Transfer of learning from simulation to clinical practice in pre-registration healthcare student education.

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TRANSFER OF LEARNING FROM SIMULATION TO CLINICAL PRACTICE IN PRE-REGISTRATION HEALTHCARE STUDENT EDUCATION

A thesis submitted in partial fulfilment of the requirements of Robert Gordon University for the degree of Doctor of Professional Practice (DPP).

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LIST OF ABBREVIATIONS

ALS	Advanced Life Support
ASPiH	Association Simulation Practice in Healthcare
BMI	Body Mass Index
CAE	CAE Healthcare: Simulation-based medical education solutions
CSMEN	Clinical Skills Managed Education Network
CRM	Crisis Resource Management
DASH	Debriefing Assessment for Simulation in Health Care
DPP	Doctor of Professional Practice
EDR	Educational design research
GDPR	EU General Data Protection Regulation
GMC	General Medical Council
HCPC	Health and Care Professions Council
HEI	Higher Education Institute
IPE	Interprofessional Education
INASCL	International Nursing Association Clinical Simulation and Learning
JBI	Johana Briggs Institute
NES	NHS Education for Scotland
NICE	National Institute for Health and Care Excellence
NIHR	National Institute for Health Research
NMC	Nursing and Midwifery Council
OSAD	Objective Structured Assessment of Debriefing
OSAT	Onsite Assessment and Training
OSCE	Objective structured Clinical Examination
SCSN	Scottish Clinical Skills Network
RCUK	Research Councils UK
SBE	Simulation-Based education
SBL	Simulation-Based Learning
SCSN	Scottish Clinical Skills Network
SIGN	The Scottish Intercollegiate Guidelines Network
SMART	Specific, Measurable, Achievable, Realistic, Timely
UK	United Kingdom
USA	United States of America
VR	Virtual Reality

ABSTRACT

Transfer of learning from simulation to clinical practice in preregistration healthcare student education.

BACKGROUND

Simulation has become an established pedagogy for teaching clinical skills to healthcare professionals and has been incorporated into pre-registration curricula internationally. Simulation can often be used to replace clinical practice hours and it is projected that the use of simulation will rise as placement opportunities decline. Simulation is also both resource and cost-intensive. Therefore, it becomes incumbent on educators to demonstrate the effectiveness of simulation.

AIM

The broad purpose of this thesis is to extend the healthcare education knowledge base around the transfer of clinical skills to clinical practice after simulation. Three studies were undertaken, each with their own discrete aims. Firstly, an integrative literature review, to identify what evidence exists to support transfer of learning following simulation activities to clinical practice. Secondly, an explanatory sequential mixed-methods study, to ascertain and explore nurse academics' views on current practice in Scottish Higher Education Institutions in relation to the use of simulation best-practice statements and staff development. Thirdly, a convergent mixed-methods feasibility study exploring the parameters of evaluating the transfer of learning respiratory assessment skills from simulation to clinical practice for healthcare students.

METHODS

The paradigm underpinning this work is pragmatism using an iterative mixed-methods approach, which was applied in the following way:

1) An integrative review on transfer of learning.
2) An explanatory sequential mixed-methods study incorporated an e-Delphi study followed by telephone interviews that were thematically analysed using a qualitative descriptive approach.

3) A convergent mixed-methods study design was adopted for the feasibility study so that quantitative data from questionnaires and qualitative data from interviews could be integrated.

MAIN FINDINGS

The Integrative review: there is limited published evidence on the effectiveness of simulation transferring to clinical practice in both health care education generally and pre-registration nurse education specifically. The current evidence-base could be improved by improving methodological rigor and being transparent around the intervention of simulation.

The explanatory sequential mixed-methods study: differences in simulation practices across Scottish Higher Education Institutions (HEI's) were reported; however, participants unanimously agreed that they would welcome the use of simulation best practice statements in the future. They also identified a need for staff development and leadership in simulation.

Feasibility study: whilst there are challenges to conducting studies evaluating transfer of learning to practice, such as the length of time required, this study demonstrated that a larger study would be worthwhile and parameters of a future main study were explored.

