the link between teacher efficacy and effective teacher education was broached, with many others joining in the discussion. Zimmerman (1995) pointed out that, with the publication of Bandura’s decisive discourse (Bandura, 1986), there was provided a theoretical basis and guidelines for the measuring of self-efficacy - for a range of areas of functioning. Sewell and St. George (2000) meanwhile identified that it was important to provide and prepare learners with the capacity to be well-informed and self-assured, so that they can use that capacity and capability throughout life. Sewell and St. George (2000) make note of the need to foster efficacy beliefs using creative problem solving instruction strategies to enhance self-efficacy and promote motivation.

There is further support of the self-efficacy theory. Pajares and Schunk (2001) discuss the connections between self-belief and school success and self-efficacy, self-concept, and positive achievement at school, while Artino (2006) highlights self-efficacy beliefs and presents information on the connectivity between the education theory and the instructional practice required. Pajares (2009) makes further comment on the basis and sources of self-efficacy beliefs, the natural and motivational consequences of self-efficacy beliefs and self-efficacy beliefs and academic attainments – and the implications for both schools and teachers. Haddoune (n.d.) in the meantime points out that the contemporary changing landscape of learning in higher education has raised the need to look at strategies that more effectively address students' self-efficacy expectancies, in efforts to improve achievement outcomes.

From a teacher's perspective Shooter (n.d) describes using self-efficacy theory as a guide for instructional practice. Henson (2001) reviewed and discussed a range of theoretical and historical factors and issues related to teacher efficacy, including research outcomes and advances, implications and dilemmas to be addressed. Silverman & Davis (2009) meanwhile point out how teachers develop self-efficacy, as does Hastings (2012) who has looked at the self-efficacy of early career teachers in their preparation to deliver reading instruction. Haddoune (n.d) also discusses the need to facilitate learners to be better prepared, more responsible and more self-efficacious, for the demands of an ever-changing world.

The evidence would appear then to assert, from an educational perspective, that self-efficacy is a vital and pivotal element in the preparation of both teachers and learners to ensure there are effective outcomes respectfully. That is, teachers who are well prepared in their role and feel comfortable in ensuring their learners are in an optimal learning space, and learners who are provided with resources and opportunities to develop a positive sense of self. This is important for there is also evidence in healthcare education that there is a need to cater for, address and encourage self-efficacy in the healthcare workforce – for this has ramifications to patient care and safety (Artino, 2012; Pike & O'Donnell, 2010; Smith & Gray, 2011).

With that in mind then it is also incumbent to reflect on where Self-efficacy theory intersects with and relates to all the previous education theories covered in the conceptual framework to date Andragogy; Heutagogy; Tacit Knowledge; Learning Styles; Experiential Learning Theory; Critical Thinking Theory; Reflective Learning Theory and Novice to Expert Theory. It would be logical if some or all of these theories are considered / embedded – or even new ones introduced - during simulation curriculum development and course delivery, that the opportunities for impacting positively on a learner's experience would in turn establish the best opportunities for positive, efficacious outcomes – using simulation.

Effective integration of these theories before and during simulation education activities would ensure learners are in the most useful and applicable learning environment to benefit – given that the other elements of simulation itself as a teaching and learning method are addressed in design, execution and evaluation. Such planning and implementation would encourage a feed-back loop that would encourage / enhance self-efficacy - as the learner's needs are achieved and they continue to reflect on those outcomes in a positive constructivist way.

There is ongoing research in this area as more educators identify the need to address Self-efficacy in the preparation of healthcare professionals using simulation. Radhakrishnan, Roche and Cunningham (2007) have reported on a randomized pilot study that described how simulation had a positive impact on the clinical performances of students' safety and basic assessment skills. Leigh (2008) carried out a review of the literature to examine the available research related to self-efficacy in the education of nurses, the impact of high-fidelity patient simulation on nurses' self-efficacy and the effectiveness and challenges of high-fidelity simulation. Hicks, Coke and Li (2009) pilot study measured the effect of high-fidelity simulation on nursing students' knowledge and performance.

Kuznar (2009) presented the outcomes of a doctoral study on determining how associate degree nursing students' self-efficacy, motivation, and learning in the simulated environment compare to nursing educational experiences without simulation. Kuznar (2009) determined that simulation was identified as an acceptable learning strategy for novice associate degree nursing students. Meanwhile Cardoza & Hood (2012) reported on a comparative study of baccalaureate nursing student self-efficacy before and after simulation. Boeglin (2012) in a Master of Science research proposal looked at student's level of self-efficacy obtained with clinical simulation. The purpose of the study was to determine if self-efficacy in student nurses was increased by use of high-fidelity simulation (HFS) as a teaching and learning method. As a prelude to further research, Franklin and Lee (2014), have published a meta-analysis that reviewed the effectiveness of simulation in improving self-efficacy amongst novice nurses. Franklin et al. (2015) have subsequently highlighted the positive outcomes of a multiple–patient simulation exercise designed to assess novice nurses' competence and self-efficacy.

In conclusion it is also important to ensure – when applying this education theory – that the focus is targeted correctly and outcomes are measurable. Kardong-Edgren (2013) points out there is research being undertaken and reported, with disconnect occurring between what is intended to be measured and what outcomes are identified. Kardong-Edgren (2013) reported that in a number of manuscripts the researchers had found no association between Bandura's Self-efficacy Theory and actual observed nursing student clinical competency. Kardong-Edgren (2013) also reported that there is repeated reporting of researchers' identifying the inability of participants to demonstrate effective psychomotor and/or higher order cognitive skills even though the same participants report they are very confident that they are performing well (Kardong-Edgren, 2013). What is being measured and how, become important criteria to consider when establishing a simulation activity.

Theory 10: Deliberate practice and acquisition of expert performance

The tenth education theory identified is the Deliberate Practice and Acquisition of Expert Performance Theory. It is this theory in conjunction with the other relevant theories that addresses how one moves forward significantly in terms of learning, understanding, achievements, actions, success and sustainability.

Deliberate Practice and Acquisition of Expert Performance is seen as the unique process by which some individuals move from one level to another level of capacity and capability – whether it is of attitude, knowledge, awareness, expertise and/or performance. Thus exploring where this theory fits with simulation and the other education theories in the conceptual framework is an important consideration as more and more publications appear on the subject. The individual who is widely recognized as one of the world's leading theoretical and experimental researchers on deliberate practice and acquisition of expert performance is K. Anders Ericsson (1993; 2008), a Swedish psychologist and Professor of Psychology at Florida State University.

Rationale

This education theory is an important one in the sense it supports the notion that, given other education and learning factors are in place, there comes a time and place / opportunity where the learner moves into a further learning and achieving plane. It might be generated by the learner or it might be provided externally through an organised process that facilitates the acquisition of expert knowledge, skills, attitude and performance.

What is important to recognize is the difference between practice where expert skills are honed and made more permanent / maintained to the focused effort concept of Deliberate Practice. It is this process that enables expert performance to be demonstrated – whether it be in music, acting, medicine, nursing, allied health, sports, games that require metacognitive skills, or any number of work / professional profiles that make the performer stand out from other experts.

Ericsson et al. (1993) highlight this phenomenon, presenting a theoretical framework that describes expert performance as; ‘the end result of individuals' prolonged efforts to improve performance while negotiating motivational and external constraints’ (p.363). Ericsson et al. (1993) go on to say that;

> in most domains of expertise, individuals begin in their childhood a regimen of effortful activities (deliberate practice) designed to optimize improvement. Individual differences, even among elite performers, are closely related to assessed amounts of deliberate practice. Many characteristics once believed to reflect innate talent are actually the result of intense practice extended for a minimum of 10 years. Analysis of expert performance provides unique evidence on the potential and limits of extreme environmental adaptation and learning (p.363).

Again Ericsson (2008) reviews Deliberate Practice and Acquisition of Expert Performance and reports on the scientific study of expert performance and its acquisition; where the principles of Deliberate Practice and Acquisition of Expert Performance established in other domains such as sport, chess, music and typing to gain insight into developing expert performance in healthcare. Ericsson discusses the time / deliberate practice processes used to measure individual performance acquisition of superior reproducible (expert) performance across different domains of expertise indicating it is possible to measure the time course of improvement. However in some domains there is no demonstrable improvement in performance as a function of years of professional experience [in healthcare preparation] (examples are provided) while traditional domains of expertise, such as arts and sciences, games, and sports, demonstrate improvements that appear to continue for decades.

Ericsson (2008) looked at the differences between mere experiences versus deliberate practice in efforts to reconcile the differences identified. The researchers identified those domain-related activities necessary for improving performance and classified them as deliberate practice. Then, based on a review of research on skill acquisition, a set of parameters were identified where practice had been uniformly associated with improved performance.

According to Ericsson (2008) this improvement occurs when individuals were asked to undertake a task with a well-defined focus; when individuals are determined to improve; when individuals are offered feedback; and when individuals are given plenty of chances to repeat and gradually hone their performance, which are factors that emanate from other educational underpinnings.

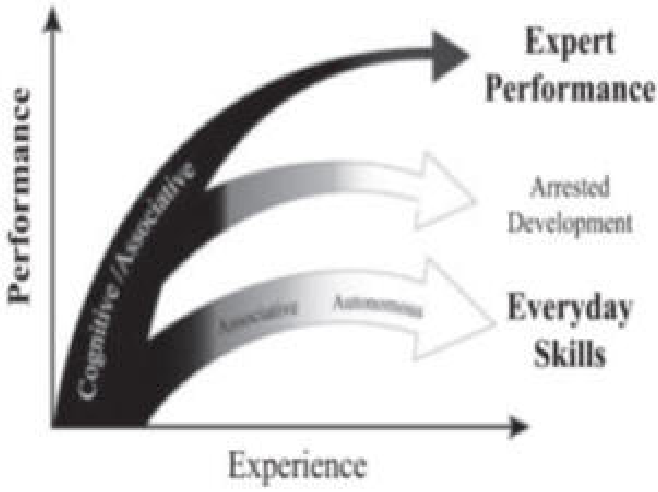

Figure 15: Expert performance curve (Ericsson, 2008)

This graph (Figure 15) reproduced from Ericsson (2008) demonstrates the cause and effect of everyday activities, as opposed to improvement of expert performance. Some experts peak, give up and decline, while others continue to engage in deliberate practice to attain expert performance. What is not identified is the plethora of real and potential factors that impact on this phenomenon.

This returns the discussion to the education theories already cited in this framework and where they may individually or collectively play a part in supporting this particular theory – and whether this theory in some ways relies on the other theories to be in place to support, if not legitimize, it.

From a constructivist perspective the learner / practitioner will be in constant transition through the cycle of construct / deconstruct / reconstruct as the deliberate practice process will require new inputs, change or modification in practice, new boundaries and challenges be they physiological, psychological, political, social, or cultural in nature. Depending on the environment, challenges and opportunities (self-made or provided) the learner / practitioner will be adapting – with deliberateness – to achieve even more expert outputs. There are any number of examples of individuals in sport, music and acting, in science and humanities, writers and researchers who have through deliberate practice achieved what others would consider phenomenal outcomes.

With that in mind it becomes obligatory to reflect also on where Deliberate Practice and Acquisition of Expert Performance intersects with and relates to the other education theories covered in the framework (Table 9). It becomes self-evident there is a strong correlation and connectivity between;

Andragogy	⟺	Deliberate Practice and Acquisition of Expert Performance
Heutagogy	⟺	Deliberate Practice and Acquisition of Expert Performance
Tacit Knowledge	⟺	Deliberate Practice and Acquisition of Expert Performance
Learning Styles	⟺	Deliberate Practice and Acquisition of Expert Performance
Experiential Learning Theory	⟺	Deliberate Practice and Acquisition of Expert Performance
Critical Thinking Theory	⟺	Deliberate Practice and Acquisition of Expert Performance
Reflective Learning Theory	⟺	Deliberate Practice and Acquisition of Expert Performance
Novice to Expert Theory	⟺	Deliberate Practice and Acquisition of Expert Performance
Self-efficacy	⟺	Deliberate Practice and Acquisition of Expert Performance

Table 9: Education theory relationships and connectivity

That is not to say that Deliberate Practice and Acquisition of Expert Performance necessarily requires all those education theories to be in place at the same time for a learner to become an expert - but it could be hypothesised that the more the connectivity the better the opportunities - for the learner to remain committed to excel at becoming an expert.

Deliberate practice and acquisition of expert performance – and simulation

Is there benefit using simulation and Deliberate Practice strategies? There is research evidence to support this. McGaghie et al. (2011) reports on this in their 20 year literature review and meta-analysis: Does Simulation-based Medical Education with Deliberate Practice Yield Better Results than Traditional Clinical Education? A Meta-Analytic Comparative Review of the Evidence. Meanwhile Udani et al. (2014) have published a research article where they demonstrated simulation-based mastery learning with deliberate practice improves clinical performance in spinal anaesthesia. They also reference similar work.

Causer, Barach and Williams (2014) hold the view of Deliberate Practice in simulation with their recent publication where they feature and emphasize the role of simulation-based education activities in combination with deliberate practice activities (such as reflection, rehearsal, trial-and-error learning and feedback) in efforts to improve the quality of patient care. Coughlan et al. (2014) looked at the kicking skills of intermediate and expert level Gaelic football players. Their findings support deliberate practice theory and provide insight into how experts practice and improve their performance.

These examples and an increasing number of other presentations are being published that subscribe to the notion – the education theory – of Deliberate Practice and Acquisition of Expert Performance has a role in simulation education. This is promising but at the same time once again only one education theory is being considered when there are others underpinning and supporting the simulation education experience being developed and delivered. Does that limit the experience and impact on outcomes? This is an important consideration and the conceptual framework is designed to both trigger that and provide a process to help plan effective educationally sound simulation interventions.

Conclusion

This chapter has presented a discussion of research regarding the ten major education theories deemed central in education design. The review of the research in relation to the educational theories supports the relevance of educational theories and their relationship to one another. Further validation of the integrity of the review comes from the information from the various other reviews, reports and research publications making comment and recommendations regarding many of these education theories and their relationship to simulation.

However within that information there still remains a deficit. While a small number of authors discuss more than one theory in relation to simulation – which is germane to and supportive of this study - there are many more authors who have only reviewed and applied singular theories. These authors are listed in Table 10 (p.112) in Chapter 5: Report and Interpretation of Findings. These applications tend to be in quite specific situations and do not necessarily translate to other contexts and settings. That in itself is not problematic, as this and any commentary and research is all valuable work in the journey to improve the educational fidelity of simulation education.

As noted in the literature review in Chapter 2 there appears to be limited evidence regarding the development and evaluation of an all-encompassing conceptual framework that guides and facilitates simulation to be used to its optimal effect. Still, there are promising signs of increased awareness and understanding about education theories in contemporary publications and these have been reported on through this chapter.

In this chapter the ten most common, pivotal and interconnected education theories believed to be the fundamental core education theories required for a functional conceptual framework have been identified. Explanations of these theories and the rationale behind their choice have been also presented. The next phase of the development of a Conceptual Framework for Simulation in Healthcare Education, based on the accumulated evidence is presented in Chapter 4. This is a discussion of the methodological approach to the study.

Chapter 4

Methodology

Introduction

In this chapter the methodological approach employed in the study is discussed. The theoretical underpinnings of the research design, issues of bias, outline of data collection, ethical and consent considerations and data analysis methods are reported. To make sure that there is rigour in the study the concepts of research trustworthiness and the audit or decision trail are addressed lastly in the chapter.

Rationale

It has been demonstrated that whilst there is extensive research and discourse in mainstream education literature on educational theories there appears to be little evidence of any significant body of research in the simulation literature. Indeed, the evidence provided suggests education theories and learning models are not regularly used overtly as underpinning philosophical drivers in simulation education programs. A recent publication was cited earlier appearing to support the hypothesis that the use of theories to underpin research in simulation is not at all optimal (Kaakinen & Arwood, 2009). Following a systematic search and review of the literature and using exclusion criteria, 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. This suggests that the use of underpinning theoretical processes in simulation education remains problematic and reinforces the need for further explorations such as this project and its accompanying research study.

Research design

In this study the research design is supported by two over-arching paradigms that provide guidance, focus, construct and boundaries to the study. The social constructivist paradigm and an evaluation paradigm provide the most appropriate over-arching viewpoint from which to both view and carry out this research.

To ensure clarity of what a paradigm is generally, Taylor, Kermode and Roberts (2007) identify a paradigm as ‘a broad view or perspective of something’ (p.5). Certainly social constructivism provides a particular perspective, as does an evaluation strategy. Meanwhile the definition of a paradigm provided by Weaver and Olson (2006) is a little more focused towards the project as it reveals how research could be affected by paradigms by stating, ‘paradigms are patterns of beliefs and practices that regulate inquiry within a discipline by providing lenses, frames and processes through which investigation is accomplished’ (p.460).

It could be argued that social constructivism as a paradigm could impact on this study by restricting alternate philosophical views to be considered and applied. However from my background reading and subsequent perspective, social constructivism is the logical choice. Likewise from an evaluation perspective, the focus of the project is consistently about the evaluation process – of the literature, of the feedback from the questionnaire and from the modified Delphi Technique activity. Making sense of it and then using the outcomes of the evaluation to guide the research to the anticipated outcome.

Social constructivist paradigm

This is grounded in Social Constructivist underpinnings (Dewey, 1933; Piaget in McLeod, 2015; Vygotsky, 1978). The study relies on the constant gathering of a range of authoritative, endorsed and compelling information from a number of sources and resources, unpacking, distilling and making sense of that information, developing new knowledge and passing that new knowledge forward. This is especially true in the three main areas of the project. The first being the literature search, review, postulations and recommendations emanating from that. The second being the design and development of the conceptual framework model which is extensively modified from its original model and contextualised, and inclusive of significant content and evidence regarding the education theories advocated and adopted. The third being the evaluation strategy used to further gather evidence, condense that evidence and apply it, in efforts to guide the research towards its outcome.

Evaluation paradigm

The research in this project falls within an evaluation paradigm, as one of the aims of this research is to develop a Conceptual Framework for Simulation in Healthcare Education. It is the construct of a conceptual framework that encourages development of a standard in how simulation may be best used in healthcare education. Healthcare educators using simulation should be able to employ the conceptual framework to guide curriculum, program and scenario development, delivery and evaluation. As such this process will require a significant level of evaluation. As the study evolves, there is evaluation occurring during all of the three planned phases of the project. There is evaluation of the data retrieved from the literature, evaluation of the data from the questionnaire and evaluation of the feedback from the modified Delphi technique (Adelman & Alexander, 1982; Silver & Pratt, 2006).

Research methodology

Evaluation research

According to Powell (2006) evaluation research can be defined as; 'a type of study that uses standard social research methods for evaluative purposes, as a specific research methodology, and as an assessment process that employs special techniques unique to the evaluation of social programs'(p.102). While this is a useful generic definition there is a need to identify which method is best to be used.

Silver and Pratt (2006) on their website indicate that evaluation is a systematic approach to acquiring and assessing information so as to generate appropriate feedback about an object, which is the focus and intent of this research. It is projected that subsequent to the preliminary literature search and analysis of data collected, the information gathered will provide context and a scaffold that will guide development of the Conceptual Framework for Simulation in Healthcare Education.

To reinforce this objective there is another pertinent definition in connection with the evaluation of educational activities provided by Adelman and Alexander (1982), who identify such evaluation as involving the forming of opinions and deciding on the value and effectiveness of educational strategies and activities, and the investment required for these strategies and activities.

This supports the intent of the study as it will involve the gathering of constructive feedback by questionnaire followed by a modified Delphi technique (Green, 2014; University of Illinois, 2013; Yousuf, 2007) that hopefully will address those elements mentioned and guide further development of the conceptual framework to where it is ready for contextual evaluation.

Evaluation research using a modified Delphi technique

The Delphi Technique is a structured communication process that can be used to collect, group, sort and rank data and reach consensus from a group of people without requiring face to face contact. The two pivotal elements that make up the Delphi Technique are;

- Sequential questionnaires; and
- Regular feedback to participants.

In the Delphi Technique, questionnaire(s) are distributed to participants. Responses to the first questionnaire are collated and summarised and used to prepare the second questionnaire which seeks agreement, disagreement and insights from the same pool of participants. The process goes on until no new opinion emerges (Green, 2014; University of Illinois, 2013; Yousuf, 2007). Hsu & Sandford (2007) support this in their description of the Delphi Technique as a well-used and accepted group-oriented process in gathering information in a constructive way from expert participants. It allows for the consensus in and merging of, opinions and recommendations, following initial assessment, exploring of alternatives and assumptions. With that in mind the use of the Delphi Technique in this instance is a valid process for Evaluation Research.

Modifications

The potential modifications in this study identified were that the number of questionnaires in the Delphi Technique may be limited to a set number depending on the initial robustness of the conceptual framework design and function. There may not be a need for multiple questionnaires. Another modification is that the invited participants were not anonymous during the actual Delphi Technique activity due to the nature of the process. To commence the activity, I had to identify and communicate with them via an invitation in the first instance. However they were invited to partake as experts by email on an individual basis, so their anonymity to the other five invitees was protected. Importantly, when all the data were collected, collated and reported on, then filed away, their individual and collective anonymity was ensured (University of Illinois Extension, 2013).

Issues of bias

While developing and applying the methodology in this study a number of potential biases were considered. In education-based research there is potential for perspective, conceptual, design, operational and evaluation bias due to the complexity of education and all its facets. Of the course the potential for individual bias is pervasive as activities such as this type of research are inevitably based on previous experiences and exposures. As I have been involved with simulation for a significant number of years, have taught using simulation, educated others in the use of simulation, undertaken course and curriculum development with simulation, carried out research in and published about simulation research, managed simulation-based projects, guided the development of simulation centres and services, the potential for bias from a legacy of preconceived ideas, knowledge, experience and expertise is ever-present.

I acknowledge this potential bias but constantly attempted to remain un-biased in the conceptualisation and development of the study by using objective evidence from numerous sources. I overtly and transparently sought out advice and instruction from many colleagues and experts in guiding the development of this study, including the methodology. This activity was to address and minimise any potential bias due to professional incompetence or bias due to instrument change: that is, changes in the researcher over the course of the project (Fenton & Mazulewicz, 2008; Medical Biostatistics, 2015; Pannucci & Wilkins, 2010).

The potential for bias with regards to demographics, cultural, social, linguistic and political perspectives is mitigated due to the random selection processes. The potential for bias due to knowing the participants is minimized due to the random method of the questionnaire being sent out to random centres around the globe. The potential for bias due to actual researcher presence, which are the reactions of program participants to the presence of the researcher, is neglible as there is no face to face contact throughout the data collection period (Fenton & Mazulewicz, 2008; Medical Biostatistics, 2015; Pannucci & Wilkins, 2010).

The potential for bias in identifying and targeting experts for the Delphi Technique is tempered by the fact that these individuals have been involved with significant research activities in their own right, understand the ethics and procedures involved and demonstrate high levels of professional integrity, and as such would be resistant to researcher influence. It should be also acknowledged that any value imposition (undue influence due to the values or biases of myself) such as my creativity, interpretive abilities and tacit knowledge may well have been employed by myself unknowingly and influenced elements of the study (Fenton & Mazulewicz, 2008; Medical Biostatistics, 2015; Pannucci & Wilkins, 2010).

Sampling technique and justification of sample size

Sampling technique – simulation centres

There may be circumstantial evidence of use of education frameworks in simulation centres, universities and colleges around the world that is not being reported in the public domain. As such there is no obvious way to research that information. However there are now hundreds of simulation centres now operational in the world that are listed on a database[18]. Use of the database allowed the random selection of a number (n = 30) of those simulation centres randomly anywhere in the world (nationally or internationally) to request whether they actively use a conceptual framework or not - and if so, which one.

Sample size - simulation centres

The research sample size of simulation centres was recommended by a senior researcher experienced in carrying out similar 'snapshot' techniques to gather pertinent, representative information. Importantly, based on my knowledge about the experts targeted, the centres approached were not centres affiliated with the experts who were invited to respond in the modified Delphi Technique. This was to mitigate any potential corruption of data. Once the target number of simulation centres were confirmed, the activity was to include an initial mailout to the centres requesting their voluntary participation in the study.

A post data collection review was carried out to ascertain the reliability of the results (Harvard University, 2008). While the strategy decided upon might well be a missed opportunity to gather further data, the logistics of emailing out to every university, college, hospital, paramedic service and other likely simulation users was considered to be an unviable proposition. The 'snapshot' process decided on thus guided the research activity.

Sampling technique –modified Delphi technique

With respect to the review of a conceptual framework model and the Delphi Technique review process, as a result of many conversations and communications, it was recommended by peer qualitative researchers to seek responses from a small number of high

[18] http://www.bmsc.co.uk/ World-wide simulation database.

profile experts rather than a larger number of lesser experts, so as to maintain a high level of credibility. I also discussed this with a number of simulation education experts and they too supported the contention that a small number of experts would provide significant feedback.

Sample size - modified Delphi technique

It was recommended that six (n = 6) experts in the simulation education community (international and national) who are researching and publishing in this domain would provide sufficient rigour to the Delphi Technique component of the research (Green, 2014; Hsu & Sandford, 2007; University of Illinois, 2013; Yousuf, 2007). These are persons who have a high profile internationally and are well respected for their work and leadership

Once the target number of experts were confirmed, in keeping with the principles of the Delphi process, the activity was to include an initial mailout to the experts of the conceptual framework and its accompanying questionnaire for their initial assessment, agreement or disagreement, insights, opinions and recommendations. On their return all responses were to be collated and summarised. Based on the outcomes of the responses it was planned to use them to modify the conceptual framework and a potential second questionnaire for further responses from the same pool of experts. This process was to continue if needed until no new opinion emerged and there was consensus about the conceptual framework. What was pivotally important based on advice provided would be the focus and construct of the questionnaires that accompanied the conceptual framework.

Data Collection

1. Instruments

Both the simulation centre questionnaire (Appendix A) and the modified Delphi technique questionnaire (Appendix B) included a set of questions designed to generate both quantitative data using a Likert-type format and qualitative data using expanding text boxes. Before presenting to ethics for approval, the questionnaires were formatted and peer reviewed. They were sent out as a word document, so as to allow for easy further modification if required, in attempts to end up with a product that would have face validity (appears to be a good product), construct validity (the extent to which what was to be measured is actually measured) and content validity (evidence involves the degree to which the content of the test matches a content domain associated with the construct), high levels of reliability with internal consistency (over different items/activities), inter-rater consistency (multiple users) and test-retest consistency (over time) (Phelan & Wren, 2006).

2. Recruitment

It was planned that all potential participants were to be approached via email and informed about the intent of the research, inviting their involvement and how they may notify the investigators of their interest in participating. Attached to the email there were to be, a detailed description of the research proposal with the expected activities by the researcher and participants (Appendix C), a consent form and a request to return their consent by email (Appendix D and Appendix E). Subsequent communications were to continue by emails and attachments.

3. Competing interests

While this information was considered and addressed during ethics application, it is important to confirm here that during the process there were no new competing interests identified. There were no dual relationships or conflicts of interest seen to exist between any researcher and potential or actual participants. None of the potential participants were a colleague or a friend of myself or any member of my family. There were no dependent or unequal relationships with myself or any potential participant, there were no incentives or reimbursements as part of the research project and there were no approvals required from any external organisation.

Phases of data collection

Phase one

1. Literature review

The systematic literature search was extensive with a timeline boundary of fifteen years where all appropriate and available search engines were used and appropriate key words were utilised. These included Cumulative Index of Nursing Applied Health Literature (CINAHL), CINAHL Plus, ProQuest Dissertation and Theses for empirical reports, Medline, Health Source: Nursing/Academic Education, Google, Google Scholar, Other MeSH search terms**,** Gaming and any potential grey literature were scrutinised also.

2. Simulation centres

Data collection from thirty (n=30) randomly selected simulation centres (international and national, but not where the experts are based) were by return e-mail. An initial covering email was sent out to the selected centres, with information for potential participants involved in the research (Appendix C) and a consent form for participants involved in the research-site questionnaire (Appendix D). Once completed consent forms were received the consenting participants were forwarded Questionnaire 1: Education Frameworks in Simulation Centres (Appendix A). This questionnaire was distributed to ascertain what frameworks provide a basis for simulation education at each centre – or not. A reasonable timeframe for returns was set and if there were any delays in responses, follow-up emails were provided.

All emails between the participants and the researcher were quarantined to one private computer via one email address. All documents received were placed in a dedicated folder in a dedicated file on the computer hard-drive. Copies were made and stored on a compact standalone Seagate 500GB hard-drive and this was continuously stored in a locked filing cabinet.

Data collection was by return e-mail. There were minimal delays in responses thus significant follow-up emails to ensure a reasonable return rate were not required. The return of completed questionnaires was within the two month timeframe. The feedback from the questionnaires sent out in the simulation centre survey were reviewed and collated. This included numerical and commentary data. Themes were explored using a thematic analysis approach.

Phase two

1. Education theories

Subsequent to gathering the above information this phase entailed the design and development of a draught conceptual framework where the pertinent theories identified in the literature were to be brought together in one interactive model. These theories along with their respective application considerations are described in Phase two, Results (p.130)

2. The design of the Conceptual Framework

The background design of the conceptual framework was a web-based functioning framework graphic based on the Australian Qualifications Framework (AQF) spinning wheel mechanism. The identified theories were embedded in the web-based functioning framework graphic. Permission was sought and granted from the Governance, Quality & Access Branch, Higher Education Group, Australian Government Department of Education and Training for use under the Creative Commons Attribution 3.0 Australia licence, Commonwealth of Australia© (Appendix F).

Phase three

The first draft of the conceptual framework (Appendix G) and the questionnaire for the evaluation of a conceptual framework (Appendix B) was sent to the simulation experts for constructive critique, subsequent to their consenting to take part in the process. As per the Delphi Technique the circulation phases were primary, with potential for sequential questionnaires. The first questionnaire sought primary feedback about the conceptual framework. If required, second and subsequent questionnaires were to be modified also to demonstrate that primary feedback was responded to and to facilitate ongoing feedback. These were to cease when there was a consensus of opinion about the conceptual framework.

- Data was focused on concept, design, relevance, applicability, validity and reliability;
- Data collection was primarily electronic via email and stored in word format;
- Data was primarily qualitative however there were also quantitative data gathered that were collated and reported on;
- Data was collected via a private computer with appropriate and current firewall and virus protection;
- All final data published were de-identified with use of pseudonyms to protect respondents;
- All identified / de-identified / analysis data is stored in compliance with current ethics rules.

Data analysis

Both an evaluation and interpretive paradigm approach (Phothongsunan, 2010)[19] allowed exploration of the various data and synthesis of these data. The three triangulated phases of data collection produced stages for data analysis that ultimately produced the distillation of a conceptual framework. Data analysis occurred by the various techniques described in the following three phases.

1. Phase one

The literature search determined to what extent there was evidence or not of conceptual frameworks in use. This data is in a report format and the collective information helped inform design of the conceptual framework. This was done by demonstrating what conceptual frameworks are being used – or not, their design and focus and whether they are in any way similar - or not, to the proposed conceptual framework.

Feedback from the questionnaires sent out in the simulation centre survey was reviewed and collated. This included numbers, percentages and commentary data. Themes were explored using a thematic analysis approach (Harvard University, 2008). Key words and phrases were highlighted, distilled to themes and commented on.

Both data were used to determine the extent of conceptual framework existence and utilisation. These data informed the ultimate design of the proposed conceptual framework in this research including what theorists ultimately make up this projected conceptual framework.

2. Phase two

Data from the literature search and review plus data from the simulation centre survey was used to determine the extent of conceptual framework existence and utilisation. These data were strategically crucial to the development process of the conceptual framework for this study. This evidence guided the development of the content of draft conceptual framework, which is modelled on the AQF model (Appendix F). This development was the inclusion of the ten education theories identified in the research that were considered pivotal

[19] http://www.aulibrary.au.edu/multim1/ABAC_Pub/Galaxy-The-English-Department-Journal/v2-n1-1-oct-10.pdf

to the conceptual framework. Once the draft conceptual framework was constructed it was deemed ready to be reviewed by the modified Delphi technique.

3. *Phase three*

The experts' responses to the conceptual framework was the final set of data emanating from this research. During the period of time the participants in the modified Delphi Technique provided information guided by the conceptual framework design, the information obtained was categorised and rated under the established criteria (concept, design, relevance, applicability, validity and reliability). Also the experts had the opportunity to indicate if they believe any other pivotal theory should be considered as part of the conceptual framework.

Thematic analysis was again used, if other comments were forthcoming from an open-ended question section that was provided (Harvard University, 2008). Key words and phrases were highlighted, and distilled to themes with commentary. If any pertinent data emerged, this collective feedback was considered along with the feedback from the established set of criteria - in informing and guiding the final developmental and moderation stages of the conceptual framework.

Data retrieval, maintenance and storage

Questionnaire data was focused on concept, design, relevance, applicability, validity and reliability. Data collection was primarily electronic via email and stored in word format. Data was primarily qualitative however there was numerical quantitative data provided that was collated and reported on. Data was collected via a private computer with appropriate and current firewall and virus protection. All final data published was de-identified with the use of either sequential numbering or pseudonyms to protect respondents. All identified, de-identified and analysis data is stored in compliance with current ethics rules.

Ethics

The application to undertake this research project was accepted and deemed to meet the requirements of the National Health and Medical Research Council (NHMRC) 'National Statement on Ethical Conduct in Human Research (2007) by the Victoria University Human Research Ethics Committee. Approval for the Application ID: HRE14-060 was granted for two (2) years from the approval date of 29/04/2014 (Appendix H).

Participants in the research were provided with precise, non-technical information and clear common language explanations regarding the research proposal (Appendix C; Appendix D; Appendix E). This was to ensure participants will be able to provide informed consent, participants will be offered confidentiality, and, participants will be offered an opportunity to review outcomes of the research.

It needs to be reported here that there were no overt demographic data requested or provided. While I could identify the name of the respondents on their consent forms before de-identifying the responses, I was completely blinded to quantitative information regarding factors such as age, experience, expertise and exposure to simulation, education preparation and role. These data were deemed not essential to the focus of the questionnaire as they would not provide any further insight into the research.

Real or potential risk

Risk-benefit

Given the nature of the research activity it was believed there was negligible or no real or potential risks to the participants of this study. Nevertheless all care was undertaken when explanations were provided and informed consent sought. All participants had the option of withdrawing from the project if they believed they were becoming compromised in any manner (Appendix D, Appendix E).

The potential benefits to the participants and / or contributions to the general body of knowledge significantly outweigh any potential or real risk. From a benefit perspective it was hoped that the feedback from the participants would be of a calibre that will enable the conceptual framework be developed to a quality that it will contribute to the knowledge about simulation as a teaching and learning method.

The ethical benefit is that future simulation education development will be of an educational standard that will generate improvements in healthcare practice outcomes. There are no identified legal issues or legal risks associated with any aspect of the research that require specific consideration including those related to participation in the research, the aims and nature of the research, research methodology and procedures, and/or the outcomes of the research.

Research trustworthiness

Given the mainly qualitative nature of the research, trustworthiness is an important concept because it provides the researcher the opportunity to describe the research evidence not so much in the quantitative concepts of generalizability, internal validity, reliability, and objectivity but in the alternate qualitative terms of transferability, credibility, dependability, and confirmability (Fenton & Mazulewicz, 2008; Lincoln & Guba, 1985; Loh, 2013). An audit trail is a transparent description of the research steps taken from the start of a research project to the development and reporting of findings. These are the records that are stored and can be retrieved and reviewed as to what was done in the research project (Fenton & Mazulewicz, 2008; Lincoln & Guba, 1985; Loh, 2013). To ensure that there was rigour in the study the concepts of research trustworthiness and the audit or decision trail were addressed. That is, the initial trustworthiness of collecting qualitative data from the experts and the initial quantitative validity and reliability of the model itself.

From a trustworthiness perspective credibility is provided in various ways. The questionnaires, subsequent to peer review, were reviewed by the university ethics committee and seen to be credible; the structure and boundaries of the research activity with a clear and unambiguous focus on what the project was aiming for is another. Furthermore, the extensive information able to be gathered from the expansive information technology resources now available (computers, smart phones, internet, websites, databases, electronic journals, email, skype) on a 24 hour x 7 day cycle, with almost instant response rates allowing the rapid gathering of and ongoing interpretation of both background information and research data – provides credibility around data gathering (Fenton & Mazulewicz, 2008; Lincoln & Guba, 1985; Loh, 2013).

It was planned that data was to be collected using a triangulation methods approach in efforts to capture different dimensions of the same phenomenon. This triangulation process of data collection, which is the collection of data from the three data sources in the study – the literature, the simulation centre questionnaire (Appendix A) and the modified Delphi Technique questionnaire (Appendix B) - is a valid and vigorous research technique (Jick, 1979; Write.com website, 2015). Using a multiple methods approach ensures the research is rich, robust, comprehensive and well-developed, which helps facilitate greater insight, deeper understanding and generate rigorous outcomes (Jick, 1979; Write.com website, 2015).

This has allowed for very effective triangulation and constant comparison of incoming data which could be filed and stored electronically in ways that can be easily retrieved for further review. This adds level of transparency and credibility as it is both the repository of the research data and also essentially an audit resource. Finally credibility involved establishing whether the research was credible or believable from the perspective of the participants in the research (Fenton & Mazulewicz, 2008; Lincoln & Guba, 1985; Loh, 2013).

To be able to demonstrate both transferability and contextualisation in this study will be to first; utilize a data retrieval process that systematically gathers enough and appropriate data, which will in turn verify that the researcher has been accurate in their assumption(s); that the evidence gathered will corroborate that there remains a need for a conceptual framework; that the research activity is valid and genuine, and that this is confirmed through the support of the data both from the literature and from the support of the respondents feeding back meaningful data (Fenton & Mazulewicz, 2008; Lincoln & Guba, 1985; Loh, 2013). To enhance the contextualisation of the research outcomes will require the researcher to carry out a methodical analysis of the results, so as to ascertain if the research can be generalized or contextualised to other contexts or settings. (Fenton & Mazulewicz, 2008; Lincoln & Guba, 1985; Loh, 2013).

Dependability is provided by the nature and construct of the research process and by the actions of the researcher. Dependability requires that the researcher account for the dynamics and context within which research occurs. The researcher is responsible for describing any changes that may occur in the research and how these changes may affect the way the researcher both considers and manages the study. The researcher needs to ensure that there is validated rigour in the way the research is designed, developed, scrutinised, modified, carried out and evaluated, along with the audit strategies in place to maintain a standard from an ethics and quality perspective. So when a reader peruses the research there is an obvious evidentiary trail in terms of accuracy of analysis and findings, within the context of the research (Fenton & Mazulewicz, 2008; Lincoln & Guba, 1985; Loh, 2013).

Confirmability refers to the extent to which the results can be confirmed or corroborated by others. Confirmability is where the reader of the research outcomes can identify and confirm that the analyses, explanations and recommendations can be linked to the collected and collated data, via the audit trail (Fenton & Mazulewicz, 2008; Lincoln & Guba, 1985; Loh, 2013). This is inclusive of the rationale attached to the literature review, the rationale in selecting the participants in the initial questionnaire and the rationale for selecting the experts to undertake the constructive critique in the Delphi Technique. These participants were approached based on their involvement in and expertise in the use of simulation in healthcare education. Beside the provision of a set of questions pertinent to the study they were also given opportunities to respond via a set of open-ended questions thus allowing the gathering of further data for analysis. Thus as part of the audit trail the reader is provided with a literature review (Chapter 2), a methodology (Chapter 4) interpretation of and discussion of the findings, (Chapter 5) and the concluding remarks and recommendations (Chapter 6).

Summary

In this chapter the methodological approach employed has been presented including the rationale for the research. The theoretical underpinnings of the research design that provide guidance, focus, construct and boundaries to the study have been identified. The research methodology of evaluation research has been reported, including the rationale and use of a modified Delphi technique. The sampling technique and the justification of the size of the research sample have been provided, as has been the data recruitment and collection phases. Issues of bias, ethics and consent considerations, data analysis methods and risk factors are discussed. To make sure that there is rigour in the study the concepts of research trustworthiness and the audit or decision trail are addressed last in the chapter.

The following chapter comprises a report and an interpretation of the research findings. The research findings are synthesized to demonstrate evidence supportive of the research aims. This included a reiteration in report form of the outcomes of the literature search and review, interpretations of the accumulative data from the primary questionnaire and from the Delphi Technique undertaken. The collective interpretation was analysed and the information is used to guide the final chapter of the study.

Chapter 5

Report and Interpretation of Findings

Introduction

In this chapter the collective evidence gathered from the various data sources is presented and interpretations of the findings are discussed. This includes a further review of the literature. This information is provided to demonstrate and reinforce the rationale for and validation of the move through to the next phases of the research activity. The next set of data presented is the information provided by the participants who responded to the questionnaire sent out to the simulation centres. The education theories inserted into, and the design of, the draft conceptual framework are then presented. The third set of data presented is the outcome of the Delphi Technique. The Conceptual Framework for Simulation in Healthcare Education is the end-product of the distillation and application of the collective information.

Phase one

1*. Literature review*

It is first important to acknowledge that while there was a rich, robust and diverse capture of data from the literature search, the procedure to gather this information had limitations. The primary literature search and review was initially a broad approach. Once a core number of papers and references started appearing that warranted closer inspection, ongoing literature searches were conducted until no new substantive evidence was appearing. This activity was also conducted post data collection, to make sure that contemporary publications could inform the study. Those identified as relevant were included.

There were also repeated secondary searches following potential leads via reference lists, website citations, commentary in journals, text books and conversations with colleagues and alerts from a number of databases triggered by key identifying words provided by the researcher. As a consequence the reporting is the best–informed perspective, interpretation and recommendations of the researcher, based on the best available evidence that could be retrieved and reviewed at that time.

During the literature search and review of those reporting, discussion and research publications on and around simulation in healthcare, the first area of evidence that demonstrated the potential need for a conceptual framework was the significant variation in perceptions and understandings about simulation as an educational method. From a timeline perspective, over the last fifteen years of the simulation literature as reported in Chapter 1, the first variable to be identified was the different and maturation of definitions of simulation. While there were some indications scattered throughout the literature that authors potentially understood its educational underpinnings there was not strong evidence of this. Later definitions did start to allude to the educational aspects more and these have been cited in Chapter 1. It could be suggested that a conceptual framework will in the future guide discussion towards a more educationally sound definition, mitigating disagreement and encouraging a move to educational fidelity.

The second variable was in the variation in the defining of and understanding about the concepts of low, medium and high, environmental, equipment and psychological fidelity. This is an important dynamic to consider given their pivotal role in simulation language, debate and activity to date. While there are significant numbers of publications and research outcomes presented, especially around high-fidelity simulation, there appears to remain contextual limitations being reported and recommendations for further research with some mentioning education theories. The third variable to consider from the literature is the level of ongoing scepticism as to how valid and reliable simulation is as an assessment method. As stated in Chapter 1 it could be argued that if the construct and delivery of the simulation activity is supported by a relevant education framework then that scepticism could well be diminished.

As reported in Chapter 1 it is important to reinforce here that simulation is now well identified in the healthcare simulation literature as a valid teaching and learning method across disciplines. This has emanated from the initial focus on what simulators were to the early enablers; to research on whether simulators were user-friendly or not; the early forecasts of their future use; to being identified as an appropriate education intervention to help address a whole range of learning, clinical, clinical placement, healthcare personnel capacity and capability needs; the potential to deal with a wide range of clinical, non-technical and contextualised factors via a very dynamic process, while addressing delivery and opportunity issues; adding to one's professional capacity, including increased levels of critical thinking, reflective practice and self-efficacy compared to traditional education interventions; the use of standardised, validated and repeatable simulation interventions reduces the theory to practice gap while increasing the confidence and competency of the participants; and simulation now provides the healthcare service with a more work-ready and work-safe person who is more likely to be more effective not only clinically but also in the clinical human factors domain. Finally a further outcome now arising in the literature are the significant returns on investment benefits to be derived from the use of simulation in healthcare. The potential macro benefits of healthcare simulation include resource savings, capability enhancement, risk mitigation and safety enhancement.

With this a planned, designed, delivered and evaluated simulation session not only acts as a more effective conduit for teaching and learning but also acts as a catalyst for learning. However one of the pivotal and strategic ingredients appearing to be, if not missing, not yet tactically and functionally part of the right mix is a contextualised conceptual framework. That is, an evidence-based conceptual framework underpinning and guiding these educational endeavours - and from an educational research perspective, giving transferability, credibility, dependability, and confirmability to individual and accumulative simulation education interventions (Fenton & Mazulewicz, 2008; Lincoln & Guba, 1985; Loh, 2013).

While this background evidence is valuable and supportive, the major outcome of the literature review highlighted the limited availability of conceptual frameworks for simulation. This is not to say that such frameworks were not being applied, but the scarcity of reports on their development and use demonstrated there was scope to look deeper into this educational domain and to explore, design, and develop a specific model.

As more and more publications were identified and accessed there appeared to be a range of data needing to be reported on. Table 10 (p.112) provides an overview of the forty-five (45) publications retrieved that 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 author mention of the application of a conceptual framework within the context of the publication.

It would appear that in many instances, while there is due acknowledgement by the author(s) of the need for education theories in the development of simulation programs, there is a paucity of evidence in their application in any overt, transparent, integrated or reflective way. The commonest statement appeared to be one where the authors would indicate one or another education theory or model (such as adult learning principles) was applied. It appeared that is where the application activity started and ended and there did not seem to be a rationale or theme emerging. One could speculate that this was because the authors did not have a solid grounding in the various education theories, did not understand the significance of underpinning theories and thus could not make the connection**.** As a result of being minimized or completely overlooked by the authors, this facet of curriculum, course or scenario design and development was not given priority and focus.

Nonetheless from a thematic perspective, fourteen (n =15 / 33.3%) of the forty-five (45) publications identified Experiential Learning as a key education theory and there were various non-thematic reasons why that theory was identified – further circumstantial evidence of the limited understanding of the actual theory and its relationship to learning – and to other relevant theories. One assumption is that it is an easy theory to relate to and thus link to simulation, given the nature of simulation activities. A publication subsequently reviewed did however demonstrate deeper pedagogical understanding of the need for a conceptual framework, plus demonstrable outcomes. Yin et al. (2013) discuss the development and implementation of a framework that used an experiential learning model. They indicate that the system was both beneficial to the students' experiential learning activities and effective, as demonstrated by improved performances.