CONCLUSION

This thesis developed some key recommendations for both research and educational practice. Research into the effectiveness of simulation to transfer skills to clinical practice could be enhanced by greater collaboration between Higher Education Institutions, which would enable larger samples to be reached across multiple research sites. Adopting a quasi-experimental research design might avoid methodological limitations of previous simulation evaluation studies. If institutions collaborated tools to evaluate the transfer of skills after simulation to clinical practice could be validated. The intervention of simulation could be strengthened using best-practice statements which would standardise future multi-site research.

Recommendations for educational practice in Scottish HEI's include the following: Stronger leadership for simulation to drive and promote change. Development in simulation pedagogy for healthcare educators. The use of simulation best-practice statements to provide a framework for simulation educators to standardise, evaluate and improve simulation activities. The introduction of simulation champions intra-institution to mentor, guide and support simulation educators; this could include sharing of simulation resources nationally. Finally, Scottish Schools of Nursing are currently not able to consider simulation as a significant replacement for clinical hours.

KEY WORDS

Simulation, transfer of clinical skills, clinical practice, mixed-methods, pragmatism, best-practice statements, staff development.

Overview Thesis

This thesis will mainly be presented in the third person; however, part of the overviews and chapter summaries will contain an element of reflexivity and this will be expressed in the first person. It is hoped the reflexivity will illuminate my research experiences and decision-making processes. Reflexivity, with its origins in ethnography, is considered a 'cardinal virtue' in research (Hammersley 1994) It involves the researcher critically reflecting on their role as a researcher and how that may have affected the research process (Lichtman 2010). More particularly, and with reference to constructivism, reflexivity demands a researcher examines how they have both interpreted the language of others and used their own language to construct reality (Xerri 2017). Powell (2006) proposes reflexivity involves using reflection to examine personal biases and motivations. Reflexivity is essential in research that involves participant observation and anywhere there is a high degree of analysis of language but is equally useful to contemplate research decisions generally.

Overview of Chapter One

Chapter one, presents an overview of the thesis starting with my personal motivation for exploring simulation-based education, and my rationale for choosing the Doctorate of Professional Practice route. The structure of the thesis will be outlined, and definitions of the terms used throughout will be provided to promote clarity for the reader. The educational theories underpinning simulation-based education will be discussed and the notion of whether simulation is a pedagogy explored. Finally, the overall aim for the thesis will be set out.

1.0 Introduction

The introduction will explain my personal and professional reasons for choosing simulation as a topic for exploration and my rationale for undertaking a Professional Doctorate.

1.1 Declaration of Personal/Professional Interest and Motivation

Throughout my career to date, my professional roles have been that of nurse and educator. I registered with the Nursing and Midwifery Council (NMC) as an adult nurse in 1987 and worked in care of the elderly rehabilitation and then medical acute care as a staff nurse before being promoted to Sister and the role of Night-Coordinator. Whilst working part-time I completed a combined studies honours degree followed by a post-graduate teaching certificate and thus began my teaching career. In 2000 I was employed as a Nurse Lecturer in a Scottish university. One of my roles was to teach clinical skills and I subsequently had my introduction to simulation in various guises. I have undertaken a variety of senior roles over the years, Senior Lecturer for Clinical Skills and Learning Enhancement Co-ordinator, both of which have afforded me opportunities to engage in scholarly activities investigating aspects of simulation. From these experiences it was clear there was much to explore with regards to simulation and its effectiveness in nurse education.

1.2 Doctorate of Professional Practice (DPP)

The Doctorate of Professional Practice (DPP) seemed to me the most appropriate mode of study. After full consideration of the choices, I opted for the DPP rather than the traditional Doctor of philosophy (PhD) route because the DPP is concerned with creating new knowledge that can be used to advance work-based practice and has a more pragmatic approach. As an experienced nurse and educator, I was keen to undertake valid and reliable research in the educational arena of simulation that would be of practical use and relevance to my job as a Nurse Lecturer and that could have the potential to impact on the educational and research practice of colleagues, nationally and internationally and had the potential to improve patient care. I also wanted to develop my critical evaluation and research skills, with a view to being better equipped to support all nursing students, pre and post-registration, to challenge traditional methods of teaching and develop an evidence base to support educational practices. Lastly, as a keen exponent myself of simulation-based education I wanted to challenge my own assumptions of simulation.