The small numbers of the other educational philosophical and theoretical concepts and approaches to teaching and learning identified included, Novice to Expert; Critical Thinking; Adult Learning; Situated Learning; Prior Learning; Feedback; Reflection; Skill acquisition; Clinical Competence; Clinical judgment; Situated Cognition; Behaviourism; Constructivism; Self-efficacy; Deliberate Practice and Feedback; Cognitivism, Cognitive Apprenticeship; Reflective Practice; Transformative Learning; Clinical Reasoning; Learning styles and Learner Centeredness – plus other adjunct models. This included the reporting of a pedagogical model (Keskitalo, 2015).

Given the broad nature of this diverse data it is not possible to draw any firm conclusions except that this scattered application of education theories indicate that the majority of authors may have focused on their respective theories for various reasons. There could be a variety of explanations such as the theories used were suggestions by others, or a researcher had previous exposure, had limited understanding, or did not make the connection or identify the need.

However there appeared to be emerging differences of understanding by the various authors regarding these theories. There were some who appeared to demonstrate effective understanding about the role of education theory and could provide a sound rationale within the context of their work. The research by Herrmann-Werner et al. (2013) is a case in point as they describe how they applied two conceptual frameworks in stating;

> as conceptual frameworks for the learning content we used standard up-to-date manuals, which have been used regularly in our classes as well as for our previous studies … (and) … regarding the conceptual frameworks for methods, the current study was based on Ericsson's model of deliberate practice with feedback as the basis of our skills lab training, and Bandura's social learning theory as basis for the traditional bedside teaching (p.3).

Sowerby (2015) indicated in her dissertation that the conceptual framework for the study was the constructivist theory. In reviewing the paper there seemed only passing evidence of how that educational philosophy was applied however it did demonstrate understanding as Sowerby (2015) made comment about what transpires from a constructivist perspective – that is the dynamics of the experience–reflection nexus and how through internalisation of experiences, change occurs. There was discussion and reference made to adult learning theory, with Sowerby (2015) seeing it compatible with constructivism in how learners construct meaning, individually and socially. Sowerby (2015) identified that these theories resonated with the subject of the study - that being the measuring of the personal interpretation of the learning experience of simulation by graduate nurses.

There is evidence that others hold a similar view to conceptual frameworks. Keskitalo (2015) has been developing, researching and reporting on a pedagogical model for Simulation-Based Learning Environments (SBLE). This model includes the process activities of simulation and the educational theoretical aspects in one encompassing pattern. Keskitalo (2015) has explored facilitators' conceptions and their approaches to teaching and learning in SBLE and has studied students' expectations of the learning process in SBLE using this model (Keskitalo, 2011; Keskitalo, 2012; Keskitalo et al., 2013; Keskitalo et al., 2014). Importantly Keskitalo (2015) recommends further work needs to be done including the need to test and redesign educational models, compare and test different types of models, identify what kind of models and methods improve learning results and the need to collaborate and combine multiple data collection and analysis methods to add to the body of knowledge supporting simulation education.

Another supposition might be that because of the contemporary eclectic demographics that are the simulation community, many of the authors may have widely varying levels of educational preparation. As a result it could be inferred that because of this perceived potential gap in education theory knowledge and use, that there is offered fertile ground to provide a potential solution – such as a Conceptual Framework for Simulation in Healthcare Education.

Publications, related education theories, models and frameworks

Author(s)	Underpinning Education Theory Identified	Framework identified/ applied
Rubino & Freshman (2001)	Experiential learning	No
Morgan et al. (2002)	Experiential learning	No
Underberg (2003)	Experiential learning	No
Nehring and Lashley (2004)	None	No
Sewchuk (2005)	Experiential learning	No
Kayes, Kayes & Kolb (2005)	Experiential learning Kolb Team Learning Experience	No
Larew et al., (2005)	Benner's novice to expert theory	No
Medley & Horne (2005)	Experiential learning Interactive critical thinking	No
National Patient Safety Education Framework (2005)	Adult learning principles	Yes
Lunce (2006)	Situated learning	No
National Patient Safety Curriculum for Junior Doctors (2006)	Adult learning Prior Learning (Tacit Knowledge) Feedback Reflection	Yes
Jeffries (2007)	Simulation Framework	Yes
Jeffries & Rogers (2007)	Theoretical Framework for Simulation Design	Yes
Program for Nursing Curriculum Integration (PNCI) (2007)	Miller's Pyramid/Prism of Clinical Competence (1990)	No
Waldner & Olson (2007)	Nursing skill acquisition Experiential learning	Yes
Lasater (2007)	Clinical judgment	No
Doerr & Murray (2008)	Simulation learning pyramid Adult learning Experiential learning	Yes
Huang et al., (2008)	Simulation Standards Definitions of: Andragogy, Critical Thinking, Clinical Reasoning, Clinical Judgement, Constructivism, Cognitive, Debriefing, Feedback, Guided Reflection, Reflective Thinking and Skill Acquisition.	No
Miller et al., (2008)	Experiential learning	No
Williamson et al., (2008)	Present five stage framework: The	Yes

	Curriculum Procedures Frames Simulation Framework	
Bambini et al., (2009)	Clinical judgement	No
Paige & Daley (2009)	Situated cognition	No
Parker & Myrick (2009)	Behaviourist and Constructivist theory	Yes
Waxman & Telles (2009)	Benner's nursing skill acquisition theory	Yes
Pike & O'Donnell (2010)	Self-efficacy	No
Kaddoura (2010)	Critical thinking	No
Weller et al., (2010)	Deliberate practice and feedback	No
Ker & Bradley (2010)	Discussion paper on behaviourism, cognitivism, social constructivism, situated learning and cognitive apprenticeship, experiential learning, activity theory, novice to expert theory, feedback, reflective and transformative learning – and simulation	No
Levett-Jones et al., (2010)	Clinical reasoning	Yes
Davies (2011)	United Kingdom Department of Health Overarching framework: six principles • Patient–centred and service-driven • Educationally coherent • Innovative and evidence-based • Able to deliver high quality educational outcomes • Deliver value for money • Ensure equity of access and quality of provision	No
Pollard & Nickerson (2011)	Identify key components of educational theory specific to simulation. Modified Theoretical Framework for Simulation Design by Jeffries & Rogers (2007)	Yes
Zigmont, Kappus & Sudikoff (2011)	Adult learning theory Kolb's experiential learning cycle Learning outcomes model.	Yes
Sadideem & Kneebone (2012)	Discussion on educational theory	No
Stanley (2012)	Experiential learning Reflective practice	No
Young & Shellenbarger (2012)	Describe positive outcome from exposure to and application of Theoretical Framework for Simulation Design by Jeffries & Rogers (2007) model	Yes
Alinier & Platt (2013)	Make reference to United Kingdom Department of Health publication (2011) on development of a strategic framework to provide direction in the use of technology such as simulation	No
Harris et al (2013)	Call for more robust education framework development	No
Herrmann-Werner et al., (2013)	Ericsson's model of deliberate practice with feedback Bandura's social learning theory The Kolb Learning Style Inventory The General Self-Efficacy Scale	Yes

Hicks et al., (2013)	Propose use of template in a framework supporting integration of content knowledge, clinical reasoning and reflection	Yes
Humphreys (2013)	Constructivism Behaviourism Experiential learning theory Benner's model of skill acquisition Learning styles Learner centeredness Reflective practice	Yes
LaFond & Van Hulle (2013)	Critique of the NLN / Jeffries Simulation Framework	No
Ball (2015)	Self-efficacy Transformative learning	Yes
Botelho et al., (2015)	Kolb's experiential learning theory Belhot's learning cycle	Yes
Keskitalo (2015)	Pedagogical model Socio-constructivist Socio-cultural Meaningful learning Experiential learning	Yes
Sowerby (2015)	Constructivism Adult Learning Theory	Yes

Table 10: Publications, related education theories, models and frameworks

There are a number of systematic reviews, meta-analyses and other like reports retrieved that have occurred over the last decade (Table 11). 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. Hence, no further evidence could be extracted that would inform the researcher of any significant presence and use of education theory-based conceptual frameworks.

Author(s)	Review
Issenberg et al., (2005)	Systematic review
Flanagan, Clavisi & Nestel (2007)	Commissioned report
Laschinger et al., (2008)	Meta-analysis
Leigh (2008)	Literature review
McGaghie et al., (2009)	Systematic review
Okuda et al., (2009)	Systematic review
Kaakinen & Arwood (2009).	Systematic review
Harder (2010)	Systematic review
Lapkin et al., (2010)	Systematic review
Carey, Madill & Manogue (2010)	Systematic research review
Cant & Cooper (2010)	Systematic review
Cook et al. (2011)	Literature review and Meta-analysis
McGaghie et al., (2011)	Meta-analysis
Weaver (2011)	Integrative review
Ross (2012)	Literature review
Cooper et al., (2012)	Systematic review
Yuan et al., (2012)	Systematic review
Norman (2012)	Systematic review
Kim, Park & Shin (2013)	Systematic review
Shearer (2013)	Integrative review
Foronda, Liu & Bauman (2013	Integrative review
Ilgen, Sherbino, & Cook (2013)	Systematic review and Meta-analysis
Cook et al., (2013)	Systematic review and meta-analysis
Murdoch, Bottorff & McCullogh (2013)	Best practices review
Shin, Park, & Kim (2015)	Meta-analysis

Table 11: Systematic reviews 2005 - 2015

As stated above the development of a conceptual framework would be of value to the simulation education community, and is evidenced by the following small number of publications supporting such a need as identified in the following section titled ‘Literature supporting research’.

Literature supporting research

As reported in Chapter 2 the systematic review by Kaakinen and Arwood (2009) pointed out there is a gap in the understanding of the use of education theories and frameworks. As a strategic publication this review is pivotal as it purposefully looked at the nursing simulation literature between 2000–2007 in efforts to ascertain to what level learning theory was used to design and assess learning that occurs in simulation activities. As earlier reported Kaakinen and Arwood (2009) identified a significant lack of any referencing or mention of learning theory in the simulation design or assessment of student learning. Out of the one hundred and twenty (n = 120) papers included in the review, there was a small number, sixteen (n = 16) that purported to use learning or developmental theory in their design and deliver to set up the simulation yet the review demonstrated flaws in that belief. Kaakinen and Arwood (2009) report that, of the sixteen (16) papers that indicated use of a learning type of foundation, only two (2) identified learning as a cognitive task. In effect the review demonstrated that simulation was being used primarily as a teaching modality rather than a learning paradigm. Kaakinen and Arwood (2009) suggested the need for a fundamental shift from a teaching paradigm to a learning paradigm, that a foundational learning theory should be used to design and evaluate simulation and they recommend that more research is required that investigates the efficacy of simulation for improving student learning.

As reported previously Parker and Myrick (2009) indicate there is little evidence of research into a pedagogy or educational philosophy that would suitably lead the development of simulation-based learning. Their critical review of the use of behaviourist and constructivist theory to guide the development, delivery and outcome evaluations of high-fidelity scenario-based simulation sessions is relevant as it supports the concept of a constructivist approach in the design and development of a conceptual framework. The Young and Shellenbarger (2012) adaptation of the NLN / Jeffries Framework model is a further indication that use of a framework to guide simulation design was appropriate and effective.

Williamson et al., (2008) present their Curriculum Procedures Frames Simulation Framework as an operational and workflow process. However as previously reported there does not appear to be any linkages made to underpinning teaching and learning theories. This would suggest that there remains a mixed understanding of what a conceptual framework is. While there are any number of process-focused frameworks developed there remains very little development of a conceptual framework that helps guide the development, educational elements and focus in that process. As a further example Howell and Higgins (2004) developed a Validation Methodology for Medical Training Framework and indicate that they identified a key set of underlying principles of learning science that have been demonstrated to enhance learning and are relevant to the training of medics and surgeons. Howell and Higgins (2004), while mentioning instructional design theory, also commented that there were educational theories considered. However there did not appear to be any clear and precise terminology used to reinforce this comment.

It is important to revisit Doerr & Murray (2008) who discuss the use of a simulation learning pyramid to guide simulation activities. While this is not technically a framework they do overtly allude to Knowles's adult learning principles and Kolb's experiential learning theory as applied to their pyramid of learning principles to simulator session design. This is a rare demonstration on how the authors translated that pyramid into curriculum or into programs and scenarios. Zigmont, Kappus and Sudikoff (2011) also make mention of experiential learning and describe the development of a framework based on adult learning theory, the Kolb Experiential Learning Cycle and the Learning Outcomes Model. Zigmont, Kappus and Sudikoff (2011) called the framework the 3D Model of Debriefing: Defusing, Discovering, and Deepening. In reality it is a two dimensional model however it is designed to assist facilitators of debriefings, providing them with useful phrases, descriptions of reactions to observe for, behavioural analysis strategies and how to incorporate new information (knowledge, skills) into clinical practice. Zigmont, Kappus and Sudikoff (2011) believe it enhances learning both in the simulation or real environment. While it only focuses on one aspect of simulation this is one of the few frameworks used as an educational tool and in keeping with the concept of a conceptual framework.

Meanwhile the outcomes of the 2007 Simulation Education Summit as reported by Huang et al. (2008) focused on standards for simulation-based applications. Notably a subsequent draft of standards for simulation-based education was developed and this has since become a published taxonomy supporting simulation development. Included in that current 2013 taxonomy are definitions of education theories such as Andragogy, Critical Thinking, Clinical Reasoning, Clinical Judgement, Constructivism, Cognitive, Debriefing, Feedback, Guided Reflection, Reflective Thinking and Skill Acquisition. There has been a recent Australian College of Nursing project that included a team review of the standards (Rutherford-Hemming, Lioce & Durham, 2015).

Further to that quality improvement activity, a recent news release about the National Council of State Boards of Nursing (NCSBN) simulation guidelines in LinkedIn by a leading simulation research academic indicates that there will be further publication activity regarding the new simulation guidelines, to ensure registration bodies are aware of them and to encourage adoption of the guidelines (Kardong-Edgren, 2015).

The literature does provide further evidence for more robust research activity in the domain of simulation education (Issenberg et al., 2011) and more robust framework development (Harris et al., 2013) in generating evidence that demonstrates the application of teaching and learning methodology and simulation leads to desired and demonstrable learning outcomes. Harris et al., (2013) argue further that in efforts to improve on theory and practice delivery, a better understanding of human performance and how it is enhanced is necessary.

The recommendations from a strategic Utstein style meeting that focused on the setting of a research agenda for simulation-based healthcare education in 2010 are pivotally important (Issenberg et al., 2011). A significant number of international experts, including a range of academics, clinicians, researchers and technical experts gathered and discussed a collection of issues related to simulation education and desired educational outcomes, with a number of recommendations including further research subsequently being published (Issenberg et al., 2011).

Issenberg et al. (2011) indicate that while there is significant growth in the use of simulation in healthcare, research that demonstrates preferred and verifiable learning outcomes is still in the beginning stages. They signal that it is important that the effective use of the simulation method of teaching and learning should be transparent to decision makers and other stakeholders. This includes its role in the clinical experience component of training (Issenberg et al., 2011). While there are a significant number of questions generated from the meeting, there are quite specific questions that underpin and have helped drive this research project in terms of context and relevance. These include research questions on learning theory, translational research questions and the authors specifically identified the need for more research in the area of education theories and simulation (Issenberg et al., 2011).

There is more evidence of the need for a conceptual framework that offers developers and teachers the right and best opportunity to design and deliver, assess and evaluate simulation education interventions. Subsequent to the critique by LaFond and Van Hulle (2013) of the NLN / Jeffries Simulation Framework they reported that the framework would appear to support guidance in the design and delivery of simulation interventions that result in positive outcomes for students. LaFond and Van Hulle (2013) then acknowledge that as there is already a widespread use of simulation in the preparation of nurses globally, so they see the need for a sturdy framework to guide educators in developing and facilitating these experiences effectively. Further reinforcement comes from Lambton and Prion (2009) who recommend that faculty need to possess not only clinical and technical but also educational expertise.

This recommendation is defended by Alinier and Platt (2013) who advise that instead of focusing on the simulator, more attention should be given to how the learners are educated using simulation. They indicate the essential importance of shifting emphasis towards improved educational preparation and development of simulation education personnel. The goal is to ensure simulation activities have greater education rigour; that is, the activities are more effectively designed, delivered and measured. This advice to undertake a particular course of action, a ‘call to arms’ as it were by Alinier and Platt (2013) certainly is in keeping with the focus of this study.

Ball (2015) presented at a conference the outline and intent of a study that would use the principles of Self-Efficacy Theory and Transformative Learning Theory as theoretical frameworks to explore nurses’ and physicians’ perceptions about interprofessional collaborative practice in end-of-life care situations and examine factors associated with interprofessional collaborative practice. Ball (2015) is aiming to measure perceptions around communication, teamwork and interpersonal relationship factors with the goal of the research adding to the body of knowledge about educational and practice measures that could be implemented into a health science syllabus (web page abstract).

Additionally Botelho et al. (2015) present a pedagogical application in engineering education as a model for enhancing the teaching-learning process and computer simulations. In essence this is a conceptual framework as they use it to guide specific content delivery. Botelho et al. (2015) acknowledge the role of simulation in complementing educational activities dealing with real and complex situations while ensuring students learn in a safe and supported environment. What Botelho et al. (2015) have recognized is the need to ensure that the computer-based simulation activity is educationally relevant and acknowledge the need for a framework to facilitate that.

Finally it is important to highlight the publication that supports the statement that the use of theories to underpin research in simulation is not at all optimal. Rourke et al. (2010), following a systematic search and review of the literature and using exclusion criteria, 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. This suggests that the use of underpinning theoretical processes via a conceptual framework, simulation-based education remains problematic and reinforces the need for further exploration and development.

From the outcomes of the overall literature review it appears there has been reporting on the application of various education theories to validate particular simulation – based activities but often this has been from a single or double theory perspective. The ongoing gap in the literature in this domain 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. Nevertheless the evidence from the literature supports the need to seek further evidence that will support the development and evaluation of a Conceptual Framework for Simulation –Based Education that builds on and potentially complements existing activities.

2. Simulation centres

To ascertain if there are conceptual frameworks in existence providing a basis for simulation-based education development in simulation centres, a questionnaire seeking out that evidence was distributed (Appendix A). Thirty (n=30) simulation centres from a simulation centre database[20] were randomly selected. This number was a recommendation from an experienced researcher and was supported by the University ethics committee. The centres were national and international but did not include those centres where the experts who were identified for the Delphi Technique component of the study are based.

[20] http://www.bmsc.co.uk/ World-wide simulation database.

Results

Questionnaire 1: Education frameworks in simulation centres

Of the thirty questionnaires circulated to those who consented there were nineteen (n = 19) returned responses. This demonstrates a return rate of 63.333% (n = 19/30). The returns came from a spread of countries so the impact of bias due to a large proportion of the respondents coming from one country where there may be a high uptake of simulation and maybe more personnel attuned to education theories and conceptual frameworks was considered neglible.

The following data is from the set of questions and answer boxes provided in the questionnaire (Appendix A). As the questionnaires were received they were given a numerical code to de-identify the respondents. The nineteen returned questionnaires were coded 1 to 19. The answers provided were then placed in their appropriate answer box. Where quantitative data was collected that is presented in numerical and percentage format. In the open-ended question sections the complete responses are provided to demonstrate to the reader the diversity in interpretation to the question. Thematic analyses have been generated.

Participants were first asked:

Q1a. Does your organisation utilize a conceptual framework for simulation education development?

Answers:

Yes	No
(n = x) / %	**(n = x) / %**
(n = 12) / 63.16%	**(n = 7) /** 36.84%

While 63% identified they utilize a conceptual framework for simulation education development, 37% did not. As the 'no' response is over one third ($^{1}/_{3}$) of the total response, this provides an opportunity to explore that response rate in attempts to find ways to decrease that gap through further exposure to the use of conceptual frameworks.

Participants were then asked:

Q1b. If yes which model and why?

The following answer table contains select responses demonstrating the variance in interpretations of this question.

R1 *The conceptual framework utilised depends on the simulation activity being delivered. Our curriculum is constructivist in nature and we integrate simulation into all 5 years of the undergraduate curriculum. We use a variety of frameworks to define simulation for example the Calgary Cambridge model for communication skills training (See Appendix G for complete response).*

R2 *In our center we use a conceptual framework for simulation education because of the following reasons:*

1. *to make our courses authentic and plausible for the participants*
2. *to be able to "justify" our concept to participants, stakeholders and others*
3. *to also make it easier for our instructors who are not active regularly – they can also "fall back" on this framework.*

R4 *The activities are based on learning theories, such as cognitive learning theories, experiential learning and collaborative learning. The learning objectives comes from the 7 roles of a physician (DK version of CanMED roles). We base the development of courses on needs assessment using a variety of sources, set learning objectives, method and evaluation.*

R6 *A comment about my answer: we essentially use the conceptual model developed by Pamela Jefferies, but we have not formally adopted it as one to uniformly use by all simulation educators that use our Center.*

R9 *When the simulation centre first opened a balanced score card approach was used to develop a business plan with strategic objectives and measures of success. This was more about business than the educational framework.*

R10 *Brain-based learning. This is used as the educators believe it provides the best educational framework for our learners.*

R11 *We have a straightforward approach to the use of simulation and debriefing in healthcare. We liken it to the use of practice and coaching in professional athletics and therefore do not debate or validate whether it works nor spend time attempting to classify what we do according to education/learning theory.*

R12 *I have developed a framework for our Physiotherapy programme which was developed as part of my PhD. This is largely based on the Jeffries/NLN simulation framework.*

We have also used another paper to guide instructional design within our curriculum.

R14 *Situated learning – a lot of the work involves undergraduate students who need to learn to practice using a range of discipline specific tools and knowledge and resources.*

This is not at present an organisational approach however it is the intent that conceptual frameworks will be integrated across the faculty of health sciences as the simulation program expands

R15 *We use "the Circle of learning" [A Laerdal graphic] based on Kolb's experimental learning, http://www.laerdal.com/no/binaries/AGODGYQF.swf*

R16 *Most of our interventions would follow the experiential learning paradigm, where we place a high importance on the reflective part during debriefings. We also draw on the simulation setting model by Dieckmann to help us think in the different phases of courses.*

R19 *The Medical School (for which we are contracted to provide simulation-based learning exercise in the final year of undergraduate study) utilises primarily a constructivist model or framework, with an element of a generative learning model in the background. (See Appendix G for complete response).*

Theme	As noted earlier the complete responses are provided to demonstrate to the reader the diversity in interpretation to the question. Given they were provided with a definition, there would appear to be still some variation in understanding of what a conceptual framework is, why it is used, when it is used, where it is used and how it is used. Examples of this are from R1 to R19. While there are no strong theme(s) emerging, there is some demonstration by some of those who responded in the affirmative they could identify education theories and models and their function. Others were more nebulous in their answers. Examples of this are from R1 to R19. Those who responded in the negative did not provide further information so nothing more can be deduced. From a summative perspective one could surmise that the data from Q1 could be considered less representative of the utilization 'picture'. This potentially represents an opportunity to demonstrate the benefits of a Conceptual Framework for Simulation in Healthcare Education. Examples of this are from R1 to R19.

Participants were then asked:

Q1c. If a conceptual framework for simulation education development is not used has your organisation considered employing one?

The following answer table contains select responses.

R1 *As stated above a lot of what we use is imported from other concepts and regulators. Developing a conceptual framework for SBME is essential. We try and adhere to the principles of Issenberg's BEME article and develop from that point forward.*

R3 *Not averse to the concept. Unsure of ultimate utility. As all education models are ultimately conceptual constructs by nature, that change over time with socio-cultural interactions, we are not fixated nor would we want to lock into a single framework, but are willing to consider multiple educational constructs depending on educational or assessment goals.*

R5 *Yes, we don't use 1 model. But we do have a framework for employing simulation in the curriculum (how many simulation/year/student,) we use a template to make the scenarios we do have a certain structure in the sessions and we do have an evaluation tool. But we didn't bundle everything in one framework.*

R6 *Yes, definitely.*

R8 *It's not clear what you mean by a "framework". Do we use learning theory? Yes. Knowles, Kolb, Schön, etc. Do we review the literature, like Jefferies framework or the Chiniara paper and use concepts, yes… but it's not like we espouse a certain "framework".*

R9 *Yes, definitely be keen to look at one.*

R17 *Absolutely, as soon as I finish my doctorate which is due to be submitted in October.*

Theme	Given twelve (12) of the nineteen (19) did not respond (63%) there is not enough feedback to come to any conclusion. However a small number (5) identified that they would consider employing one if given the opportunity. Examples of this are from R1 to R17. No further assumptions are made in relation to this question.

Participants were then asked:

Q2a. As an organisation do you use a conceptual framework to facilitate the evaluation and research of your simulation experiences?

Yes	No
(n = x) %	**(n = x) %**
(n = 8) /42.11	**(n = 11)** 57.89

42% identified they utilize a conceptual framework to facilitate the evaluation and research of their simulation experiences, however 58% did not. As the 'no' response is nearly two thirds ($^2/_3$) of the total response, this provided an opportunity to explore further the open –ended responses in attempts to ascertain why there is such a diverse gap.

Participants were then asked:

Q2b. If yes how do you use the framework?

The following answer table contains select responses.

R1 *We use educational research frameworks to evaluate our programmes of SBME and to underpin our research activity. We have used Kolb's experiential learning cycle, Dewey's amazing vision for education and the principles of personal transformation as described by Vygotsky & Mezirow.*

R2 *We use our conceptual framework for evaluation and research purposes. For evaluation we use one to also be able to compare simulation activities with other national centers (we all use the same framework); for research purposes we use one to meet international standards.*

R4 *We do not use a specific framework, but do often use the kirkpatrick model. (See Appendix G for complete response).*

R5 *Yes, we don't use 1 model. But we do have a framework for employing simulation in the curriculum (how many simulation/year/student) we use a template to make the scenarios we do have a certain structure in the sessions and we do have an evaluation tool. But we didn't bundle everything in one framework.*

R7 *No precise conceptual framework, but we have developed an evaluation tool for a specific project to gather feedback from staff about their perception of the various* *simulation programmes we run. It is based on a validated tool regarding perceived ease of use, perceive effectiveness of information technology (Exact reference not at hand). We are about to apply for ethical approval to extend the use of our evaluation questionnaire to all our simulation-based activities.*

R8 *No response.*

R9 *We have recently begun to use Kirkpatrick's and Phillips model of learning analytics showing level-wise measurement objectives as a mode of program evaluation for all training activity at our organisation. This includes the simulation centre; however at this stage the only level we are really achieving are review at lower levels such as satisfaction and learning. We are not at a place where we are clear about the impact on the learners, results impacting on the business and ROI yet.*

R10. *Donald Kirkpatrick's Four Level Evaluation Model. (See Appendix G for complete response).*

R11 *Again, with the assistance of colleagues in the departments of risk management, patient safety and quality assurance at our hospital, we examine the real-world outcomes of our daily clinical activities and determine whether our simulation-based programs are reducing adverse outcomes and near misses and improving safety, efficiency and effectiveness. For example, our program in the management of difficult deliveries has shown a return on investment of >300%.*

R12 *The framework guides the integration of appropriate SBE within the curriculum. Chiniara et al (2013) guides faculty to consider the appropriate simulation modality to achieve the required learning outcomes. The framework guides construction of the educational resources in relation to the teacher, students, educational practices, simulation design characteristics and desired educational outcomes. These are then related to appropriate assessment components to review our course/programme, scenario and practices.*

R13 *No.*

R14 *Organisationally no but at the moment we are trialling a psychometric test based on student satisfaction with their simulation experience.*

R15 *The Circle of learning is not a research-based framework, consequently we use other conceptual models of learning and simulation to inform research and evaluation such as the didactic relation model by Hiim and Hippe and Dieckmann, 2009.*

R16 *Most courses are still evaluated with "happy scores", more for immediate feedback and political reasons (often nice to show the good evaluations to our stakeholders). We also have knowledge tests in some course and use OSCE type of tests. In research projects we try to dig into the educational processes around simulation.*

R17 *Not at this time but again, it is all in the plan.*

Theme	While there is comment from eleven (11) that allude to how they use a conceptual framework to facilitate the evaluation and research of their simulation experiences, six (6) demonstrate a strong theme related to use of some type of conceptual framework while five (5) refer to an evaluation framework. Once again there seems to be a diverse and mixed understanding of what a conceptual framework is and used for. Examples of this are from R1 to R17. It would appear there is an opportunity for further explanation and demonstration around the use of conceptual frameworks.

Participants were then asked:

Q2c. If a conceptual framework for simulation education evaluation and research is not used has your organisation considered employing one?

The following answer table contains select responses.

R5 *See responses above. We use a few documents/templates to evaluate our simulation education. But we do not use one conceptual framework.*

R6 *Yes.*

R8 *Again, we evaluate our programs in a myriad of ways. Is it linked to a specific "framework"? No. Jefferies has a framework and we take concepts discussed there. We use a debriefing framework that is a conglomeration of many (CMS, iSIM, GAS, MSR).*

R9 *Yes, but we are still not clear on the best way to approach this in terms of methodology.*

R14 *Yes as above. Have used DASH and OSAD.*

R17 *Yes, as soon as my doctorate is completed I will begin to have a platform for this.*

R18 *No.*

R19 *I think we fall short here because we act primarily as an educational provider for a diverse range of staff and student groups in higher education and across different professions and specialties. Hence opportunities to develop and implement a research strategy have been secondary to ensuring we continually source commissioned educational activities.*
However we are now exploring a number of themes of research in learning and professional development, the two key concepts being based on a mastery learning model and development of expert team behaviours. (See Appendix G for complete response).

Theme	The answers were quite variable and overall there was no clear picture as to whether they would consider employing a conceptual framework for simulation education evaluation and research if one is not used in their organisation. There were four (4) only who made a clear statement in the affirmative and three (3) in the negative with many non-responses. Examples of this are from R5 to R19. One could make the

	assertion – again – that there is not a clear understanding about what a conceptual framework is – or the question was not well understood. No further comment is offered.

Participants were then asked:

Q3a. If your organisation had access to a validated conceptual framework for simulation education development would you consider using it?

Yes	No
(n = x) / %	(n = x) / %
(n = 17) 89.5%	**(n = 2)** 10.5%

Here there is a far more positive response to the question posed. A significant 89.5% identified they would consider using a validated conceptual framework for simulation education development If their organisation had access to one. 10.5% responded in the negative. This provided an opportunity to explore why there was such a positive response.

Participants were then asked:

Q3b. If yes, why?

The following answer table contains select responses.

R1 *The question here is what value this framework brings. Is it too isolating to develop a framework solely for evaluating SBME? Gaba argued in 2011 that simulation was a methodology now. Sometimes distancing ourselves from other disciplines or educational framework and theories limits integration. I'd be keen to see an SBME framework but it would have to speak to other educational theories and be relational to a wide modality of educational interventions.*

R2 *I personally think that it is always nice to compare your own framework with others to improve your activities!*

R3 *Would consider using any tool that improves the quality (and ideally outcomes, however this can be measured) of simulation based educational or assessment sessions*

R4 *If the framework did fit into our culture, educational system and worked for us-then yes*

R5 *A validated conceptual framework is more useful than a non-validated. Otherwise the framework should be useable in Europe and the education system in Belgium. The feasibility of the framework would be important before we would use it.*

R6 *We are at great time in our evolution as an institution to formally adopt a conceptual framework. Being a higher education institution focused primarily on our teaching mission (for more than 100 years), we are focusing more intently on the research and other scholarly production completed by our faculty and students. We have also developed a strong culture of assessment across all programs and divisions of the university – having a standard, validated framework to apply to assessments of our simulation-based learning activities would be excellent.*

R7 *Why re-invent the wheel? We have a developmental process that uses a published template (Alinier, 2011) and scenarios are reviewed by 2 other people in addition to* *the developer. Scenarios are further refined through piloting, and upon implementation with staff.*

R9 *It would be great to have access to a tool that could be used to apply a framework that had sound evidence for its use and clearly defined results.*

R10 *We think it is important to have a theoretical framework to underpin simulation education development.*

R12 *We would consider using other conceptual frameworks if they were evidence-based and suited our programme educational design.*

R13 *Maybe: We run a program that is successful in terms of trainees' satisfaction and research output with a very limited amount of personal and financial resources; thus we see no obvious need to change or implement something new; however, we would certainly have a look at a conceptual framework.*

R15 *If the framework fits into the Norwegian context we would consider using it. A validated evaluation form would develop simulation based education (is missing in the research literature).*

R16 *Sure, we would consider. Question is what "validation" means in this context. I would see a challenge in balancing generic issues and local implementation of such a framework. In principle, I think such frameworks already exist, when you look into the literature on training design.*

R17 *Standardisation of simulated learning environments (SLEs) is absolutely essential so that there is equal access and ability to grant all students equal opportunities in simulated learning.*

R18 *Time saving access to a validated tool may be a trigger to use, no own activities because of lack of human resources, time and money.*

R19 *I think this would give us opportunity to step back from the coal face and re-examine our educational and research strategies to ensure they are aligned, based on sound educational theory involving development of professional practice, and provide us opportunity to introduce a more robust longitudinal evaluation of impact of sim-based learning at an organisational level.*

Theme	Based on the response rate and the comments here there is a very strong theme of acceptance coming through. There are different reasons provided but essentially the majority see the provision of such a tool as positive and indicate why that might be for their individual requirements. This is positive feedback and supportive of the project. Examples of this are from R1 to R19.

Participants were then asked:

Q3c. If no, why?

The following answer table contains select responses.

R8 *There's enough "frameworks" out there. I don't really get what a framework is all about. If anything I use the CQI – continuous quality improvement framework of PDCA (plan do check act) and the notion I learned in college of plan, implement, evaluate. We have a process we use to create a program. I don't think we need a "framework".*

R11 *Again, with the assistance of colleagues in the departments of risk management, patient safety and quality assurance at our hospital, we examine the real-world outcomes of our daily clinical activities and determine whether our simulation-based programs are reducing adverse outcomes and near misses and improving safety, efficiency and effectiveness. For example, our program in the management of difficult deliveries has shown a return on investment of >300%.*

Theme	The return on this question demonstrated that those who responded previously in the affirmative did not offer any further information. The two who responded in the negative essentially offered their respective views. Examples of this are R8 and R11 - and given the complexity of the subject it can be assumed there will be those who have alternate views and answers. While taking into account and respecting these views the majority 89.5% positive response rate is considered the driver for future activities.

Conclusion

These collective data and themes demonstrated that there remained a need for and supported the development of, a conceptual framework. Given the reported outcomes of both Phase One, Activity 1. Literature Review; and Phase One, Activity 2. Simulation Centres, the research proceeded to Phase 2, the construction of, and Phase 3, the testing by modified Delphi technique of, the draft Conceptual Framework for Simulation in Healthcare Education.

Phase two

Results

Definition of the conceptual framework for simulation in healthcare education

The earlier defining of a conceptual framework provides the background to the definition for the study's Conceptual Framework for Simulation in Healthcare Education. The definition for the Conceptual Framework for Simulation in Healthcare Education (the Conceptual Framework) is:

> 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).

Education theories in the Conceptual Framework

Theory 1: Adult Learning Theory

The first education theory to be considered as a component part of the Conceptual Framework for Simulation in Healthcare Education is the Adult Learning Theory.

Application considerations

As noted with constructivism principles and constructivist learning, to ensure, as a standard, that the conceptual framework takes the user from the theoretical aspects being provided to a processing and application approach, there are a number of pre-design and development questions needing to be considered and addressed. When developing a curriculum, a course, tutorial, workshop, scenario, learning objectives and outcomes where simulation will be embedded and is integral to the educational and assessment process, it becomes necessary to first consider;

- What foundational Andragogy factors are important to review and consider? This links to the other education theories identified.
- How will Andragogy principles and adult learning strategies and activities guide these developments?
- Where will Adult learning be of benefit?
- When will Adult learning be of benefit?

The next consideration is to ascertain where and how Andragogy principles and adult learning strategies and activities intersect with, and augment, a range of other components of the conceptual framework (Table 12). These include;

Andragogy and ⟹	The teacher / instructor / facilitator / technician
	Resources (educational, human, technical, infrastructure)
	The curriculum
	Groups of learners
	A learner's work experience
	Complexity (in learning and environment)
	Authenticity (in learning and environment)
	Fidelity (in learning and environment)
	Situated learning
	Contextual learning
	Scaffolded learning
	Identified learning objectives and outcomes
	Heutagogy
	Tacit knowledge
	The individual learner's learning style and characteristics
	Experiential learning
	Critical thinking
	Clinical reasoning
	Clinical judgment
	Feedback and debriefing
	Reflective learning
	Competency attainment
	Self-efficacy
	Expert practice
	Education taxonomies and simulation

Table 12: Andragogy and the Conceptual Framework

At this juncture, especially in relation to the review of this particular education theory, it is important to note that new learners commencing undergraduate or graduate studies in their progression to becoming healthcare professionals may require modification in the how they receive discipline-specific education initially. However many will already have had primary, secondary school and/or college exposure to the flipped classroom, active learning, self-directed learning, e-learning, researching material, either through working alone or in teams, while identifying their own needs based on their perceptions of what is expected.

Theory 2: Heutagogy or Self-determined Learning

The second education theory to be considered as a component part of the Conceptual Framework for Simulation in Healthcare Education is the theory of Heutagogy or Self-determined Learning.

Application considerations

As noted with constructivism principles and constructivist learning, and Andragogy, to ensure, as a standard, that the conceptual framework takes the user from the theoretical aspects being provided to a processing and application approach, there are a number of pre-design and development questions needing to be considered and addressed. When developing a curriculum, a course, tutorial, workshop, scenario, learning objectives and outcomes where simulation will be embedded and is integral to the educational and assessment process, it becomes necessary to first consider;

- What foundational Heutagogy factors are important to review and consider? This links to the other education theories identified.
- How will Heutagogy principles and self-determined learning strategies and activities guide these developments?
- Where will self-determined learning be of benefit?
- When will self-determined learning be of benefit?

The next consideration is to ascertain where and how Heutagogy – self-determined learning principles, strategies and activities intersect with, and augment, a range of other components of the conceptual framework (Table 13). These include;

Heutagogy and ⟹	⟹ The teacher / instructor / facilitator / technician
	⟹ Resources (educational, human, technical, infrastructure)
	⟹ The curriculum
	⟹ Groups of learners
	⟹ A learner's work experience
	⟹ Complexity (in learning and environment)
	⟹ Authenticity (in learning and environment)
	⟹ Fidelity (in learning and environment)
	⟹ Situated learning
	⟹ Contextual learning
	⟹ Scaffolded learning
	⟹ Identified learning objectives and outcomes
	⟹ Andragogy
	⟹ Tacit knowledge
	⟹ The individual learner's learning style and characteristics
	⟹ Experiential learning
	⟹ Critical thinking
	⟹ Clinical reasoning
	⟹ Clinical judgment
	⟹ Feedback and debriefing
	⟹ Reflective learning
	⟹ Competency attainment
	⟹ Self-efficacy
	⟹ Expert practice
	⟹ Education taxonomies and simulation

Table 13: Heutagogy and the Conceptual Framework

As identified with the adult learning theory, it is important to reiterate here that new learners commencing undergraduate or graduate studies in their progression to becoming healthcare professionals may require modification in the how they receive discipline-specific education initially. However many will already have had primary, secondary school and/or college exposure to the flipped classroom, active learning, self-directed learning, e-learning, researching material, either through working alone or in teams, while identifying their own needs based on their perceptions of what is expected. They may well be ideal candidates where a heutagogical approach may be of benefit, once other curriculum factors such as timelines and assessments have been addressed.

Theory 3: Tacit knowledge

The third education theory to be considered as a component part of the Conceptual Framework for Simulation in Healthcare Education is the theory of Tacit Knowledge.

Application considerations

As noted with Constructivism principles and Constructivist learning, Andragogy and Heutagogy, to ensure, as a standard, that the conceptual framework takes the user from the theoretical aspects being provided to a processing and application approach, there are a number of pre-design and development questions needing to be considered and addressed. When developing a curriculum, a course, tutorial, workshop, scenario, learning objectives and outcomes where simulation will be embedded is, and integral to, the educational and assessment process, it becomes necessary to first consider;

- What foundational Tacit Knowledge factors are important to review and consider? This links to the other education theories identified.
- How will Tacit Knowledge principles, strategies and activities guide these developments?
- Where will Tacit Knowledge be of benefit?
- When will Tacit Knowledge be of benefit?

The next consideration is to ascertain where and how Tacit Knowledge principles, strategies and activities intersect with, and augment, a range of other components of the conceptual framework (Table 14). These include;

Tacit knowledge and ⟹	
	⟹ The teacher / instructor / facilitator / technician
	⟹ Resources (educational, human, technical, infrastructure)
	⟹ The curriculum
	⟹ Groups of learners
	⟹ A learner’s work experience
	⟹ Complexity (in learning and environment)
	⟹ Authenticity (in learning and environment)
	⟹ Fidelity (in learning and environment)
	⟹ Situated learning
	⟹ Contextual learning
	⟹ Scaffolded learning
	⟹ Identified learning objectives and outcomes
	⟹ Andragogy
	⟹ Heutagogy
	⟹ The individual learner’s learning style and characteristics
	⟹ Experiential learning
	⟹ Critical thinking
	⟹ Clinical reasoning
	⟹ Clinical judgment
	⟹ Feedback and debriefing
	⟹ Reflective learning
	⟹ Competency attainment
	⟹ Self-efficacy
	⟹ Expert practice
	⟹ Education taxonomies and simulation

Table 14: Tacit Knowledge and the Conceptual Framework

Every person will have differing Tacit Knowledge. It may be age related, exposure related or a combination. New learners will have different incoming Tacit Knowledge to that of learners who have experience and expertise. Or, while some will be able to draw on their know-how and know-what, and intuitively make heuristic connections to new knowledge and experiences, others may not. For a curriculum or course developer being first aware of this influencing factor and catering for it is an important activity. It is strategic to explore this with learners to gain an overview of individual and group Tacit Knowledge.

Theory 4: Learning styles / characteristics / preferences

The fourth education theory to be considered as a component part of the Conceptual Framework for Simulation in Healthcare Education is the theory of Learning Styles / characteristics / preferences.

Application considerations

As noted with Constructivism principles and constructivist learning, Andragogy, Heutagogy and Tacit Knowledge, to ensure, as a standard, that the conceptual framework takes the user from the theoretical aspects being provided to a processing and application approach, there are a number of pre-design and development questions needing to be considered and addressed. When developing a curriculum, a course, tutorial, workshop, scenario, learning objectives and outcomes where simulation will be embedded and is integral to the educational and assessment process, it becomes necessary to first consider;

- What foundational Learning Style factors are important to review and consider? This links to the other education theories identified.
- How will Learning Style principles, strategies and activities guide these developments?
- Where will Learning Styles be of benefit?
- When will Learning Styles be of benefit?

The next consideration is to ascertain where and how Learning Styles principles, strategies and activities intersect with, and augment, a range of other components of the conceptual framework (Table 15). These include;

	The teacher / instructor / facilitator / technician
	Resources (educational, human, technical, infrastructure)
	The curriculum
	Groups of learners
	A learner’s work experience
	Complexity (in learning and environment)
	Authenticity (in learning and environment)
	Fidelity (in learning and environment)
	Situated learning
	Contextual learning
	Scaffolded learning
	Identified learning objectives and outcomes
	Andragogy
Learning style, characteristics, preferences	Heutagogy
	Tacit knowledge
	Experiential learning
	Critical thinking
	Clinical reasoning
	Clinical judgment
	Feedback and debriefing
	Reflective learning
	Competency attainment
	Self-efficacy
	Expert practice
	Education taxonomies and simulation

Table 15: Learning Styles and the Conceptual Framework

The literature and research previously identified demonstrates that every person will have differing Learning Styles. While there may be cohorts of learners with similar preferences in learning, some learners may have quite significant differences in their approach to learning. Catering for that spectrum could be potentially problematic. Whether it is Kolb, Honey & Mumford, Fleming or any other learning styles / preferences theorist being considered to help guide, develop and deliver a simulation, in a simulation activity - it first becomes important how might these differing learning preferences be accommodated and addressed so that the achieving of learning outcomes via preferred learning styles are maximized.

Theory 5: Experiential learning

The fifth education theory to be considered as a component part of the Conceptual Framework for Simulation in Healthcare Education is the theory of Experiential Learning.

Application considerations

As noted with Constructivism principles and Constructivist learning, Andragogy, Heutagogy, Tacit Knowledge and Learning Styles, to ensure, as a standard, that the conceptual framework takes the user from the theoretical aspects being provided to a processing and application approach, there are a number of pre-design and development questions needing to be considered and addressed. When developing a curriculum, a course, tutorial, workshop, scenario, learning objectives and outcomes where simulation will be embedded and is integral to the educational and assessment process, it becomes necessary to first consider;

- What foundational Experiential Learning factors are important to review and consider? This links to the other education theories identified.
- How will Experiential Learning principles, strategies and activities guide these developments?
- Where will Experiential Learning be of benefit?
- When will Experiential Learning be of benefit?

The next consideration is to ascertain where and how Experiential Learning principles, strategies and activities intersect with, and augment, a range of other components of the conceptual framework (Table 16). These include:

Experiential learning	
⟹	The teacher / instructor / facilitator / technician
⟹	Resources (educational, human, technical, infrastructure)
⟹	The curriculum
⟹	Groups of learners
⟹	A learner's work experience
⟹	Complexity (in learning and environment)
⟹	Authenticity (in learning and environment)
⟹	Fidelity (in learning and environment)
⟹	Situated learning
⟹	Contextual learning
⟹	Scaffolded learning
⟹	Identified learning objectives and outcomes
⟹	Andragogy
⟹	Heutagogy
⟹	Tacit knowledge
⟹	The individual learner's learning style and characteristics
⟹	Critical thinking
⟹	Clinical reasoning
⟹	Clinical judgment
⟹	Feedback and debriefing
⟹	Reflective learning
⟹	Competency attainment
⟹	Self-efficacy
⟹	Expert practice
⟹	Education taxonomies and simulation

Table 16: Experiential learning and the Conceptual Framework

Why is this important? A search of the healthcare education literature demonstrates that there are many ongoing discussions, reports and research focusing on the learning styles of various disciplines – and the need to consider them more effectively. A survey by Rassool and Rawaf (2007) provides insight and support with their results demonstrating a level of congruency with previous studies; that their study indicated that a reflector is the preferred learning style of undergraduate nursing students. They reported that a 'dual' learning style category was also identified; that there was significant mismatch between teaching styles and the learning styles of students which led to unfavourable consequences; and a recommendation that a mixed mode of teaching and learning should be generated to more effectively meet the learning needs of students. Frankel (2009) reported that those questioned in that survey mainly prefer visual or kinesthetic learning and as a result this was an indication that their current training programme was not meeting their learning needs – and that this was impacting on learning outcomes.