1.3 Structure of the Thesis

This thesis is submitted in partial fulfilment of the requirements of the degree of Doctorate of Professional Practice at the Robert Gordon University (RGU). It is focussed on the use of simulation in pre-registration nurse education. This introduction will set the scene for simulation in nurse education, defining terms that will be used throughout the thesis. The second chapter will include a broad narrative review of literature on healthcare professionals' use of simulation to transfer learning to clinical practice. The third chapter will present the underpinning methodology and justify methods used in the thesis. The fourth chapter will present an integrative literature review, which examines the research investigating whether learning through simulation activities can be transferred to clinical areas and change the behaviour and practice of student nurses. There follows the fifth chapter which is an explanatory sequential mixed-methods study comprising of (i) an e-Delphi study to determine nurse academics consensus view on simulation best-practice statements, and (ii) an interview study to explore nurse academics views on staff development needs for the effective delivery of simulation in u. The sixth chapter presents a feasibility study, with a convergent mixed-methods design, that evaluates the parameters of conducting transfer of learning research. The seventh chapter is an inclusive discussion of the previous chapters and finally, the eighth concluding chapter follows with recommendations for both educational practice and research practice along with some suggestions for future study.

1.3.1 Outline of Chapters

Chapter One: Setting the scene for simulation-based education and the transfer of learning to clinical practice: An introduction.

Chapter Two: Identifying a need for research in simulation-based education and the transfer of learning to clinical practice: A literature review.

Chapter Three: Philosophy underpinning the thesis and justification for methods used in chapters four – six: Methodology.

Chapter Four: Student Nurses' transfer of clinical skills learning from simulation to clinical practice: An integrative review.

Chapter Five: Determining levels of consensus on simulation best-practice statements for pre-registration nursing in Scotland: An explanatory sequential mixed-methods e-Delphi study and follow up interviews.

Chapter Six: Exploring the parameters of evaluating the transfer of learning from simulation to clinical practice for healthcare students: A convergent mixed-methods feasibility study.

Chapter Seven: Key findings: Discussion.

Chapter Eight: Contribution, originality and the future: Conclusions.

1.4 Context of Simulation

The context for this thesis is mainly the education of pre-registration nursing students. Since 2013, nurse education is studied at bachelor's degree level. All pre-registration courses in the UK are approved by the NMC and must meet their educational standards. Legislative frameworks govern pre-registration nurse education from admission to registration with the NMC. Students must qualify in a specific field of practice as a level 1 nurse. The four fields are: adult, children, learning disabilities and mental health and a nurse can enter the register in one or more fields. All pre-registration courses are fifty percent theory and fifty percent practice with students having to achieve 2300 hours in clinical practice (NMC 2018). Practice hours can be replaced by simulation, which will be considered in chapter four.

Usage of simulation in nursing, has evolved rapidly over the last few decades (Ricketts 2011) and will be the focus of this thesis. Definitions are therefore required of key terms that will be adopted in this thesis such as simulation, simulator, simulated patient, and fidelity.

1.4.1 Simulation History

Simulation is by no means a recent phenomenon. There is documentary evidence of simulation being used in 400BC by the Romans which describes soldiers using

wooden beams instead of swords (Rhodes 2011). Later, in medieval times, knights on horse-back struck a mounted figure called a 'quintain' with a lance (Good and Gravenstein 1989). The military have continued to utilise simulation and the aviation industry has also hugely benefited from and expanded its use particularly since the development, in 1929, of flight simulators so pilots can learn to fly safely (Johnson and Patterson 2006). The medical profession, especially the field of anaesthesia, were early adopters and can claim to have led the way for all healthcare professions (Issenberg et al. 2005).

The nursing profession has also adopted the use of simulation. Nurse education has been using simulators since 1910, with the introduction of one of the first nursing mannequins '*Mrs Chase'*. Nurse educators would use her to demonstrate nursing skills and then nursing students would practice those nursing skills (Herrman 2008). Developed in the United States of America (USA) and named after the inventor, this mannequin was simply a large hand-made doll. The USA army requested infant dolls and male prototypes of this original mannequin. A more advanced Mrs Chase (with injection sites and appropriate orifices for practicing technical skills like catheterisation) quickly followed (Nickerson and Pollard 2010).