A longitudinal study by Fleming et al. (2011) found that there were a range and mix of learning styles identified by nursing students, with the preferred learning style of students in their first and final year being reflector. Fleming et al. (2011) identified that it is important that nurse educators be cognizant of the various learning styles, characteristics and preferences of students, so that they can design, develop, deliver and evaluate a cohort of teaching, learning and assessment strategies that maximizes the student's learning experiences. Meanwhile other studies report on various learning style traits (Caulley et al., 2012; D'Armore et al., 2012; Manolis et al., 2012; Bostrom & Hallin, 2013). Importantly Aina-Popoola & Hendricks (2014) undertook a literature review and identified that there is limited literature on the learning styles of first semester nursing students, which only leads to creating partial understanding of how the learning styles models affect these group of nursing students.

The literature reviewed makes recommendations regarding knowing how learners prefer to learn, what the implications are and the ramifications of not addressing learning preferences - and that educators need to address them more effectively.

In conclusion, with regards to Experiential Learning Theory and model(s) - in the context of simulation – it becomes important to not only ask how this education theory can be addressed, applied and measured, but how it guides attempts to capture and guide students' learning more effectively.

Theory 6: Critical Thinking / Clinical Reasoning / Clinical Judgement.

The sixth education theory to be considered as a component part of the Conceptual Framework for Simulation in Healthcare Education is the theory of Critical Thinking / Clinical Reasoning / Clinical Judgement.

Application considerations

As noted with Constructivism principles and Constructivist learning, Andragogy, Heutagogy, Tacit Knowledge, Learning Styles and Experiential Learning to ensure, as a standard, that the framework takes the user from the theoretical aspects being provided to a processing and application approach, there are a number of pre-design and development questions needing to be considered and addressed. When developing a curriculum, a course, tutorial, workshop, scenario, learning objectives and outcomes where simulation will be embedded and is integral to the educational and assessment process, it becomes necessary to first consider;

- What foundational Critical Thinking Theory factors are important to review and consider? This links to the other education theories identified.
- How will Critical Thinking Theory principles, strategies and activities guide these developments?
- Where will Critical Thinking Theory be of benefit?
- When will Critical Thinking Theory be of benefit?

The next consideration is to ascertain where and how Critical Thinking Theory principles, strategies and activities intersect with, and augment, a range of other components of the conceptual framework (Table 17). These include;

Critical thinking ⟶	⇒	The teacher / instructor / facilitator / technician
	⇒	Resources (educational, human, technical, infrastructure)
	⇒	The curriculum
	⇒	Groups of learners
	⇒	A learner's work experience
	⇒	Complexity (in learning and environment)
	⇒	Authenticity (in learning and environment)
	⇒	Fidelity (in learning and environment)
	⇒	Situated learning
	⇒	Contextual learning
	⇒	Scaffolded learning
	⇒	Identified learning objectives and outcomes
	⇒	Andragogy
	⇒	Heutagogy
	⇒	Tacit knowledge
	⇒	The individual learner's learning style and characteristics
	⇒	Experiential learning
	⇒	Clinical reasoning
	⇒	Clinical judgment
	⇒	Feedback and debriefing
	⇒	Reflective learning
	⇒	Competency attainment
	⇒	Self-efficacy
	⇒	Expert practice
	⇒	Education taxonomies and simulation

Table 17: Critical thinking and the Conceptual Framework

Why is this important? A search of the healthcare education literature demonstrates that there many ongoing discussions, reports and beginning research focusing on Critical Thinking Theory and its component parts of Clinical Reasoning and Clinical Judgement of various disciplines – and the need to consider them more effectively.

Indeed the following are beneficial in considering how best to incorporate this theory into simulations:

- Critical Thinking and Clinical Reasoning. (Pearson Higher Education web link);
- Clinical Reasoning: Instructor resources. (University of Newcastle, 2009); and,
- Critical Thinking, Clinical Reasoning and Clinical Judgment. (Alfaro-LeFevre, 2013).

Being cognizant of the need for clinicians to have these attributes and skills means that they need to be catered for, nurtured and measured when utilizing simulation as a teaching, learning and assessment education method. These theories contribute to the design, development, delivery and evaluation elements of a simulation intervention and also to their development of these pivotal metacognitive attributes and skills in clinicians.

Theory 7: Reflective Learning Theory

The seventh education theory to be considered as a component part of the Conceptual Framework for Simulation in Healthcare Education is the theory of Reflective Learning.

Application considerations

As noted with Constructivism principles and Constructivist learning, Andragogy, Heutagogy, Tacit Knowledge, Learning Styles, Experiential Learning and Critical Thinking to ensure, as a standard, that the conceptual framework takes the user from the theoretical aspects being provided to a processing and application approach, there are a number of pre-design and development questions needing to be considered and addressed. When developing a curriculum, a course, tutorial, workshop, scenario, learning objectives and outcomes where simulation will be embedded and is integral to the educational and assessment process, it becomes necessary to first consider;

- What foundational Reflective Learning Theory factors are important to review and consider? This links to the other education theories identified.
- How will Reflective Learning Theory principles, strategies and activities guide these developments?
- Where will Reflective Learning Theory be of benefit?
- When will Reflective Learning Theory be of benefit?

The next consideration is to ascertain where and how Reflective Learning Theory principles, strategies and activities intersect with, and augment, a range of other components of the conceptual framework (Table 18). These include;

Reflective Learning ⟹	⇒ The teacher / instructor / facilitator / technician
	⇒ Resources (educational, human, technical, infrastructure)
	⇒ The curriculum
	⇒ Groups of learners
	⇒ A learner's work experience
	⇒ Complexity (in learning and environment)
	⇒ Authenticity (in learning and environment)
	⇒ Fidelity (in learning and environment)
	⇒ Situated learning
	⇒ Contextual learning
	⇒ Scaffolded learning
	⇒ Identified learning objectives and outcomes
	⇒ Andragogy
	⇒ Heutagogy
	⇒ Tacit knowledge
	⇒ The individual learner's learning style and characteristics
	⇒ Experiential learning
	⇒ Critical thinking
	⇒ Clinical reasoning
	⇒ Clinical judgment
	⇒ Feedback and debriefing
	⇒ Competency attainment
	⇒ Self-efficacy
	⇒ Expert practice
	⇒ Education taxonomies and simulation

Table 18: Reflective learning theory and the Conceptual Framework

It is also important to acknowledge that there are now many education and research publications relating to debriefing in simulation and any number of simulation centres that have debriefing to encourage reflective practice and debriefing strategies as a core process in their simulation education activities. This is a significant change from 2007 when Fanning and Gaba (2007) after a comprehensive description of the various aspects of debriefing, concluded that while debriefing is a pivotal component of the simulation activity and there is beginning study into this, there is a dearth of peer-reviewed publications. Fanning and Gaba (2007) did note at that time that there was encouraging presentations about a various aspects of debriefing at conferences.

Indeed the significant publications on debriefing presented in table format warrant attention as they may be beneficial for others when considering how best to incorporate this theory into simulations. A search from 2000 to 2015 has revealed a significant number of publications with broad and diverse areas of focus, with many being published in peer-review journals.. These publications have been described earlier in Table 8.

Being cognizant of the need for clinicians to have reflective practice attributes and skills means that they need to be catered for, nurtured and measured when utilizing simulation as a teaching, learning and assessment education method. This requires of course that the educators and facilitators are appropriately prepared to ensure this stratagem achieves desired outcomes. There is a plethora of published information to help this happen (Table 8; Arthur, Levett-Jones & Kable, 2010; Cant & Cooper, 2010; Centre for Medical Simulation website; Punch, 2013) and simulation educators also have access to any number of resources such as simulation educator workshops, short courses, graduate and higher degrees, mentoring, apprenticeship and fellowships, all directed to helping enhance a teacher’s knowledge, skill, expertise and experience in facilitating debriefing.

However there remains ongoing debate as to how that might be best achieved, including what are the best strategies to ensure educators and facilitators are appropriately prepared to develop and use simulation activities to achieve such outcomes. Waznonis (2015), after carrying out a national survey on simulation debriefing practices in traditional baccalaureate nursing programs, presented the results which were somewhat disquieting given the cohort of educators involved and the numbers of students who may have been adversely impacted on.

Waznonis (2015) reported that from a human capital perspective, many of the debriefers were full-time master prepared educators, with other workload and professional development commitments, who were also facilitating large numbers of debriefings, often with limited support and resources. This led to time commitment issues, resistance by faculty and safety issues such as fatigue. Disparities were also found across the gamut of the various elements that make up simulation overall. These included all aspects of training, policy and ethical issues such as privacy and confidentiality, the way students were engaged in the simulation process, including how they were initially briefed beforehand and the design, delivery and evaluation of debriefing. Based on the outcomes, recommendations were focused on strategies to close the gaps between practice and the best practice standard for debriefing (Decker et al., 2013).

Again Cheng et al. (2015) raised this in a recent commentary where they first acknowledge the relevance of debriefing and the various sources that educators have available to become educationally prepared to debrief. They went on to raise what might be the best educator development strategies to ensure maintenance and even enhancement of debriefing strategies in healthcare simulation. Cheng et al. (2015) then broached five key issues in the form of questions that they considered required further debate and development in any future debriefing training development. They asked, ‘are we teaching the appropriate debriefing methods? Are we using the appropriate methods to teach debriefing skills? How can we best assess debriefing effectiveness? How can peer feedback of debriefing be used to improve debriefing quality within programs … [and] … How can we individualize debriefing training opportunities to the learning needs of our educators?’(p. 217).

That being the case it becomes even more important to reiterate here that this underpinning education theory with its many expositions requires careful consideration for what might be the most effective way of achieving debriefing and reflective practice outcomes using simulation – especially in combination with the other theories presented in this conceptual framework. As the literature continues to attest, debriefing and reflective practice are increasingly being seen as a significant if not key contributor to learning in the overall simulation experience.

Theory 8: Novice to expert theory

The eighth education theory to be considered as a component part of the Conceptual Framework for Simulation in Healthcare Education is the Novice to Expert Theory

Application considerations

As noted with Constructivism principles and Constructivist learning, Andragogy, Heutagogy, Tacit Knowledge, Learning Styles, Experiential Learning, Critical Thinking and Reflective Learning to ensure, as a standard, that the conceptual framework takes the user from the theoretical aspects being provided to a processing and application approach, there are a number of pre-design and development questions needing to be considered and addressed. When developing a curriculum, a course, tutorial, workshop, scenario, learning objectives and outcomes where simulation will be embedded and is integral to the educational and assessment process, it becomes necessary to first consider;

- What foundational Novice to Expert Theory factors are important to review and consider? This links to the other education theories identified.
- How will Novice to Expert Theory principles, strategies and activities guide these developments?
- Where will Novice to Expert Theory be of benefit?
- When will Novice to Expert Theory be of benefit?

The next consideration is to ascertain where and how Novice to Expert Theory principles, strategies and activities intersect with, and augment, a range of other components of the conceptual framework (Table 19). These include;

	⇒ The teacher / instructor / facilitator / technician
	⇒ Resources (educational, human, technical, infrastructure)
	⇒ The curriculum
	⇒ Groups of learners
	⇒ A learner's work experience
	⇒ Complexity (in learning and environment)
	⇒ Authenticity (in learning and environment)
	⇒ Fidelity (in learning and environment)
	⇒ Situated learning
	⇒ Contextual learning
	⇒ Scaffolded learning
	⇒ Identified learning objectives and outcomes
	⇒ Andragogy
Novice to expert ⟹	⇒ Heutagogy
	⇒ Tacit knowledge
	⇒ The individual learner's learning style and characteristics
	⇒ Experiential learning
	⇒ Critical thinking
	⇒ Clinical reasoning
	⇒ Clinical judgment
	⇒ Feedback and debriefing
	⇒ Reflective learning
	⇒ Self-efficacy
	⇒ Expert practice
	⇒ Education taxonomies and simulation

Table 19: Novice to Expert Theory and the Conceptual Framework

There is a further factor that needs to be considered within the context of this theory. Although a clinician achieves a certain level of expertise does not mean he or she will automatically retain that level. There are many mitigating reasons[21] why expertise may be negatively impacted on - and they can be pursued through a variety of analyses.

However while simulation can be of value to help the novice develop along the journey to competence and expertise, simulation also becomes a strategic process to mitigate knowledge and skill decay - and to maintain confidence and self-efficacy – a further education theory.

[21] http://cogdevlab.yale.edu/sites/default/files/files/Fisher2015.pdf

Theory 9: Self-efficacy

The ninth education theory to be considered as a component part of the Conceptual Framework for Simulation in Healthcare Education is the Self-efficacy Theory.

Application considerations

As noted with constructivism principles and constructivist learning, Andragogy, Heutagogy, Tacit Knowledge, Learning Styles, Experiential Learning, Critical Thinking, Reflective Learning and Novice to Expert Theory to ensure, as a standard, that the conceptual framework takes the user from the theoretical aspects being provided to a processing and application approach, there are a number of pre-design and development questions needing to be considered and addressed. When developing a curriculum, a course, tutorial, workshop, scenario, learning objectives and outcomes where simulation will be embedded and is integral to the educational and assessment process, it becomes necessary to first consider;

- What foundational Self-efficacy Theory factors are important to review and consider? This links to the other education theories identified.
- How will Self-efficacy Theory principles, strategies and activities guide these developments?
- Where will Self-efficacy Theory be of benefit?
- When will Self-efficacy Theory be of benefit?

The next consideration is to ascertain where and how Self-efficacy Theory principles, strategies and activities intersect with, and augment, a range of other components of the conceptual framework (Table 20). These include;

Self-efficacy	
⟹	The teacher / instructor / facilitator / technician
⟹	Resources (educational, human, technical, infrastructure)
⟹	The curriculum
⟹	Groups of learners
⟹	A learner's work experience
⟹	Complexity (in learning and environment)
⟹	Authenticity (in learning and environment)
⟹	Fidelity (in learning and environment)
⟹	Situated learning
⟹	Contextual learning
⟹	Scaffolded learning
⟹	Identified learning objectives and outcomes
⟹	Andragogy
⟹	Heutagogy
⟹	Tacit knowledge
⟹	The individual learner's learning style and characteristics
⟹	Experiential learning
⟹	Critical thinking
⟹	Clinical reasoning
⟹	Clinical judgment
⟹	Feedback and debriefing
⟹	Reflective learning
⟹	Novice to expert
⟹	Expert practice
⟹	Education taxonomies and simulation

Table 20: Self-efficacy and the Conceptual Framework

It is recommended that the other theories are considered and referred to when applying Self-efficacy Theory into simulation education. It is also important to consider the embedding of and researching of this theory, to identify what and how this might be delivered and measured. Remembering that it has strong connectivity to the other theories already identified – and maybe should not be considered in isolation – as so many education theories are as identified in the literature reviewed.

Theory 10: Deliberate practice and acquisition of expert performance

The tenth education theory to be considered as a component part of the Conceptual Framework for Simulation in Healthcare Education is the Deliberate Practice and Acquisition of Expert Performance Theory.

Application considerations

As noted with Constructivism principles and Constructivist learning, Andragogy, Heutagogy, Tacit Knowledge, Learning Styles, Experiential Learning, Critical Thinking, Reflective Learning, Novice to Expert and Self-efficacy Theory to ensure, as a standard, that the conceptual framework takes the user from the theoretical aspects being provided to a processing and application approach, there are a number of pre-design and development questions needing to be considered and addressed. When developing a curriculum, a course, tutorial, workshop, scenario, learning objectives and outcomes where simulation will be embedded and is integral to the educational and assessment process, it becomes necessary to first consider;

- What foundational Deliberate Practice and Acquisition of Expert Performance factors are important to review and consider? This links to the other education theories identified.
- How will Deliberate Practice and Acquisition of Expert Performance Theory principles, strategies and activities guide these developments?
- Where will Deliberate Practice and Acquisition of Expert Performance Theory be of benefit?
- When will Deliberate Practice and Acquisition of Expert Performance Theory be of benefit?

The next consideration is to ascertain where and how Deliberate Practice and Acquisition of Expert Performance Theory principles, strategies and activities intersect with, and augment, a range of other components of the conceptual framework (Table 21). These include;

Expert practice ⟹	⟹	The teacher / instructor / facilitator / technician
	⟹	Resources (educational, human, technical, infrastructure)
	⟹	The curriculum
	⟹	Groups of learners
	⟹	A learner's work experience
	⟹	Complexity (in learning and environment)
	⟹	Authenticity (in learning and environment)
	⟹	Fidelity (in learning and environment)
	⟹	Situated learning
	⟹	Contextual learning
	⟹	Scaffolded learning
	⟹	Identified learning objectives and outcomes
	⟹	Andragogy
	⟹	Heutagogy
	⟹	Tacit knowledge
	⟹	The individual learner's learning style and characteristics
	⟹	Experiential learning
	⟹	Critical thinking
	⟹	Clinical reasoning
	⟹	Clinical judgment
	⟹	Feedback and debriefing
	⟹	Reflective learning
	⟹	Novice to expert
	⟹	Self-efficacy
	⟹	Education taxonomies and simulation

Table 21: Deliberate practice-expert performance theory and the Conceptual Framework

It may be that the Deliberate Practice and Acquisition of Expert Performance Theory has the potential to influence and impact on a person's total 'being' positively or negatively. That being so, it is important in the context of using simulation as a teaching, learning and assessment method and delivery platform to guide a learner towards change, for educators to be cognizant of the theory of Deliberate Practice and Acquisition of Expert Performance. It also becomes an imperative to provide an environment that will facilitate Deliberate Practice and Acquisition of Expert Performance development in a learner.

While the research is mainly supportive of the Deliberate Practice and Acquisition of Expert Performance theory there are others arguing that there are other confounding factors that influence the development of expert performance. Kulasegaram, Grierson and Norman (2013) report that the research on deliberate practice and acquisition of expert performance minimises the role of individual ability in expert performance. They believe that intrinsic cognitive differences in individuals such as working memory capacity also impact on expert performance development. Kulasegaram, Grierson and Norman (2013) indicate research would suggest that while deliberate practice does facilitate expert performance, it depends on the task at hand. They suggest that working memory capacity is greater for activities that are irregularly carried out or are functionally complex, such as clinical reasoning. They recommend further research to see if there are differences between novices and experts in respect to deliberate practice and working memory capacity. Meinz and Hambrick (2010) also report that their research results question the notion that expert performance is solely a reflection of deliberate practice; that in their evaluation of novice to expert piano playing, while deliberate practice accounted for a proportion of performance outcomes, there was also a positive effect from the innate working memory capacity.

Whether Deliberate Practice and Acquisition of Expert Performance theory is applied in isolation or not, the main objective is to raise to the consciousness of educators the importance of examining a number of education theories, in the context of using simulation as a change agent. The existence of any or all of the ten education theories - and others - and their potential to provide guidance in any simulation development should promulgate the need for their review, critique and reflection on how they will add educational fidelity to the simulation. The conceptual framework is designed to facilitate that activity. Support for this perspective can be seen in the recent article by Nestel and Bearman (2015) who comment on the role of, provide a number of definitions on, and refer to common and less common education theories in simulation-based education; provide editorial support for other publications that examine specific education theories in simulation; and report favourably on the increasing awareness and application of education and other theories to simulation-based health professional education.

It is important to acknowledge that these ten theories to be considered as a component part of the Conceptual Framework for Simulation in Healthcare Education are not a prescriptive list to follow. Indeed it is the interconnectivity and interweaving of these theories that will best contribute to the development of a conceptual framework. Then it becomes the task of the educator and facilitator to make the relevant theory-practice connections as they begin to design and develop a simulation activity.

That being said, it is important to report that the practice is still continuing by educators, clinicians and researchers to mostly review and apply singular education theories. A number of these have already been cited in the literature and referred to in this report. However, even from a contemporary perspective, Reedy (2015) is reporting on the use of cognitive load theory to inform simulation design and practice. Meanwhile Husebø, O'Regan and Nestel (2015) remind us that reflection is an important learning activity in simulation, and provides an overview of Gibbs's reflective cycle - a theoretical model – and its relevance to the debriefing and reflective aspects of a simulation activity. Kelly and Hager (2015) also report on the application and outcomes of a singular learning theoretical concept – informal learning – that they believe has relevance for health care simulation. Importantly they acknowledge that through informal learning opportunities gained through simulation strategies and activities, that the learners increase their tacit knowledge – an education concept identified as central to the conceptual framework.

Design and delivery attributes of the Conceptual Framework

In considering the design and delivery attributes of the conceptual framework in presenting the education theories in a dynamic process, it was identified that to potentially achieve a wide exposure to and potential use of a conceptual framework, a web-based format would be of benefit. Such an approach would allow any potential users, easy and repeated access to this conceptual framework. I sought permission and received permission (Appendix H) to modify and use an existing web-based framework - the Australian Qualifications Framework (AQF)[22].

The AQF was developed to guide a range of levels and levels criteria of educational complexity in regulated qualifications in Australian education and training, under a single compact framework. The AQF level summaries are testimonials of the expected attainment of graduates who have been conferred a qualification at a particular level in the AQF.

The Conceptual Framework for Simulation in Healthcare Education is presented as a web-based conceptual framework graphic based on AQF spinning wheel mechanism, which has been significantly modified and transformed into the Conceptual Framework for Simulation in Healthcare Education. The copyright of AQF spinning wheel mechanism belongs to the Commonwealth of Australia. Written permission for its use and modification was sought and granted from the Governance, Quality & Access Branch, Higher Education Group, Australian Government Department of Education and Training, under the Creative Commons Attribution 3.0 Australia licence, Commonwealth of Australia ©.

Design: The framework graphic

The Conceptual Framework for Simulation in Healthcare Education graphic (Figures 16,17,18) is designed to bring together in a logical, sequential manner a specific number of

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[22] http://www.aqf.edu.au/aqf/in-detail/aqf-levels/

education theories under an ‘umbrella’ - or as the researcher sees it a ‘web’ - that looks to transparently but effectively cover and guide, while being sensitive to, the changing educational culture and environment, requirements and priorities. Whereas the AQF provides a range of educational standards to be met depending on a series of qualification levels, the Conceptual Framework for Simulation in Healthcare Education offers a series of education theories to be considered in the design of simulation – based education programs. This is further explained in the rationale.

Design rationale

The rationale behind the sequencing process of the rotating Framework is as follows. An underpinning constructivism philosophy guides the conceptual framework model, where, as the user rotates through the sequential numbers from 1 to 10, there is the opportunity to gain from those theories new information, discard information, unpack and reconstruct ideas and knowledge. As a final consequence, the user can finish up with a mix of theoretical elements to consider before and during any curriculum, course and scenario development.