Mrs Chase became obsolete with the development of computers and software. These innovations enabled the development of fully interactive patient mannequins in use today (Cooper and Taqueti 2004). These mannequins were used first in anaesthesia to practice caring for a sedated patient. Many other medical disciplines adopted simulation and the use of mannequins such as emergency medicine, intensive care, surgery, trauma, and paediatrics. Healthcare education in all areas quickly adopted the use of simulation (Ricketts 2011).

Despite the use of simulation gathering momentum there is little evidence about the effectiveness of simulation in nurse education (Zitzelsberger et al. 2017; Alexander et al. 2015; Canadian Association of Schools of Nursing 2015; Hayden et al. 2014; Ricketts 2011). Therefore, this thesis will focus on evaluating the effectiveness of simulation to enable students to transfer clinical skills to the clinical environment and patient care. The main terms used throughout this thesis will now be defined.

1.4.2 Definitions of Simulation

There are no definitions for simulation that are universally accepted, which can lead to ambiguity when simulation is being discussed. Cooper and Taqueti (2004) provide definitions to distinguish between simulator and simulation. 'Simulator' refers to a physical object or portrayal of the full or part task to be imitated. 'Simulation' refers to the use of simulators for education or training. Simulation is "*the promotion of understanding by 'doing'*" (Hope et al. 2011 p.711) whilst the simulator is the object that helps us to do this. The term simulation is defined for this thesis in accordance with the context of the pre-registration nursing and the NMC's definition:

> *"an artificial representation of a real-world practice scenario that supports student development and assessment through experiential learning with the opportunity for repetition, feedback, evaluation and reflection".* (NMC 2018 p.14).

For the purposes of this thesis however the modality of e-learning will be excluded to reduce the number of variables present in the research studies and because the foci are practical clinical skills normally taught in the clinical skills centre to pre-registration student nurses.

Terms have been created to link simulation with learning such as simulation-based education (SBE) and simulation-based learning (SBL). Zitzelsberger et al. (2017) proposed the "*replacement of "simulation" as a stand-alone term with "simulation pedagogy" or "simulation-based learning (SBL)" where the intent is to demonstrate how this approach is used through the development, implementation, and evaluation of quality teaching-learning methods unique to this modality*" (p.162). A newer concept is simulation-based mastery learning (SBML) which has been adopted by medical educators (McGaghie et al. 2014). The premise being that each student receives enough practice until they achieve the learning outcomes. In this thesis where the term 'simulation' is used it is referring to all these definitions: simulation-based education, simulation-based learning and simulation pedagogy because they are all describing the same phenomenon.

1.4.3 Types of Simulators

A part-task trainer is an object that replicates a segment of a complete process. These can be physical models such as an intravenous venepuncture arm or virtual reality, for example, endoscopy trainers. Learners can improve performance by repetitive practice of an isolated task.

Mid-range simulators are usually full or half-bodied mannequins that have a few functions but not full physiological responses, *Nursing Anne* would be one such example (Laerdal 2012).

High-fidelity patient simulators are electronic patients that are computerised to achieve physiological responses, with features such as palpable pulses, programmable heart, breath, and bowel sounds, and chest movement to suggest breathing. Most mannequins have an artificial airway and can have appendages such as catheters, chest tubes or nasogastric tubes inserted. An example of a whole mannequin would be '*IStan*' (CAE Healthcare 2017). A mannequin such as this can be pre-programmed to run an exact scenario or be used in an ad hoc way with educators controlling the mannequin during the scenario, perhaps in response to student actions or inaction (Nagle et al. 2009).