The education theories included in the conceptual framework have all been randomly identified in a significant number of journal publications as being pertinent to simulation-based education but have not been presented under a single compact framework for consideration. The use of the spinning wheel framework approach in simulation education is to emulate that which has been used for the AQF in tertiary education to guide the teaching and learning pedagogy in that domain.

The Conceptual Framework for Simulation in Healthcare Education provides a similar teaching and learning pedagogy experience using a validated and reliable approach in delivering pertinent information to be reviewed, considered and addressed. As the user rotates through the Andragogy, Heutagogy, Tacit Knowledge, Learning Styles, Experiential Learning, Critical Thinking, Reflective Learning, Novice to Expert, Self-efficacy and Expert Performance Theories, and gains an understanding of each theory and its relationship to simulation, choices can be made. By cross referencing these theories individually and collectively with such factors as the discipline and cohort concerned, the demographics of the group, where they are in their learning cycle, the context and complexity of the learning, then the user can determine the best design and delivery approach.

The web-based conceptual framework (web link: Figure 17) allows the user to consider in a very rapid and logical, sequential way the most appropriate educational approach to the simulation intervention. The conceptual framework takes the user, through the theoretical aspects being provided, to a thought-generating, cross-checking process and application activity, that is designed to facilitate the educational fidelity aspect of the simulation. Then if any research is to be undertaken, then the designer and deliverer of the simulation activity can demonstrate and report on how the educational underpinnings were addressed.

The example screenshot of the rotating conceptual framework graphic in Figure 18 is to demonstrate its construction and functionality. This design brings to the attention of the reader and user the underpinning definitions and educational philosophy plus the logical sequence of theories to consider. It also provides an overview of each of the ten theories, which includes a rationale and a templated range of factors to consider when designing, developing, delivering and evaluating simulation – based healthcare education. The following example screenshot of the dropdown graphic in Figure 18 provides the relevant information regarding both the underpinning educational philosophy and each education theory under the following headings:

- Theory;
- Theorist(s) to consider;
- Rationale;
- Considerations.

- 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

Figure 16: Conceptual Framework for Simulation in Healthcare Education

Modified and transformed from the Australian Qualifications Framework (AQF) spinning wheel mechanism.

(Appendix F: Copyright permission)

To observe how this framework functions including seeing a clear image of each dropdown graphic the following quarantined web link is provided:

Web link: http://www.btwebz.com.au/irwyn/framework.htm

Figure 17: Conceptual Framework graphic

On opening the framework there are a number of horizontal banners that provide definitions to:

- Education Theory
- Conceptual framework
- A Conceptual Framework for Simulation in Healthcare Education
- Education Philosophy underpinning the conceptual framework

There is an explanation on how to access each education theory

All of the ten theories present in the same manner for viewing.

There are also links to draft examples of application tools to trigger activities using the framework.

Figure 18 is a screen shot of one of the education elements embedded in the graphic. This screen shot is the graphic of the underpinning educational philosophy of constructivism.

As it is a very long dropdown graphic it is difficult to demonstrate a complete resolution on one page. The following example image has been presented over two pages in this document.

Educational Philosophy underpinning the Conceptual Framework	
Theory	Social constructivism / constructivist learning
Theorist(s) To consider	John Dewey Jean Piaget Lev Vygotsky Jerome Brunner Ernst von Glasersfeld
Rationale	Social philosophy has humans continuingly interacting in a social context. Embedded in that interactivity is knowledge, attitudinal, behavioural and social change, at an individual, collective, cultural, societal and civilisation level. Constructivist theory has individuals as learners discarding, re-aligning or reconstructing 'old' knowledge, attitude and activities as they construct (build) new perceptions, thoughts, ideas, knowledge and actions as a result of an education / learning experience. Embedded in this activity is an individual's review and reflective thought processes that allows the individual to draw new conclusions, attach new meaning, understanding, memories and applications. New mental models are formed (constructed). New activities and outcomes occur. Educationally constructivist learning can occur while under instruction, through facilitation, in a collaborative or independently. This connects strongly with education and practice scaffolding strategies and techniques. Constructivism provides a sound educational foundation for other education theories to build on and relate to. Constructivist learning resinates strongly with simulation, given simulation - as an education and learning method - provides opportunities for both deconstructing - reconstructing previous perspectives and practices, and/or the constructing of new viewpoints and practices. Simulation thus is a constructivist-based teaching and learning change agent.

Considerations	When developing a curriculum, course, tutorial, workshop, scenario, learning objectives/outcomes where simulation will be embedded and integral to the educational process: Consider: • How and what constructivism principles and constructivist learning will guide these developments? • What foundational factors are important to review and consider? (this links to other education theories) • Where will constructivist learning be of benefit? • When will constructivist learning be of benefit? Consider constructivist learning and where it intersects with: • The curriculum; • The teacher / instructor / facilitator / technician; • The individual learner's learning style and characteristics (see conceptual framework theory); • Groups of learners; • Andragogy (see conceptual framework theory); • Heutagogy (see conceptual framework theory); • Tacit knowledge (see conceptual framework theory); • Education taxonomies and simulation; • Identified learning objectives and outcomes; • Situated learning; • Contextual learning; • Scaffolded learning; • Experiential learning (see conceptual framework theory); • Critical thinking (see conceptual framework theory) • Clinical reasoning; • Clinical judgment; • Feedback and debriefing (see conceptual framework theory); • Reflective learning (see conceptual framework theory); • Competency attainment (see conceptual framework theory); • Self-efficacy (see conceptual framework theory); • Expert practice (see conceptual framework theory) • Complexity (in learning and environment); • Authenticity (in learning and environment); • Fidelity (in learning and environment); • Resources (educational, human, technical, infrastructure).

Figure 18: Conceptual Framework for Simulation in Healthcare Education

Phase three

The final set of data emanating from this research is the experts' responses by modified Delphi Technique to the draft conceptual framework.

The following data is from the set of questions and answer boxes provided in the Delphi Technique questionnaire (Appendix B). The participants were informed that this questionnaire may well be used multiple times during the Delphi Activity depending on the responses. Ultimately only one cycle was required with the Delphi process based on the feedback from the first response. Clarification on minor details was by email.

As the returned questionnaires were received they were given a numerical code to de-identify the respondents. The six (6) returned questionnaires were coded R1 to R6. The answers provided were then placed in their appropriate answer box. Where quantitative data was collected that is presented in numerical and percentage format. I did not need to apply further statistical analysis. In the open-ended question sections the complete responses are provided to demonstrate to the reader the diversity in interpretation to the questions. Please note that R2 did not offer any comments. Thematic analyses of the other collective comments have been attempted to generate further evidence supportive of the development of the Conceptual Frameworkfor Simulation in Healthcare Education.

Participants were first asked:

Q.1: *After reading the rationale provided to you regarding this conceptual framework, please indicate to what degree you consider this framework has face validity?*

Level	**Number**	**%**
High	n: 1	16.667
Medium	n: 5	83.333
Low		
None		

While 16.7% indicated that the conceptual framework had a high degree of face validity, 83.3% indicated that the conceptual framework had a medium degree of face validity. This is considered to be an acceptable level of face validity.

Participants were then asked to also provide any comments and recommendations.

Comments from:

R3: This is a very good piece of work bringing together great concepts but I believe the rationale should expand on the theories considered and on what basis they were selected, and why others were not. Was there some form of inclusion criteria?

R4: After reading the rationale I have a more comprehensive understanding of the underpinning reasons for the development of an educational framework. I think that the rationale requires a greater level of reporting on data from the questionnaires to put in context where the data set has come from. I am unsure if there were 100 organisations or 10 involved in the process and if there were multiple respondents from each organisation. In addition, demographics in regards to discipline and type of organisation are even at this point important to give context to the rationale.

R5: One of the assumptions of the framework as presented is a focus on the individual learners rather than a focus on the development of a systems thinker in different contexts. This is the basis of human factors science which I think need to be incorporated into the framework as a specific spoke. There is a concern that you are re-writing a text book. The most useful aspect I found was the considerations for application of theory to simulation in each segment.

R6: The issue really is that the conceptual framework is so expansive and covers so many theories that on the one hand, how could you ever say it did not have face validity of some sort? On the other hand, because it encompasses most of the predominant educational theories it is impossible to drill down to a useable framework for simulation, so validity is difficult to defend. I understand this problem intimately. When I was developing my method of debriefing, I too, felt the need to underpin my work with most of these same theories. As a result, I get quite a bit of critique for that point.

Researcher Response:

The inclusion criteria were based on the level of recurring evidence in the literature where the educators and researchers in simulation community have been identifying these theories. That the background demographics were not required in efforts to ensure the information was blinded to those data. The initial information being sought was essentially a ‘snapshot’. Human factors science is important but it is not an education theory. The conceptual framework is designed to ensure that in the design stage context issues such as human factors is considered and addressed. As far as the response to the expansiveness its construct is to guide people to one, a combination or all of the dominant theories. Application tools will be provided to trigger that process.

Participants were then asked:

Q.2: *Please indicate to what degree you consider this framework has overall content validity?*

Level	Number	%
High	n = 1	33.333
Medium	n = 4	66.667
Low		
None		

While 33.3 % indicated that the conceptual framework had a high degree of content validity, 66.7% indicated that the conceptual framework had a medium degree of content validity. This is considered to be an acceptable level of content validity.

Participants were then asked:

Q.2.1: *Please indicate to what degree you consider the underpinning philosophical education theory of this framework has content validity?*

Level	Number	%
High	n = 3	50.00
Medium	n = 3	50.00
Low		
None		

While 50.0% indicated that the underpinning philosophical education theory of this framework had a high degree of face validity, 50.0% indicated that the underpinning philosophical education theory of this framework had a medium degree of face validity. Given the varied understanding about constructivism and where it sits with simulation, this is considered to be an acceptable level of content validity regarding this underpinning philosophical education theory.

Participants were then asked to also provide any comments and recommendations.

Comments from:

R3: The content and face validity of the framework are directly linked I believe. I think the framework would be stronger if its construct into 10 subdomains was explained.

R4: As discussed I think that the use of the terms validity mislead the reader somewhat as for me they grounded in the assessment world. In regards to whether the content is appropriate I think that as a whole the content for educational theory is sound. One area the needs more clarification and should be explicit is how they are practically being applied to clinical education and simulation. The "considerations" needs to be expanded upon and perhaps an additional section on practical applications could describe how the theory is being utilised.

R5: What this framework highlights is that simulation is a method for learning which can be adapted through the use of underpinning theory to maximise learning but is dependent on the learning outcomes identified. The framework also highlights the layers of complexity in analysing applying and synthesising the appropriate or leading educational theory which links to the specific learning outcomes that simulation can support.

R6: I put "medium" for overall content validity because the definitions and explanations of the various aspects of the framework do not appear complete or expansive enough to include all of the components seen in the simulation literature today when these very theories are explicated or described.

Researcher Response:

There was an explanation provided regarding the construct of the conceptual framework. The respondents were not made aware that the design was modelled on another framework. The choice of the format was based on the researcher's conviction that the format had already been validated within mainstream education. However there is good argument that further explanation of the sequencing might well be of value. There were examples of application tools provided within the model to demonstrate how the conceptual is contextualised. The number of considerations was considered expansive enough by the researcher to act as a trigger for other considerations by others to be thought of. Again it demonstrated the dilemma in how much information and in what format is required to act as a catalyst for guided applications and even for innovation.

Participants were then asked:

Q.3.0: *Please indicate to what degree you consider this framework has overall construct validity?*

Level	Number	%
High	n = 1	16.667
Medium	n = 5	83.333
Low		
None		

While 16.7% indicated that the conceptual framework had a high degree of construct validity, 83.3% indicated that the conceptual framework had a medium degree of construct validity. This is considered to be an acceptable level of construct validity.

Participants were then asked to also provide any comments and recommendations.

Comments from:

R3: See response to question 1.

R4: In regards to whether the framework provides an overall inference for the purpose, I think that the framework offers a range of theories and their application to simulation based education. Perhaps a broader statement or underpinning explanation that possibly no one theory alone underpins simulation but a combination of theories applied to various contexts and at a range of times would assist this.

R5: I am taking the meaning of construct validity in this context to provide an expert opinion on how the framework measures up to its claims. The main purpose of the framework from my perspective in terms of how I would use it would be to enable me to check whether I had constructively aligned my LOs with my educational theoretical underpinning with my simulation based learning activity and my debriefing and feedback so I could continuously enhance my practice as an educator. The power of the framework to me is through the exemplars with links to educational theory.

R6: This is challenging to answer. I am most familiar with construct validity being determined by statistical analyses based on the findings using an instrument to test this type of validity. I am also familiar with a construct being a skill, attribute or ability based on theoretical underpinnings. I can however make a leap (whether or not it is what you intended) to identifying the constructs of Learning, Reflecting, Debriefing and Practice in the theories that you present. Clearly you make the strongest case for constructivism to underpin simulation—likely because it is often considered an umbrella term or overarching theoretical framework. Given that all of these are clearly evident and relevant, I could support the idea (albeit without data) that there is construct validity. I have trouble however differentiating it from face validity without data. Note: All of my subsequent answers about the different theories come from this same perspective.

Researcher Response:

The recommendation to provide an explanation that possibly no one theory alone underpins simulation but a combination of theories will be included in future modelling. While the application tools were designed to facilitate this process it will be important to guide users to think through their individual needs. There is also coming through thematically that the use of the various validity approaches has generated discourse and differing opinions. The use of qualitative terms of transferability, credibility, dependability, and confirmability within the context of the questionnaire is another approach to consider.

Participants were then asked:

Q.3.1: *Please indicate to what degree you consider Theory 1 of this framework has construct validity?*

Level	Number	%
High	n =4	66.667
Medium	n = 2	33.333
Low		
None		

While 33.3% indicated that Theory 1 had a medium degree of construct validity, 66.7% indicated that Theory 1 had a high degree of construct validity. This is considered to be an acceptable level of construct validity.

Participants were then asked to also provide any comments and recommendations.

Comments from:

R1: I believe healthcare education needs to move out of the pedagogical model and into andragogy! Too much of our research is based on pedagogy. Thus this is a good model!

R3: Clear, concise, yet fairly comprehensive. I would recommend a review of the punctuation for serial commas, and a few missing "'s "in several places.

R4: Theory 1 provides and solid overview of adult learning theory and the theorist involved. A section including the principles of adult learning (9 principles) would be useful and perhaps a link between these principles and how they are applied in the clinical education context.

R5: I think it would be more useful to present as concrete teaching example using simulation and then to explain aligning theory rather than as presented. You could use the same scenario with different learning outcomes and different educational theory to demonstrate alignment.

Researcher Response:

These responses were all seen as positive. Editorial work aside the additions identified will be considered within the context of an application tool.

Participants were then asked:

Q.3.2: *Please indicate to what degree you consider Theory 2 of this framework has construct validity?*

Level	Number	%
High	n = 1	16.666
Medium	n = 4	66.667
Low	n = 1	16.666
None		

While 16.7% indicated that the conceptual framework had a high degree of construct validity, 66.6% indicated that the conceptual framework had a medium degree of construct validity. A further one respondent (16.6%) rated this theory as low. While this is considered by the researcher to be still an acceptable level of construct validity it is important to acknowledge that the introduction of an education theory designed to address learning with new technologies and emerging new learner characteristics will face further scrutiny. However the researcher believes this area is an increasing challenge that needs to be considered.

Participants were then asked to also provide any comments and recommendations.

Comments from:

R1: Generally speaking this is a good adult model that should be used in medical school where a self-motivated learner can progress ahead no matter what year they are in. For the less motivated learner this could be a problem. I am seeing medical students who are not watching their skills training videos prior to coming to the simulation center.

R3: Well researched.

R4: This theory could possibly be later down the list as explained in your text is one of the more recent pieces of work and aims to fill the gaps identified by other theories. Its nature of self-direction works well with simulation but possibly needs more emphasis on the problem solving nature of the theory.

R5: Different theories have different limitations and strengths but need to be analysed in context. See above for suggested ease of use.

R6: I have the most trouble with this one. In learning environments where simulation is used I rarely (if ever) see the educator fully relinquishing ownership of learning to learners who then negotiate learning and determine what is learned and when. I don't know how this can.

Researcher Response:

While there are some positive comments the over-riding perception is there is a level of scepticism. Once again the conceptual framework itself is a trigger process and the consideration, application and use of these theories will be further processed through the application tools.

Participants were then asked:

Q.3.3: *Please indicate to what degree you consider Theory 3 of this framework has construct validity?*

Level	Number	%
High	n = 2	33.333
Medium	n = 3	50.00
Low	n = 1	16.667
None		

For such a pivotal education theory which is not at all addressed well in the healthcare simulation literature but is elsewhere such as in emergency services, this response requires further scrutiny.

In this response 33.3% indicated that Theory 3 had a high degree of construct validity, 50.0% indicated that Theory 3 had a medium degree of construct validity and a further one respondent (16.6%) rated this theory as low. While this is considered by the researcher to be still an acceptable level of construct validity, albeit challenging, it is important to acknowledge that the introduction of an education theory designed to address background understanding will face further scrutiny. However this underdeveloped area requires consideration – hence its inclusion early in the tool.

Participants were then asked to also provide any comments and recommendations.

Comments from:

R1: Scored this low as it is a good model but for faculty to try to develop a curriculum around each learner's knowledge base (if I understand this correctly) would be a nightmare. The adult learner intrinsically comes with all that so why work at calling it a specific theory?

R3: I would recommend a review of the punctuation for serial commas.

R4: The work of Polanyi first started in 1958 with the work on personal knowledge. Your rationale for tacit knowledge reads far too closely to what the rationale for constructivism would. Including comments around how the individuals are not often aware of the knowledge they possess or how it may be of importance to others. Perhaps a more common explanation as to the interaction of tacit knowledge with performing a task would assist the reader.

R5: Depending on the complexity of the scenario and the expertise of the learners it may be that several theories underpin a specific learning event and therefore the use of the different dimensions of expertise and deliberate practice may influence which is the most appropriate theoretical application for the outcomes identified.

Researcher Response:

Positive comments about this theory are not in abundance. Once again it is important to remember the conceptual framework itself is a trigger process and the consideration, application and use of these theories will be further processed through the application tools. The conceptual framework is there to raise to the consciousness of the user the various theories and their potential to guide and influence the simulation activity – or not.

Participants were then asked:

Q.3.4: *Please indicate to what degree you consider Theory 4 of this framework has construct validity?*

Level	Number	%
High	n = 2	33.333
Medium	n = 2	33.333
Low	n = 2	33.333
None		

There is considerable referral to this theory and its variables in the healthcare simulation literature. Plus it is a component of other education theories included in this conceptual framework. So the spread of responses across the three levels is of interest as this response does not correlate with subsequent comments. Thus there remains an imperative to seek out ways to address the variation in simulation participants' learning styles / characteristics / preferences to ensure these are adequately catered for during course development and delivery.

Participants were then asked to also provide any comments and recommendations.

Comments from:

R1: Definitely need to consider this theoretical framework when building learning sessions. Without some sort of inclusion in faculty's curriculum development you may see those you cannot retain the material presented.

R3: Very closely linked with your first and fifth domains. This makes me wonder if you should have had 9 rather than 10 domains by merging some of them or on the contrary unpacking other domains (1) into several ones.

R4: This provides a good overview of learning style theory. It would be important to more explicitly acknowledge that although individuals have a preference for the way they learn we are able to learn in all of the various domains but prefer one more than the other. Hence you may be more of a visual that auditory but can still learn in the auditory. An indication as to why this is important in simulation based education needs to be well developed and again more information provided as to the practicalities of this.

R5: Simulation based learning usually involves participation so learning styles may not have strong construct validity.

R6: Learning styles has come under such intense critique as the field of cognitive neuroscience continues to expand. The validity of this framework is doubtful over time. I don't know how this can be defended empirically or subjectively and the threats to this validity are apparent.

Researcher Response:

These responses would appear to bely the evidence that surrounds and supports the need to cater for learning styles / preferences / characteristics. The changing nature of the learning environment and the increasing numbers of technology- oriented learners with their propensity to learn via multiple technologies this theory still needs to be considered even if requiring contextualising.

Participants were then asked:

Q.3.5: *Please indicate to what degree you consider Theory 5 of this framework has construct validity?*

Level	Number	%
High	n = 4	66.666
Medium	n = 1	16.667
Low	n = 1	16.667
None		

66.6% indicated that Theory 5 had a high degree of construct validity and16.7% indicated that Theory 5 had a medium degree of construct validity. This is considered to be an acceptable level of construct validity. This is despite one respondent (16.7%) rating this theory as low. Experiential Learning was the education theory that rated the highest mention in Phase One, Activity 1: Literature Review (Table 9).

Participants were then asked to also provide any comments and recommendations.

Comments from:

R1: This theory sums up the whole enchilada! This addresses the What's In It For Me-WIIFM.

R4: This, along with reflective learning, has been one of the theories that those working in simulation have used to base their teaching on. I think that more consideration needs to be placed on its application to the simulation based education environment. As well as providing a theory and areas for considerations you need to justify why it is of consequence in clinical education and how it has been used successfully thus far.

R5: Depending on the learning outcomes many clinically based simulation learning events for senior students and postgraduate learners involves experiential learning as they have the capability of comparing it to the realities of their own norms of practice while less experienced students sometimes find experiential learning more challenging. There is more opportunity of changing frames of reference (Gauffman) using experiential learning in simulation with more experienced practitioners.

R6: I think this is where it all starts to get murky for me. For instance Situated Cognition runs counter to theories of tacit knowledge. So you can't espouse them all within the framework of simulation without dealing with that. I don't know how this can be defended empirically or subjectively and the threats to this validity are apparent.

Researcher Response:

While there are positive comments about this theory and supportive of its role it appears that some respondents believe further considerations are required. These considerations can be addressed via the application process. It is important to reiterate here the conceptual framework is primarily designed to bring to the surface challenges for the user to consider theories and their potential to guide and influence the simulation activity – or not.

Participants were then asked:

Q.3.6: *Please indicate to what degree you consider Theory 6 of this framework has construct validity?*

Level	Number	%
High	n = 3	50.00
Medium	n = 3	50.00
Low		
None		

Given 50.0% indicated that Theory 6 had a high degree of construct validity and50.0% indicated that Theory 6 had a medium degree of construct validity. This is considered by the researcher to be an acceptable level of construct validity.

Participants were then asked to also provide any comments and recommendations.

Comments from:

R1: This is another common thread that subconsciously should be being used.

R4: This provides a comprehensive explanation of the theory. There should be a summary of Shabans theory as it mentions the work but does not go into any depth as to why you have listed it.

R5: There are so many models of clinical reasoning and critical thinking there needs to be clarity in using these theories in simulation based education in terms of what kind of thinking is being explored. Using think aloud techniques as part of the debrief /feedback can give some insight into pattern recognition, rule based thinking, option appraisal or creative thinking.

R6: I understand what you did in this theory category (combining critical thinking, clinical judgment and clinical reasoning) but I strongly object to it because instead of providing clarity between the concepts you further muddy the understanding by relating them together under one category. What you seem to be missing is the cognitive and decision-making theories that contribute to the differentiation between critical thinking, clinical judgment and clinical reasoning. All that said, this is a framework that does have instruments (although limited in scope and specificity) and can be tested empirically within the simulation environment.