Berragan (2011) argues that because there is much we cannot predict about human behaviour and the social context in which humans operate, when mannequins are solely used it can lead to unrealistic simulation. However, educators can attempt to replicate this human effect by using simulated, volunteer or standardised patients these are individuals playing the roles of patients. They may be actors, volunteers, or volunteers acting as simulated or 'real' patients in that they allow procedures to be performed on them such as intrusive examinations. "Expert" patients can also be used; this would be an individual with a specific condition or illness who either recounts to students their story or influences education provision (Griffiths et al. 2007). Another method of using real people in simulation is expounded by Reid-Searle et al. (2011): A lecturer simulates a patient by adopting the clothing and behaviours of a certain patient meantime hiding their own identity by wearing a silicone mask.

'Patient-focussed simulation', a term coined by Nestel and Kneebone (2010), is used to describe the combination of actors and inanimate objects in delivering teaching sessions. An example would be when a volunteer patient has a venepuncture training model attached to their arm. In this way, the social and communication aspects of the procedure would be met by the human interaction and the simulated arm would allow the skill of venepuncture to be completed. This approach is sometimes labelled '*hybrid-simulation'* (Goolsby et al. 2014; Tun and Kneebone 2011; Nestel and Kneebone 2010).

Another approach is computer simulation, which has developed with the use of gaming technology, and has been in use since the 1980's (Royse and Newton 2007). Virtual reality simulators are created by computers and generate three dimensional representations of part of the real world. The operator is immersed through interaction with the device by using visual, audio, and touch sensations. An example where this can be used is for laparoscopic surgery. Other examples include, Bremner and Brannan (2000) used a computer simulation programme to enhance staff development for nurses in decision- making skills. Whole worlds can also be created via a computer screen, and recent developments are screen based virtual worlds such as '*Second Life'*. McCallum's study from 2011 outlined how this virtual world was effective in developing student nurses' decision-making skills. For this thesis e-learning and computerised simulation are not included, as this would have introduced a slightly different dimension than 'live' simulation and the focus of the study was direct patient care involving the practical clinical skills as well as the higher cognitive skills required to complete the skill.

1.4.4 Fidelity

Fidelity is the extent to which simulation matches the real world (Nickerson and Pollard 2010). There are no agreed definitions for fidelity of simulation and it is a concept open to interpretation and debate (Tun et al. 2015). As well as the physical environment being essential, simulation also relies on psychological fidelity; how well the participant believes it matches reality (Maran and Glavin 2003). A multi-dimensional view of simulator fidelity consisting of environment fidelity, equipment fidelity, and psychological or perceptual fidelity are critical to the success of simulation (Rehmann et al. 1995). For the learning outcomes of the simulation activity to be met, attention needs to be paid to all three areas of

fidelity. The choice of which equipment is used depends on the required learning outcomes. For instance, a low-fidelity mannequin is adequate for basic life support and means multiple mannequins can be provided for larger numbers because the cost is not prohibitive whereas providing a high-fidelity mannequin for each student would be unnecessary costly. Tun et al. (2015) suggest that for simulation in healthcare a new definition of fidelity is required, proposing that simulation need not be a total and accurate replication of reality but should mimic '*real world cues and stimuli*' (p.159). Consequently, they propose a three-dimensional framework: the patient, the clinical scenario and the healthcare facilities. Like Maran and Glavin (2003) and Rehmann et al. (1995) before them Tun et al. (2015) reiterate that everything depends on the learner's perception of reality rather than any one element of fidelity such as the equipment used. **Table 1.1** below offers some suggestions of equipment and activities that hopefully illustrate the different levels and types of fidelity that would more likely to be used in pre-registration nursing using Rehmann's headings and shown alongside Tun et al.'s (2015) own suggestions.

Table 1.1 Dimensions and levels of fidelity and suggestions of simulation equipment/activities mapped to Tun et al.'s (2015) suggestions (p.168) and Rehmann's dimensions of fidelity.

Level of fidelity	Low Fidelity	Medium Fidelity	High Fidelity
Dimensions of fidelity	*"Task training or supervised practice.*	*"Participant re-enacting a scenario following a demonstration of the same scenario.*	*"Autonomous involvement of participants following adequate orientation and briefing regarding the equipment, the environment, and the expectations in terms of scenario participation.*
Clinical scenario (Tun)	*Constant prompting by educator(s).* *Participants have been informed of all steps of the scenario".*	*Some interruptions by the educator(s)* *Use of a patient simulator or simulated patient on which all interventions required by the scenario cannot be fully performed to demonstrate learning outcomes."*	*All information participants are expected to find about the patient in the scenario is available as per scenario objectives."*
The patient (Tun)	*"Suboptimal for the scenario.* *Limited anatomical or physiological representation*	*"Correct anatomical or physiological representation in relation to the scenario requirements but presenting some limitations."*	*"Simulated patient (actor) fully briefed.* *Patient simulator with all features required for the scenario allowing*

	of reality from any sensory aspects"		*participants to perform interventions and experience them as if it was with a real patient"*
The facilities (Tun)	*Not contextualized to the scenario. Element(s) of the environment need to be assumed present by participants."*	*"Simulated environment (i.e. skills laboratory). Environment not fully matching the context required by the scenario in terms of space and equipment available.* "	*In-situ (Clinical area) environment matching the needs of the scenario."*
	Pre-registration nursing suggestions		
Environmental (Rehmann)	Paper-based scenarios or case studies/ classroom-based role play or activities	Use of single Bed spaces or work-stations	Lay out of complete clinical environments. Correct documentation and equipment available
Physical (Rehmann)	Use of peers to practice on or part- task trainers. Isolated	Mannequins such as Nursing Anne. No or limited physiological computerised functioning for a single physiological function such as chest compression	Use of a high-fidelity simulator with correct physiological responses. Use of volunteer patients or actors responding in a

	skill. Lots of facilitator support.	effectiveness. Use of volunteers responding in a linear way. Addition of part-task trainers to a human (injection pad attached to a human arm). Scenario. Facilitator prompts.	natural way as possible/ fully conversant of condition they are presenting with. Complex scenario. Student led.
Psychological or perceptual (Rehmann)	Is dependent on all the above factors and the individual's perception.		

Key: blue font = suggestions from Tun et al. (2015); black font = headings from Rehmann et al. (1995) with suggestions of simulation that might be used in pre-registration nursing education.

The dimensions proffered by Tun et al. (2015) are very useful however, it could be suggested that these are more relevant to medical simulation, and there are subtle differences for simulation in pre-registration nurse education. For instance, it would be unusual for pre-registration nurses to engage with in-situ simulation in the clinical environment. Students may be exposed to such opportunities on placement as part of clinical team simulation but whole cohorts would not be generally engaging in this way. Medical students often have access to volunteers who allow certain invasive procedures to be performed on them; again, is not generally the case in pre-registration nursing. Expert patients may instead be used to 'tell their story' and student answers. Another difference is the access to virtual trainers that may be used by medical staff to practice surgical procedures such as laparoscopy, again not generally in use in pre-registration nursing.

For the purposes of this thesis any level of fidelity will be included: Low, medium and high and any use of simulation equipment apart from computer games/ virtual reality trainers. The level of fidelity will first be determined by the authors of the articles selected and confirmed by the descriptors in this thesis. The philosophy underpinning simulation as a learning and teaching strategy will now be outlined.

1.5 Simulation as a Pedagogy

The purpose of this section is to explore simulation as a pedagogy. First some definitions of important concepts: education, pedagogy and andragogy. Education is derived from the Latin 'educate' meaning to bring up or nourish. The online concise Oxford English Dictionary defines 'pedagogy' as "*the method and practice of teaching, especially as an academic subject or theoretical concept*" (Pearsall 1999). The origin of the word pedagogy is derived from the Greek *'paidagogos'* meaning the 'leading of the child/slave'. 'Andragogy' on the other hand is concerned with adult learning and is defined by the online concise Oxford English dictionary as "*the method and practice of teaching adults: adult education"* (Pearsall 1999). The history of the development of the term andragogy dates to 1833 but Knowles brought this term to the forefront of the public domain in 1968. As both concepts have been developed so have their meanings blurred and pedagogy is often also applied to adult learners.