Researcher Response:

The feedback from R5 is an excellent extension of thought and potential for use, triggered by the generic education theory. The comments by R6 while valid are not acknowledging those cognitive and decision-making concepts that demonstrate levels of interconnectivity to each other of these theories.

Participants were then asked:

Q.3.7: *Please indicate to what degree you consider Theory 7 of this framework has construct validity?*

Level	Number	%
High	n = 4	66.666
Medium	n = 2	33.334
Low		
None		

Given 66.7% indicated that Theory 7 had a high degree of construct validity and33.3% indicated that Theory 7 had a medium degree of construct validity this is considered by the researcher to be an acceptable level of construct validity.

Participants were then asked to also provide any comments and recommendations.

Comments from:

R1: This also is an important theory to include which is similar to Schoen's work.

R3: This one would benefit from greater exploration of current simulation debriefing literature from greater acceptance of the framework from the simulation community.

R4: This is one of the more comprehensive theories thus far. I particularly like the application of this theory to the debriefing process which clinical educators would see a useful. This is the type of connection to simulation that needs to be in other theories and will increase the level of acceptance by educators.

R5: One of the strengths of simulation based education is the time it provides for deliberate practice and rehearsal of thinking in a safe non-threatening environment. Thinking space or reflection can enable new or adapted practices to be considered and a commitment to action through both reflection in action and on action using video debrief.

R6: First, I am surprized you are missing Meizerow and Johns here and that you included Rodgers. I am also surprised that in your Reflection variables you did not include Reflection-Beyond-Action which is attributed to me (2009) since it is cited now so frequently in nursing simulation literature. I also must respectfully suggest you include some of the more recent citations of my DML work rather than the one you chose (obviously I know this the best so I can point it out). DML was the debriefing method in the National Simulation Study. There are a number of citations to choose from—written by me and by others. Clearly though this reflection is the framework that has underpinned most of the empirical work in simulation to date so in my mind construct validity fits without a reach.

Researcher Response:

These responses were all of benefit and their support overall of this theory is positive. I responded to the comments of R6 and have included some later publications into the body of the thesis. When reviewing and completing the final build of the conceptual framework I will be including these into the web-based version.
Participants were then asked:

Q.3.8: *Please indicate to what degree you consider Theory 8 of this framework has construct validity?*

Level	Number	%
High	n = 2	33.333
Medium	n = 2	33.333
Low	n = 1	16.667
None	n = 1	16.667

The response to this particular theory appeared inconsistent to the considerable level that this theory is reported in the healthcare simulation literature. The spread of responses with 33.3% indicated that Theory 8 had a high degree of construct validity, 33.3% indicated that Theory 8 had a medium degree of construct validity however two respondents provided a low to none response meant that this Theory could not be considered by the researcher to be an acceptable level of construct validity. This is further explored in the response to comments.

Participants were then asked to also provide any comments and recommendations.

Comments from:

R1: I think rating learning on a competency scale meets someone's need to allow someone to work! Competency (especially on the lower levels of Dreyfus' theory) is just snapshots in time! Just because a learner can mimic a specific skill for the assessment does not even make them a novice. It should be more about retention and how the environment of how we train. Make the learning experience enjoyable and taught to a learners abilities makes more sense.

R4: I am not sure of the introduction of Miller's pyramid of assessing competence. This is used to assess the level of expertise based on novice, expert, master etc. I am also unsure of this as a theory. I think that this is more of a tool used to assess the level of competence rather than an educational theory.

R5: The framework would benefit from having a systematic review of technical and non-technical skills development using learning outcomes which built and progressed layers of complexity into each scenario building up from skill to patient to context to organisational culture aligning theories to the learning outcomes for each stage evidencing the standards required.
*R6: I got confused here by the statement "**Note:** It is important to note here in this framework that intersects with and has connectivity with all the previous education theories covered in the framework: Andragogy; Heutagogy; Tacit Knowledge; Learning Styles; Experiential Learning Theory; Critical Thinking Theory; and Reflective Learning Theory. Novice to Expert Theory requires these other theories to be underpinning and addressing educational activities so that learners are in the right 'situation' to benefit ."*
I would strongly disagree. I think you have skill acquisition and skill application confused. The former, attributed most closely to Dreyfus and Dreyfus is the learning (acquisition) of the steps necessary to perform the skill. The later includes all of the previous education learning theories you covered. The later in context also provides the environment for competence which is of course contextually dependent. It could be argued that some use simulation for the former but it should be reserved for the later but that is a different argument for a different dissertation. For your purposes however I strongly urge you to unpack this piece. I would also ask you to think carefully about where skill application and constructivist theory intercept and how you might work to keep them cleanly separate. This is the most problematic area of your work in my mind.

Researcher Response:

Consideration was given to modify this particular theory but when re-reading the literature and reporting on it there is plain demonstration that there are a myriad of understandings and perceptions of where the overall Novice to Expert Theory fits. The central tenet of the theory in this model is to trigger thought, discussion and use when deciding on when and where the participant is, on the knowledge and skill acquisition, application and practice, competence attainment and expert practice spectrum. This includes whether it is technical and non-technical skills oriented, the context and the participant themselves. While acknowledging and being respectful of their views - unlike the respondents who suggest the researcher provide the unpacking process - the researcher believes it is the responsibility of the end user; the educator, facilitator, curriculum developer, to first review the theory then work through this process – using an appropriate development analysis tool.

Participants were then asked:

Q.3.9: *Please indicate to what degree you consider Theory 9 of this framework has construct validity?*

Level	Number	%
High	n = 2	33.333
Medium		
Low	n = 3	50.000
None	n = 1	16.667

This theory is identified considerably in the healthcare simulation literature and this has been reported in the study. However only 33.3% indicated that Theory 9 had a high degree of construct validity, there were no responses at the medium level, 50.0% indicated that Theory 9 only had a low degree of construct validity, and one respondent did not provide a response. This meant that this theory could not be considered to be an acceptable level of construct validity. This is further explored in the response to comments.

Participants were then asked to also provide any comments and recommendations.

Comments from:

R1: Not sure how the educator could address these behavioural characteristics if a person does not come to the learning environment without the positive outlooks. It depends on each person's ability to work through their own garbage to want to learn.

R3: Need to define what is referred to as high-fidelity simulation as it is often interpreted differently by different people. Exploring further the idea of fidelity and what is required in terms of self-efficacy in a reliable and valid way.

R4: I think many clinical educators will struggle to ever view this as an educational theory. It is more often than not considered a factor or barrier to learning. I don't personally feel that it needs to be listed as a stand-alone theory in the context of simulation based education.

R5: Self-efficacy has more evidence of use in the nursing curriculum. One of the challenges of simulation based education is that it may be the last bastion of teacher centred practice particularly for novice practitioners so it is difficult to have control over your own motivation over behaviours and belief in one's ability. One of the requirements of professional practice is not only self-efficacy but the need to be able to monitor one's own practice and simulation based education can enable students to gather a portfolio of evidence of the ability to perform in different scenarios.

R6: So this is my bias—since self-efficacy can really only be measured by self-report it inherently has too little validity to be relevant (See Darrell Spurlock's work). I wouldn't include it at all in your work despite the fact that it is so commonly measured and reported. It provides so little value to the discipline and by including it you inadvertently give credibility where it really is not due.

Researcher Response:

While there may be levels of complexity in how to identify and measure this psychological dimension that does not mean it should not be considered. Designing and delivering simulations without being cognizant of how self-efficacy can impact on learning means that a significant confounder is not acknowledged and addressed. While this domain is challenging being knowledgeable about it and considering its potential influence remains necessary. It may well be that through the use of other education theories underpinning and guiding design, development, delivery and evaluation, the potential for self-efficacy to be a positive, measureable outcome is enhanced.

Participants were then asked:

Q.3.10: *Please indicate to what degree you consider Theory 10 of this framework has construct validity?*

Level	Number	%
High	n = 3	50.00
Medium	n = 3	50.00
Low		
None		

Given 50.0% indicated that Theory 10 had a high degree of construct validity and 50.0% indicated that Theory 10 had a medium degree of construct validity, this is considered by the researcher to be an acceptable level of construct validity.

Participants were then asked to also provide any comments and recommendations.

Comments from:

R1: This is important, but it should be foundational that PERFECT practice makes perfect and that can not necessarily happen if faculty send the learner to the simulation center without a qualified mentor to ensure they are practicing correctly.

R3: Closely linked to other domains… See earlier comment. Why does it need to be separated?

R4: This theory related well to simulation based education and perhaps should have it in the section on novice to expert. There has been quite a lot of work using simulation with this and is easy for clinical educators to make the connection. It is fairly well set out and clear. Again more concrete examples of how this relates to sim would be useful. More practical examples.

R5: Deliberate practice and the development of expertise are I think different dimensions when considering the alignment of LO with a simulation based activity and underpinning educational theory as the theory aligns not to the individual but to the SBE whereas deliberate practice and expertise align to the learner. There is a link between them all but focus is different.

R6: So the initial commentary on this theory completely disengaged me but then the graph made good sense, especially when simulation is used for continuing education and for healthcare professionals in practice. Then you lost me again with this section: "With that in mind it becomes obligatory to reflect also on where Deliberate Practice and Acquisition of Expert Performance intersects with and relates to the other education theories covered in the framework". I don't think you need to muddy it all up with this inter-woven part because that makes validity almost impossible and inter-rater reliability in this section as daunting.
The only way this theory works for me is in the context of building skill acquisition and skill application with expertise such as a continuing education model. Otherwise I would give it a flat out NONE

Researcher Response:

These responses proved interesting as a number of experts provide a range of different perspectives and views especially around the theoretical basis for a subject or area where they are experts in. They bring to the discussion their opinions and recommendations based on their journey – and that can be of extreme value. Beyond the discussion this theory needs to be included in the mix and should be considered in the development of simulations – based on the context.

Participants were then asked:

Q.4.0: *Please indicate to what degree you consider this framework has potential inter-rater reliability?*

Level	Number	%
High	n = 1	20.00
Medium	n = 2	40.00
Low		
None	n = 2	40.00

Only five respondents answered this question and the following two, which changed the response rate. Nevertheless the spread of responses, with 20.0% indicating a high degree of potential inter-rater reliability and 40.0% indicating a medium degree of potential inter-rater reliability still provided a valuable outcome. The 40.0% indicating no degree of potential inter-rater reliability was disconcerting but not unexpected. Further comment is made after the respondents' comments.

Participants were then asked to also provide any comments and recommendations.

Comments from:

R1: If you plan to include all 10 of these theories into one for simulation I believe you will create a huge tool that will be hard to manage. Overall I think it would be hard as we all have our own pet theories which would influence our scoring even with rater training. This is part of life.

R3: There is no assessment scheme provided… without any scheme or scale, there cannot be any way of achieving inter-rater reliability. Even if something was worked out, I think it would be difficult to achieve good inter-rater reliability.

R4: Not sure how this would occur. Can inter rater reliability be applied in the area of identifying educational theories and how they can be used in simulation based education. Scores are not given in this area hence no need for inter rater reliability. I may be missing something though? I am not sure if others were to rate the framework as I have whether similar results would be found as there are no behaviour markers to indicate each of the three points on the scale.

R5: I would not be using this as an assessment tool so I am unsure as to why this would be relevant. The framework should be sued to enhance the performance of educators using simulation so would want the philosophy of framework to be one of continuous improvement maybe I have missed the point – Apologies if so.

R6: It all depends on what you do with the confusing areas I mention in the questions above. Ultimately there is few ways to test each of these within simulation pedagogy so that limits the ability to even collect inter-rater data much less establish reliability.

Researcher Response:

These responses demonstrated to the researcher the difficulty and complexity in even considering this level of reliability evaluation at this point in time. That is because inter-rater reliability and the various types of validity can only be formally tested when the model is implemented, post-doctoral.

Participants were then asked:

Q.4.1: *Please indicate to what degree you consider this framework has potential test-retest reliability?*

Level	Number	%
High		
Medium	n = 2	40.00
Low	n = 2	40.00
None	n = 1	20.00

The response to this question appears to be in keeping with the previous question. However with this question the spread of responses is somewhat challenging with 40.0% indicating a medium degree of potential test-retestreliability and 40.0% indicating a low degree of potential test-retest reliability. 20.0% indicated no degree of potential test-retest reliability. Further comment is made after the respondents' comments.

Participants were then asked to also provide any comments and recommendations.

Comments from:

R1: It would be possible but depending on the faculty reliability level it might not provide a standard picture in this environment.

R3: See comment above.

R4: Not sure what you are asking as I don't see this as a test and re test type of activity.

R5: In what way does the framework need to have test retest capability? The educational and psychological measurement group in USA in 1999 identified 5 areas for a validity framework which includes content, response processes , internal structure, response to variables and consequences. However you may want to use this framework for QA process and external validation of SB programmes or educators. I would pilot the finalised tool to establish this.

R6: Given the paucity of instruments available today there is little to no chance of this however, your work only adds to the need for valid and reliable instruments to be developed for simulation.

Researcher Response:

Once again these responses demonstrated to the researcher the difficulty and complexity in even considering this level of reliability evaluation at this point in time.

Participants were then asked:

Q.4.2: *Please indicate to what degree you consider this framework has internal consistency?*

Level	Number	%
High	n = 2	40.00
Medium		
Low	n = 2	40.00
None	n = 1	20.00

The response to this question appears to be in keeping with the previous questions. However with this question the spread of responses was 40.0% indicating a high degree of internal consistency, there were no respondents for medium, 40.0% indicated a low degree of internal consistency and 20.0% indicating no degree of internal consistency. Further comment is made after the respondents' comments.

Participants were then asked to also provide any comments and recommendations.

Comments from:

R3: I can't figure this one out.

R4: As above

R5: You may need a further Delphi around standard statements related to educational theory alignment to determine internal consistency

R6: Everything you did is consistent and true to the literature (and my own journey down this rabbit hole). The holes in your framework are not unique to you but rather represent the holes that the discipline has faced not only in simulation but also in clinical education frameworks. This represents a significant contribution to the literature however and I urge you to struggle through the sticky parts more—you may find the true north that has eluded so many before you!

Researcher Response:

Once again these responses demonstrated to the researcher the difficulty and complexity in contemplating this level of evaluation. The comments from R6 which appear to at least in part support the notion the conceptual framework has some degree of internal consistency.

Participants were then asked to offer further comment. The following were provided*:*

Comments from:

R1: A very interesting and well put together study. Thank you for allowing me to participate! Best to you! Please share your findings when completed.

R3: Interesting and valuable summary of learning theories.

R4: I am curious as to whether there is a reason as to why the theories are numbered 1-10 and how did they end up in that order. Is number 1 considered to be more important? Should numbers be done away with? I would also like a list of references for further reading for those interested in the area or a particular theory.

R6: Thanks for the opportunity to be a part of this work Irwyn. It was good for me to re-visit these concepts and check what has happened in the literature since I did this work in 2008-2009. Grappling with these abstract concepts in a concrete mindset is challenging but so relevant to today's educational environment—particularly in the US where we continue to be outcomes focused with an eye on measurement. This is outstanding work!

Researcher Response:

These are positive comments to the researcher as the experts appeared to ultimately demonstrate support for the study.

This was the end of the questionnaire.

Evaluation of Delphi technique data

Given this was a critique of the different elements to the conceptual framework the following table (Table 22) represents the collated responses of participants to demonstrate overall how the conceptual framework was viewed by the participants of the Delphi Technique.

Question	Area of Evaluation	Type of Evaluation	Degree of Evaluation	%			
				H	M	L	N
Q.1	Framework	Face validity	Medium to high	16.7	83.3		
Q.2	Framework	Content validity	Medium to high	33.3	66.7		
Q.2.1	Philosophy Theory	Content validity	Medium to high	50.0	50.0		
Q.3	Framework	Construct validity	Medium to high	16.7	83.3		
Q.3.1	Theory 1	Construct validity	High to medium	66.7	33.3		
Q.3.2	Theory 2	Construct validity	Medium	16.7	66.6	16.7	
Q.3.3	Theory 3	Construct validity	Medium to high	33.3	50.0	16.7	
Q.3.4	Theory 4	Construct validity	Medium	33.3	33.3	33.3	
Q.3.5	Theory 5	Construct validity	High to medium	66.6	16.7	16.7	
Q.3.6	Theory 6	Construct validity	Medium to high	50.0	50.0		
Q.3.7	Theory 7	Construct validity	High to medium	66.7	33.3		
Q.3.8	Theory 8	Construct validity	Medium to low	33.3	33.3	16.7	16.7
Q.3.9	Theory 9	Construct validity	Low	33.3		50.0	16.7
Q.3.10	Theory 10	Construct validity	High to medium	50.0	50.0		
Q.4	Framework	Inter-rater reliability	Medium	20.0	40.0		40.0
Q.4.1	Framework	Test - retest	Medium to low		40.0	40.0	20.0
Q.4.2	Framework	Internal consistency	Medium	40.0		40.0	20.0
			Raw score (n =19)	626.6	729.8	213.4	113.4
			Mean (n = 19)	32.97	38.41	11.23	5.96
			Mean of respondents evaluation (n = 6)	5.5	6.4	1.9	0.99

Table 22: Collated responses of participants

The total mean scores and the mean scores of the respondents demonstrate an overall Medium to High levels of appraisal of the Conceptual Framework for Simulation in Healthcare Education. The researcher believes these data provide strong confirmation for the design and intent of the Conceptual Framework for Simulation in Healthcare Education.

Conclusion

In this chapter the collective evidence from the various data sources has been presented and interpretations of the findings have been discussed. The information provided from the literature review on simulation, the information generated around the education theories, the accumulative data from the literature review on conceptual frameworks, the questionnaire circulated to the simulation centres and the questionnaire circulated to the experts using a modified Delphi Technique has confirmed the need for and development of a Conceptual Framework for Simulation in Healthcare Education.

The Conceptual Framework for Simulation in Healthcare Education is the end-product of the distillation and application of this collective information. Based on these collective data the information demonstrated and reinforced the rationale for and validation of the research activity.

It is important to acknowledge here that the conceptual framework is also a tool that guides the user towards increasing educational fidelity through the review of the most appropriate theories in the course of developing a simulation-based activity. The intent of the tool is to facilitate a heuristic-oriented approach by asking the user to consider each theory through the heuristic of: How? What? When? Where? Why? In that way the user is guided to consider those education theories from a range of perspectives, pertinent to the theory and practice being considered for the use of simulation.

In Chapter 6 the conclusions of the study will be acknowledged as will be the limitations of the study. Subsequent recommendations regarding further refinement and implementation of the Conceptual Framework for Simulation in Healthcare Education and further research will be discussed. Finally a thesis summary will be provided.

Chapter 6

Conclusion

Introduction

The intent of this study was an exploration of the development of a Conceptual Framework for Simulation in Healthcare Education that would establish a framework for simulation education activity. The study was about the development and provision of an educational tool and process for educators to extract a clearer, more precise set of information to guide simulation intervention development, delivery, evaluation and assessment. This chapter draws together the conclusions that can be made in relation to the interpretations of the findings and the subsequent discussion of the findings in light of the analysis of the collective information in Chapter 5.

The conclusions of the study will be acknowledged as will the limitations of the study. Subsequent recommendations regarding further refinement and implementation of the Conceptual Framework for Simulation in Healthcare Education and further research will also be discussed. Finally a thesis summary is provided.

Conclusions

The aim of this research was to identify the conceptual frameworks and theoretical models cited in the literature which inform simulation interventions; identifying whether those conceptual frameworks and theoretical models actually inform and guide the design, delivery and evaluation of simulation interventions; and by evaluation research and a modified Delphi Technique, develop a conceptual framework that will contribute to the design, delivery and evaluation of simulation interventions.

The information provided from the literature review on simulation, the information generated around the education theories, the accumulative data from the literature review on conceptual frameworks, the questionnaire circulated to the simulation centres, the draft of the conceptual framework and the questionnaire circulated to the experts using a modified Delphi technique all provided a rich data that supported the need for and development of a Conceptual Framework for Simulation in Healthcare Education.

The precursor literature review helped set the context given it provided the diverse definitions of, the history behind, the current global view of and the range of the contemporary state of healthcare simulation uptake. The review of the literature also demonstrated that the current and emerging healthcare simulation community is an extensive, complex, international movement that transcends nationalities, customs, cultures, academia, clinical services and research activities.

While this can be viewed as a positive and evolving dynamic that is impacting on how healthcare practitioners are being prepared for and supported in clinical service, there are aspects of the implementation of simulation as a change agent that required further investigation. These included the theoretical underpinnings that provide a framework with which to guide the best use and outcomes of simulation interventions. The search of the literature to ascertain to what extent there existed conceptual frameworks guiding simulation-based education was undertaken with a number of outcomes that warranted further comment and interpretation.

In essence the literature demonstrated that while a judicious number of authors acknowledged the presence, or need, or use of a variety of education theories in the context of their respective studies or reports, there was a paucity of evidence demonstrating the overt use of conceptual frameworks. Indeed there was evidence of demand that such activity was required. The language would sometimes imply that a framework was used but there was modest demonstrable evidence of that. This result indicated the potential for development of a particular conceptual framework that would be of benefit to simulation in healthcare education.

As a result a further activity was undertaken to ascertain to what level or not conceptual frameworks were being used in simulation centres. This strategy involved a random selection of thirty (30) simulation centres around the world where a questionnaire was provided to gather a range of information. Demographic data was not sought as it was believed that needed to be blinded to the study. This activity was a current analysis with a statistically acceptable return (63.3%) from which a number of rich, compelling assumptions could be put forward. The primary one being that there was enough evidence to support the need for a Conceptual Framework for Simulation in Healthcare Education to be developed.

The third and final part of the study was to forward to a select number (6) of experts in the simulation community a link to the draft of the web-based conceptual framework and an accompanying questionnaire requesting their constructive critique using a modified Delphi Technique. All six responded and provided a further strong level of evidence supporting the construct and content of the draft conceptual framework to a medium to high degree level of appraisal across most elements – as demonstrated in the Chapter 5. This expert review stage also supported the study objective of achieving medium, to medium to high levels of validity and reliability across the model as reported in table 22.

Triangulation of these various data substantiated that there was demonstrable collective proof supporting the implementation of a Conceptual Framework for Simulation in Healthcare Education. While there was a small level of commentary indicating the need for some modest design modification and editorial work - which has been reviewed - the overwhelming testimony was positive towards further development and implementation. This will include the further development of process tools to ensure concepts and theories can be contextualised and applied, as well as their relevance be researched, analysed and reported on.

Importantly the final review responses to the model were encouraging in that this peer review indicated that the study was well designed, was of value, and given the study was around providing further understanding about and the use of abstracts and theories, was identified as outstanding work.

Limitations

It was acknowledged that while there was a rich, robust and diverse data from the literature search, that the procedure to gather this information had limitations. The chosen literature search and review was a broad approach to the literature. As papers were identified that warranted closer inspection, these were reviewed, plus further more-focused reviews were triggered until no new evidence was appearing. This process was repeated again recently to make sure any contemporary publications that could add value to the research were not missed and therefore excluded. As a consequence the reporting is the best–informed perspective, interpretation and recommendations, based on the best available evidence that could be retrieved and reviewed.