Indeed, Davenport (1987) suggests that both terms could be applied to any age group as the terms denote an approach to learning rather than the age of the learner. In pedagogy, the teacher is the provider of information, whereas in andragogy learning is shared and the learner's contributions are as valuable as the teachers. It should follow therefore that simulation is andragogic learning as a key feature is what the learner does in each scenario; yet current literature generally still mostly refers to pedagogy rather than andragogy. As Knowles et al. (2005) explain a teacher may use pedagogic approaches when a learner is new to certain concepts or has low levels of confidence and then move to more andragogic approaches. Simulation is a perfect fit with this ethos as students move from novice to expert when performing basic to complex skills (Benner 1984). As facilitators of simulation, we can then adopt different approaches suitable to the learners' needs.

Accepting that the term pedagogy is more widely used it will be adopted in this thesis but there remains the question of whether simulation can be defined as a pedagogy. Ironside (2001) suggests pedagogy is an all-encompassing approach, "*a way of thinking about and comportment within education*" (p.73). This would suggest that pedagogy is the method or approach taken for learning and that this is then underpinned by theories of teaching and learning. As an example, three different methods of teaching are named and then described as pedagogies in an article by Reber et al. (2017). To illustrate Reber et al.'s (2017) point further, one teaching method they investigate is 'discussion' which is described as a pedagogy, and the underpinning methodology supporting it is presented as constructivism.

Erlam et al. (2017) suggests that simulation relies on philosophical underpinnings but then goes on to suggests that simulation is not a pedagogy but is an

> "*immersive teaching/learning platform which is a representation of a functioning system or process*" (p.780).

Erlam's views that simulation relies on philosophical underpinnings and its description as an immersive teaching and learning platform are accepted; however, his assertion that simulation is not a pedagogy is repudiated. He seems to take the stance that pedagogy equates to philosophy or theory whereas a more

literal definition equates pedagogy to a method which then relies on theories to explain its effect.

> "*Educators can use theory to seek to understand why a simulation activity did not go so well or how to better articulate alignment with clinical practice. Working with multiple theories can assist educators to work with the ambiguity of ''no one right answer,'' as solutions which may be obscured using one ''lens,'' may become clearer after considering a number of different perspectives."* (Nestel and Bearman 2015 p.32).

For this thesis it is proposed that simulation is a pedagogy relying on a plethora of underpinning theories.

1.6 Theories of Learning Applied to Simulation

Berragan (2011) recounts how much of the literature now calls for a more theoretical approach to the study of simulation (Bligh and Bleakley 2006; Kneebone 2005; Bradley and Postlethwaite 2003). One way to accomplish this is to examine the learning theories that underpin simulation. This section will illustrate how simulation does not simply rely on one theory or approach. **Table 1.2** below outlines the three main theories: behaviourism, cognitivism and constructivism and illustrates sub-theories that have developed from the premise of the main theories. After the table, the three main theories will be discussed in more detail and their contribution to simulation explained with exemplars.

Table 1.2 Theories of Learning Mapped to Key Indicators for use in Simulation

Theorist	Premise	Key indicator for use in simulation
	Behaviourism	
Watson (in Schneider and Morris 1987).	Rote learning.	Use of Mnemonics/checklists for skills.
Skinner 1953.	Operant conditioning.	Rewards for correct actions (e.g. mannequin response).
Thorndike (in Walker 1992).	Connectionism and law of exercise.	Repeat skills and opportunity to practice.
Simulation-based Mastery learning (McGaghie et al. 2014).	Using simulation with formative assessment and repeated practice till all achieve outcomes (may take learners different amount of time).	Repetition promotes safety.
Deliberate practice (Marcus et al. 2013).	Safety to practice dangerous procedures. Feedback crucial.	Repeated practice till competent promotes safety in clinical areas.
Self-regulatory learning (Zimmerman 1990).	Repeated opportunities.	Practice with checklists or feedback from technology.
	Cognitivism	

Piaget (in Huitt and Hummel 2003).	Equilibration Assimilation Accommodation.	Importance of getting the context right – matching documents/equipment/staff. Simulation in own workplace Use simulation to develop clinical reasoning and problem solving in safe environment.
Vygotsky 1962.	Environment Proximal Zone Development.	Realism Fidelity Role of facilitator to construct achievable learning outcomes.
Bandura 1977.	Learning by observation.	Active Role play versus observer role / use of videos

Constructivism

Dewey 2012.	Construct own learning Have own knowledge – build on this and use group knowledge.	Pre-and post-debrief Aware of what students have done before so scaffold activities Team based activities and group learning.
Piaget and Dewey 1998.	Teacher not didactic.	Teacher as facilitator.