There was a decision made to not collect demographic data as these were considered to be a potential confounder to the generic responses sought through the questionnaire sent out to the simulation centres. The questions posed were clearly established to clarify whether or not conceptual frameworks were regularly used, and to establish evidence warranting support of the development of a conceptual framework. Bias from the respondents who responded based on their knowledge and experience may have been an influencing factor, but as this was a single approach and not a large scale data collection – responder bias may have influenced outcomes. These limitations could be considered with respect to the modified Delphi technique component of the project also.

A further factor identified throughout the literature and questionnaire-based surveys was the vast differences in understanding about education theories and their role, the paucity in knowledge about how to apply such theories, the apparent deficit of conceptual frameworks and even their relevance to some even highly experienced simulationists. This did create some concern as this mis-match had the potential to adversely impact on the results. However on review this divergence was seen as further evidence of support for the development of a conceptual framework.

Ultimately however the combined data have provided clear jurisdiction in determining the research to be of value, and thus the aims of the research proposal have been addressed. Notwithstanding the potential and real limitations impacting on the study there remains rich and robust evidence that supported the design, development and use of a Conceptual Framework for Simulation in Healthcare Education.

Recommendations and further research

It was identified early in the development of this research activity that this was only the beginning of the journey towards the production and implementation of a conceptual framework that would contribute to simulation-based education. It was identified that at the end of this research activity minor editorial modifications to ensure the correct message is provided would be necessary before testing of the framework post-study occurred. Also while they were not part of this research proposal, there were a number of on-line draft tool examples provided to the six experts for review. However these draft tools received minimal critique so there will be a period of time required to work through these tools.

The refinement and fine tuning of the application tools will encourage users to recontextualise the theoretical elements into contextual reality. It is in the implementation stages where areas and levels of validity and reliability will be tested, so to ensure the model has broad functionality and applicability, this form of support is essential. Other post-study activities will include investigating quantitative, qualitative and mixed methods research opportunities, to obtain further insights around the use and place of theoretical frameworks in simulation education.

It is recommended and hoped that the Conceptual Framework for Simulation in Healthcare Education with its accompanying activity tools be further tested under research conditions in a simulation centre environment. This testing will be to ascertain the role that a conceptual framework has in the conceptualising, designing, developing and delivery of a number of different simulation-based activities. Research required to investigate its potential impact on learning outcomes in different settings is also recommended. Respondents to the original study will be offered the opportunity to have access to and use of this application.

As this is a web-based design that requires a specific level of information technology and technical expertise to develop and change, whatever activity is required will be carefully planned, before changes are initiated. This will require use of a quality management process. Part of the modification procedure will be to develop the tool so that it can be accessed via Ipads and smart phones. This will potentially need design and delivery adaptation while working to mitigate loss of impact value - which will necessitate further research around instructions, self-help information, access, visual acuity and user-friendliness, troubleshooting and other as yet thought of issues that may hinder uptake.

Thesis summary

The underpinning tenet to this study was that conceptual frameworks are an essential tool for the conceptualising, designing, developing and delivery of simulation-based activities in healthcare education. This research dissertation, inclusive of the rationale behind it, is about the research design, strategies and processes that were undertaken to determine whether or not there was evidence of conceptual frameworks cited in the simulation literature.

The first activity involved an extensive search, review and evaluation of the international simulation literature. Data gathering by questionnaire was subsequently undertaken to identify whether or not there was evidence of conceptual frameworks being currently employed in key simulation centres throughout the world and how they were informing simulation education – or not. From the literature review and data, a draft conceptual framework was developed. A modified Delphi technique was then employed to ascertain the views of simulation experts about the structure and utility of a Conceptual Frameworks in Simulation for Healthcare Education.

The outcomes of this thesis have evolved from the initial requests by simulation leaders in the literature, the separating and condensing of information from the literature findings, the feedback from the simulation centre questionnaire and the constructive critique from experts in healthcare simulation that has guided the design and development of a Conceptual Framework for Simulation in Healthcare Education.

The study design produced rich data that answered the research questions and supported the aims of the study. There was enough information assembled from the literature, extracted from the questionnaires and collated from the critiques to prescribe that there was and there remains a need for a Conceptual Framework for Simulation in Healthcare Education. As such the outcomes, limitations and recommendations of this research activity have been presented from that perspective.

Further research is recommended to extend the findings of this study. As recommended there will be a period of conceptual framework modification and development of application processes required followed by a period of beta-testing to evaluate all aspects. There will be further ongoing research and development requirements to ensure this technology-driven tool will contribute to simulation education.

From an educational perspective such research to be considered, may include the exploration of other underpinning education theories such as socio-cultural theory, that in turn, may add further dimensions to the value, relevance and potential impact of the conceptual framework. Seeking out and linking such theories may well provide added potential opportunities to have a positive influence in the healthcare setting.

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Appendix A

Research: A Conceptual Framework for Simulation in Healthcare Education

Questionnaire 1: Education Frameworks in Simulation Centres

Q1. Does your organisation utilize a conceptual framework for simulation education development?

☐ Yes

☐ No

If yes which model and why?

[Type response here –expand box as required]

If a conceptual framework for simulation education development is not used has your organisation considered employing one?

[Type response here–expand box as required]

Q2. As an organisation do you use a conceptual framework to facilitate the evaluation and research of your simulation experiences?

☐ Yes

☐ No

If yes how do you use the framework?

[Type response here–expand box as required]

If a conceptual framework for simulation education evaluation and research is not used has your organisation considered employing one?

[Type response here–expand box as required]

Q3. If your organisation had access to a validated conceptual framework for simulation education development would you consider using it?

- [ ] Yes
- [ ] No

If yes, why?

[Type response here–expand box as required]

If no, why?

[Type response here–expand box as required]

Thank you for your responses. Outcomes of the project will be provided on request

Appendix B:

Research: A Conceptual Framework for Simulation in Healthcare Education

Questionnaire: Evaluation of a conceptual framework.

This questionnaire may be used multiple times with the Delphi Activity

Question 1:

After reading the rationale provided to you regarding this conceptual framework, please indicate to what degree you consider this framework has face validity?

☐ High ☐ Medium ☐ Low ☐ None

To indicate answer [in any box] left mouse highlight /format / shape fill [your colour choice]

Please also provide any comments and recommendations.

[Type response here –expand box as required]

Question 2:

Please indicate to what degree you consider this framework has overall content validity?

☐ High ☐ Medium ☐ Low ☐ None

Question 2.1:

Please indicate to what degree you consider the underpinning philosophical education theory of this framework has content validity?

☐ High ☐ Medium ☐ Low ☐ None

Please also provide any comments and recommendations.

[Type response here –expand box as required]

Question 3:

Please indicate to what degree you consider this framework has overall construct validity?

☐ High ☐ Medium ☐ Low ☐ None

Please also provide any comments and recommendations.

[Type response here –expand box as required]

Question 3.1:

Please indicate to what degree you consider **Theory 1** of this framework has construct validity

☐ High ☐ Medium ☐ Low ☐ None

Please also provide any comments and recommendations.

[Type response here –expand box as required]

Please indicate to what degree you consider **Theory 2** of this framework has construct validity.

☐ High ☐ Medium ☐ Low ☐ None

Please also provide any comments and recommendations.

[Type response here –expand box as required]

Please indicate to what degree you consider **Theory 3** of this framework has construct validity.

☐ High ☐ Medium ☐ Low ☐ None

Please also provide any comments and recommendations.

[Type response here –expand box as required]

Please indicate to what degree you consider **Theory 4** of this framework has construct validity.

☐ High ☐ Medium ☐ Low ☐ None

Please also provide any comments and recommendations.

[Type response here –expand box as required]

Please indicate to what degree you consider **Theory 5** of this framework has construct validity

☐ High ☐ Medium ☐ Low ☐ None

Please also provide any comments and recommendations.

[Type response here –expand box as required]

Please indicate to what degree you consider **Theory 6** of this framework has construct validity

☐ High ☐ Medium ☐ Low ☐ None

Please also provide any comments and recommendations.

[Type response here –expand box as required]

Please indicate to what degree you consider **Theory 7** of this framework has construct validity

☐ High ☐ Medium ☐ Low ☐ None

Please also provide any comments and recommendations.

[Type response here –expand box as required]

Please indicate to what degree you consider **Theory 8** of this framework has construct validity.

☐ High ☐ Medium ☐ Low ☐ None

.Please also provide any comments and recommendations.

[Type response here –expand box as required]

Please indicate to what degree you consider **Theory 9** of this framework has construct validity.

☐ High ☐ Medium ☐ Low ☐ None

Please also provide any comments and recommendations.

[Type response here –expand box as required]

Please indicate to what degree you consider **Theory 10** of this framework has construct validity.

☐ High ☐ Medium ☐ Low ☐ None

Please also provide any comments and recommendations.

[Type response here –expand box as required]

Question 4:

Please indicate to what degree you consider this framework has **potential** inter-rater reliability?

☐ High ☐ Medium ☐ Low ☐ None

Please also provide any comments and recommendations.

[Type response here –expand box as required]

Question 4.1:

Please indicate to what degree you consider this framework has **potential** test-retest reliability?

☐ High ☐ Medium ☐ Low ☐ None

Please also provide any comments and recommendations.

[Type response here –expand box as required]

Question 4.2:

Please indicate to what degree you consider this framework has internal consistency?

☐ High ☐ Medium ☐ Low ☐ None

Please also provide any comments and recommendations.

[Type response here –expand box as required]

Further comment:

[Type response here –expand box as required]

Thank you for your responses. Outcomes of the project will be provided on request

Appendix C

Information to participants involved in research

You are invited to participate

You are invited to participate in a research project entitled 'A Conceptual Framework for Simulation Education'

This project is being conducted by a student researcher Irwyn Shepherd as part of a Doctor of Education study at Victoria University under the supervision of Dr. Trish Burton from the College of Health and Biomedicine.
This project is being overseen by Professor Marie Brennan from the College of Education at Victoria University.

Project explanation

The purpose of this evaluative research is to develop a conceptual framework for simulation in healthcare education. A social constructivist approach will guide this study and a modified Delphi technique will be used to support the development of the conceptual framework.

The conceptual framework for healthcare simulation education (the framework) will be generally defined as 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. Simulation educators will be able to employ the conceptual framework to guide curriculum, program and scenario development, delivery and evaluation.

What will I be asked to do?

You will be contacted by email and asked to respond to a questionnaire. Following a set of guidelines and provision of questions you will be asked to provide feedback to the researcher to inform the researcher about this framework. It will require a small amount of your time (approximately 1 hour).

What will I gain from participating?

It is hoped that once this draft framework is ready you will be offered the opportunity to use it in your setting to begin ascertaining its validity and reliability over time. There are no monetary gains or other material rewards being provided.

How will the information I give be used?

To facilitate the development of the framework from draft form to a model that has agreed to levels of validity and reliability. The final model, subsequent to this study, will be used to help inform simulation personnel in how they might develop simulation curriculum and programs.

What are the potential risks of participating in this project?

There are no real or potential risks identified by the researcher associated with participating in the project

How will this project be conducted subsequent to my involvement?

Subsequent to a systematic review of the literature and data retrieval through the questionnaire sent to you, a draft framework will be developed by the researcher. The use of the Delphi Technique to gather feedback will be used. This is a structured communication process that can be used to collect group, sort and rank data and reach consensus from a group of expert people without requiring face to face contact. The two pivotal elements that make up the Delphi Technique are:

- Sequential questionnaires
- Regular feedback to participants

Questionnaire(s) are distributed to participants. Responses to the first questionnaire are collated and summarised and used to prepare the second questionnaire which seeks agreement, disagreement and insights from the same pool of participants. The process goes on until no new opinion emerges.

Who is conducting the study?

Chief Investigator

Dr Trish Burton
Senior Lecturer
Bachelor of Nursing
College of Health and Biomedicine
St. Albans campus
Victoria University
Melbourne, Victoria, Australia
Phone: +61 3 9919 2197
Email: Trish.Burton@vu.edu.au
Web: www.vu.edu.au

Student Researcher

Mr. Irwyn Shepherd
Phone: +61 3 9585 4450
Mobile: 0418 344 774
irwyn.shepherd@live.vu.edu.au

Any queries about your participation in this project may be directed to the Chief Investigator listed above. If you have any queries or complaints about the way you have been treated, you may contact the Ethics Secretary, Victoria University Human Research Ethics Committee, Office for Research, Victoria University, PO Box 14428, Melbourne, VIC, 8001, email researchethics@vu.edu.au or phone (03) 9919 4781 or 4461.

Appendix D

Consent form for participants involved in research – site questionnaire

INFORMATION TO PARTICIPANTS:

We would like to invite you to be a part of a study into the development of a Conceptual Framework for Simulation Education.

This project is being conducted by student researcher Irwyn Shepherd as part of a Doctor of Education study at Victoria University under the supervision of Dr. Trish Burton from the College of Health and Biomedicine.

The aim of this evaluative research is to develop a conceptual framework for simulation in healthcare education. A social constructivist approach will guide this study and a modified Delphi technique will be used to support the development of the conceptual framework. Your responses will be taken into account in guiding the development of the draft framework.

The conceptual framework for healthcare simulation education (the framework) will be generally defined as 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. Simulation educators will be able to employ the conceptual framework to guide curriculum, program and scenario development, delivery and evaluation.

The Researchers do not envisage any real or potential risks associated with this project.

CERTIFICATION BY SUBJECT

I, "[Click here & type participant's name]"

Of "[Click here & type participant's suburb]"

Certify that I am at least 18 years old* and that I am voluntarily giving my consent to participate in the study:

Development of a Conceptual Framework for Simulation Education being conducted at Victoria University by Dr. Trish Burton.

I certify that the objectives of the study, together with any risks and safeguards associated with the procedures listed hereunder to be carried out in the research, have been fully explained to me by:

Irwyn Shepherd, student researcher

And that I freely consent to participation involving the below mentioned procedure:

- Responding to Questionnaire: Education Frameworks in Simulation Centres

I certify that I have had the opportunity to have any questions answered and that I understand that I can withdraw from this study at any time and that this withdrawal will not jeopardise me in any way.

I have been informed that the information I provide will be kept confidential.

Signed:

Date:

Any queries about your participation in this project may be directed to the researcher:

Dr Trish Burton
Phone: +61 3 9919 2197
Email: Trish.Burton@vu.edu.au

If you have any queries or complaints about the way you have been treated, you may contact the Ethics Secretary, Victoria University Human Research Ethics Committee, Office for Research, Victoria University, PO Box 14428, Melbourne, VIC, 8001, email Researchethics@vu.edu.au or phone (03) 9919 4781 or 4461.

[*please note: Where the participant/s are aged under 18, separate parental consent is required; where the participant/s are unable to answer for themselves due to mental illness or disability, parental or guardian consent may be required.]

Appendix E

Consent form for participants involved in research – Delphi technique

INFORMATION TO PARTICIPANTS:

We would like to invite you to be a part of a study into the development of a Conceptual Framework for Simulation Education.

This project is being conducted by student researcher Irwyn Shepherd as part of a Doctor of Education study at Victoria University under the supervision of Dr. Trish Burton from the College of Health and Biomedicine.

The aim of this evaluative research is to develop a conceptual framework for simulation in healthcare education. A social constructivist approach will guide this study and a modified Delphi technique will be used to support the development of the conceptual framework. Your initial and possible subsequent responses will be taken into account and where change to the draft framework is necessitated that will take place until a final draft model is developed.

The conceptual framework for healthcare simulation education (the framework) will be generally defined as 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. Simulation educators will be able to employ the conceptual framework to guide curriculum, program and scenario development, delivery and evaluation.

The Researchers do not envisage any real or potential risks associated with this project.

CERTIFICATION BY SUBJECT

I, "[Click here & type participant's name]"

Of "[Click here & type participant's suburb]"

Certify that I am at least 18 years old* and that I am voluntarily giving my consent to participate in the study:

Development of a Conceptual Framework for Simulation Education being conducted at Victoria University by Dr. Trish Burton.

I certify that the objectives of the study, together with any risks and safeguards associated with the procedures listed hereunder to be carried out in the research, have been fully explained to me by:

Irwyn Shepherd, student researcher

And that I freely consent to participation involving the below mentioned procedures:

- Receive and review the draft framework via sequential questionnaires
- Provide written feedback to the researchers.

I certify that I have had the opportunity to have any questions answered and that I understand that I can withdraw from this study at any time and that this withdrawal will not jeopardise me in any way.

I have been informed that the information I provide will be kept confidential.

Signed:

Date:

Any queries about your participation in this project may be directed to the researcher:

Dr Trish Burton
Phone: +61 3 9919 2197
Email: Trish.Burton@vu.edu.au

If you have any queries or complaints about the way you have been treated, you may contact the Ethics Secretary, Victoria University Human Research Ethics Committee, Office for Research, Victoria University, PO Box 14428, Melbourne, VIC, 8001, email Researchethics@vu.edu.au or phone (03) 9919 4781 or 4461.

[*please note: Where the participant/s are aged under 18, separate parental consent is required; where the participant/s are unable to answer for themselves due to mental illness or disability, parental or guardian consent may be required.]

Appendix F

Copyright permission

From: AQFC [mailto:AQFC@AQF.edu.au]
Sent: Friday, 10 July 2015 12:07 PM
To: irwyn@menzies.vic.edu.au
Subject: AQF spinning wheels mechanism [SEC=UNCLASSIFIED]

Dear Irwyn

I note you are seeking permission to reference the Australian Qualifications Framework (AQF) levels spinning wheel mechanism (located at http://www.aqf.edu.au/aqf/in-detail/aqf-levels) in your PhD research publications.

The AQF levels spinning wheel is provided under a. Further information on the Creative Commons Attribution 3.0 Australia Licence is available at http://creativecommons.org/licenses/by/3.0/au/.

In brief, you are free to copy and redistribute the wheel, remix, transform and build the wheel for any purpose, even commercially. However, the spinning wheel must be attributed to the Commonwealth of Australia as the copyright owner, with a link to the spinning wheel and reference to it being licenced under a Creative Commons licence.

If you have any further questions, please call the AQF hotline on 08 8306 8777 and ask to speak with Bernardette. Many thanks for your patience with this issue—a first for the office since we assumed responsibility for administration of the AQF.

Kind regards and best wishes with your PhD
Bernardette
Governance, Quality & Access Branch
Higher Education Group
Australian Government Department of Education and Training
Phone +61 8 8306 8777
Opportunity through learning
www.education.gov.au | www.aqf.edu.au

In August 2014, the AQF Council was disbanded and the functions of the Office of the AQF Council were transferred to the Australian Government Department of Education and Training.

Agreed citation format

Figure X: Conceptual Framework for Simulation in Healthcare Education
Modified and transformed Australian Qualifications Framework (AQF) spinning wheel mechanism
Permission granted for use under Creative Commons Attribution 3.0 Australia licence, Commonwealth of Australia©
Cited: http://www.aqf.edu.au/aqf/in-detail/aqf-levels

Permission provided through:

Governance, Quality & Access Branch, Higher Education Group
Australian Government Department of Education and Training
Phone +61 8 8306 8777
www.education.gov.au | www.aqf.edu.au

Appendix G

Framework link for participants involved in research – Delphi technique

A Conceptual Framework for Simulation in Healthcare Education®©2014

Note: Many of the education theories presented in this framework have been to lesser or greater degrees mentioned / discussed in the simulation literature in varying ways. This framework is a sequential compilation model with rationales, links to the underpinning philosophy and a list of application considerations. By definition it is a conceptual framework providing an overview of potential application to effect change in simulation education design, construction, validation, delivery and evaluation / assessment. You are being asked to review this framework in that context.

Research Link

http://www.btwebz.com.au/irwyn/framework.htm

Important background information: These data helped validate the research questions of the project and supported the notion for the development of the conceptual framework.

a. Literature Review

The literature search and review (which was presented to the College Review Board and then University Ethics) demonstrated that there was:

- Moderate commentary about education theories and simulation;
- Moderate commentary about frameworks and simulation;
- Very little evidence of overt application of theories / frameworks – except for a small number of papers reporting on one particular framework; and
- Minimal research papers demonstrating framework application and outcome.
- There is increasing awareness in the literature for the development of frameworks to guide simulation; and
- A number of recommendations for research to be pursued.

Note: This information will be more appropriately reported on in the thesis.

b. Survey Result: raw percentage data / no thematic analysis

The results of a questionnaire circulated to ascertain the use of education frameworks in simulation with a 66.3% return rate, 63% indicated they did use a framework but when one drilled down on the associated comments there was significant variation in what they believed to be a framework. Early interpretation would indicate the 63% is going to somewhat less based on the research question, definition and criteria. 37% indicated they did not use a framework.

When asked if a conceptual framework for simulation education development is not used, has your organisation considered employing one? There was a reasonably positive response. This requires more analysis.

When asked as an organisation do you use a conceptual framework to facilitate the evaluation and research of your simulation experiences – there was a 42% yes but a 58% no. This requires more analysis.

Finally when asked if your organisation had access to a validated conceptual framework for simulation education development would you consider using it – there was an 89.5% yes response with a 10.5% no response. This requires more analysis.

Hence the development of the conceptual framework up for your review and critique – plus draft beginning examples of how one might apply it. That work is not part of the thesis but obviously will be an extension of it.

Appendix H

Ethics approval

Victoria University Human Research Ethics Committee

-----Original Message-----

From: quest.noreply@vu.edu.au [mailto:quest.noreply@vu.edu.au]
Sent: Tuesday, 29 April 2014 4:04 PM
To: trish.burton@vu.edu.au
Cc: irwyn.shepherd@live.vu.edu.au

Subject: Quest Ethics Notification - Application Process Finalised - Application Approved

Dear DR PATRICIA BURTON,

Your ethics application has been formally reviewed and finalised.

Application ID: HRE14-060

Chief Investigator: DR PATRICIA BURTON

Other Investigators: MR Irwyn Shepherd

Application Title: A Conceptual Framework for Simulation in Healthcare Education

Form Version: 13-07

The application has been accepted and deemed to meet the requirements of the National Health and Medical Research Council (NHMRC) 'National Statement on Ethical Conduct in Human Research (2007)' by the Victoria University Human Research Ethics Committee. Approval has been granted for two (2) years from the approval date; 29/04/2014.

Continued approval of this research project by the Victoria University Human Research Ethics Committee (VUHREC) is conditional upon the provision of a report within 12 months of the above approval date or upon the completion of the project (if earlier). A report proforma may be downloaded from the Office for Research website at: http://research.vu.edu.au/hrec.php.

Please note that the Human Research Ethics Committee must be informed of the following: any changes to the approved research protocol, project timelines, any serious events or adverse and/or unforeseen events that may affect continued ethical acceptability of the project. In these unlikely events, researchers must immediately cease all data collection until the Committee has approved the changes. Researchers are also reminded of the need to notify the approving HREC of changes to personnel in research projects via a request for a minor amendment. It should also be noted that it is the Chief Investigators' responsibility to ensure the research project is conducted in line with the recommendations outlined in the National Health and Medical Research Council (NHMRC) 'National Statement on Ethical Conduct in Human Research (2007).'

On behalf of the Committee, I wish you all the best for the conduct of the project.

Secretary, Human Research Ethics Committee
Phone: 9919 4781 or 9919 4461
Email: researchethics@vu.edu.au