Social Constructivism Semiotics Bezemer 2013.	We learn in the social context by watching and discussing with others.	Scenarios are designed for students to practice skills and decision-making.
Situated Learning Lave and Wenger 1990.	Learner participates in communities of practice.	Very useful for team work, crisis resource management.
Practice-based approaches to simulation-based education such as socio-material Bligh and Bleakley 2006; Hopwood et al. 2014; Fenwick and Dahlgren 2015.	Way of learning and real world closer – simulation as a pedagogy bridges the gap.	Students experience different scenarios some of which may rarely occur in practice or which students don't get much experience in.
Experiential learning Dewey 2012.	We learn by our experiences.	Active roles in simulation.
Reflective learning and activity theory Kolb 1984; Cioffi 2001.	Need to engage in a thoughtful process what went well, what could we do differently.	Use of debrief post simulation.

1.6.1 Behaviourism

Behaviourism was founded by John B. Watson (1878-1958) who suggested that learning was achieved by a behavioural response to specific stimuli. In this approach the student is a passive recipient of the knowledge the teacher wishes to impart. The environment is seen by behaviourists as crucial to learning and this can be manipulated so that learning can occur (Schneider and Morris 1987). This assertion is confirmed during simulation if we consider how the physiological parameters of a high-fidelity mannequin are adapted as a response to a student's actions or inactions. Behaviourism is characterised by rote learning and repetition of skills and these methods can be seen to underpin healthcare professionals learning. For instance, the use of mnemonics such as the 'DRSABC' (Mnemonic for danger, response, shout for help, airway, breathing, circulation) used to teach basic life support (Linnard-Palmer et al. 2013)

Thorndike (1874-1949) proposed the theory of connectionism. This is the process of forming associations (connections) between sensory experiences and behavioural responses. Thorndike also proposed the *'law of exercise'* which suggests that to strengthen these connections practice is required (Walker 1992). Conversely, failure to practice weakens the connections and therefore the learning. The law of exercise provides an explanation for 'skills decay' (Arthur et al. 1998); in layman's terms we adopt the adage *'use it or lose it'* to explain this concept. This justifies attending refreshers in key simulated activities, such as basic life support, so healthcare professionals can maintain their competence.

Thorndike recognised that in animal experiments different actions were tried before a successful outcome was achieved. Over repeated incidents the desired actions were achieved more quickly until finally the right actions to gain a result were performed immediately. He formulated the Law of Effect (1898) which stressed the importance of a learner's efforts being followed by success (Lovell 1980 p.32); in the case of the animal experiments success meant food. Pavlov (1849-1936) developed the passive stimulus response, the renowned experiment involved a bell being rung (the stimulus) when a dog was fed, and later the dog would salivate (the response) when a bell was rung even though no food appeared (Lovell 1980 p.33); he termed this classical conditioning.

It is useful to be cognisant of this phenomenon when facilitating simulation as it serves as a useful reminder to facilitators about the emotional aspect of learning. A student's past experiences may have been difficult so the stimulus provided by simulation may evoke feelings of fear, intimidation or inadequacy (Decarlo et al. 2008; Lundberg 2008; Lasater 2007); emotions which the facilitator needs to manage sensitively so that learning can be achieved (Lundberg 2008; Jeffries and Rizzolo 2006).

Skinner (1953) developed these ideas about trial and error and classical learning into operant conditioning. This is to do with the effect of reward and punishment. He suggests that behaviour is regulated by its consequences; we don't behave randomly but with purpose to bring about a desired outcome (Naour 2009). It is suggested that goals, rewards, and incentives are examples of positive '*reinforcers*' whereas punishment, whether deliberate, such as smacking, or merely unpleasant outcomes, such as failing an exam, are negative '*reinforcers*' (Lovell 1980 p.37). During a simulated scenario, a volunteer patient complaining of pain will be managed by administering analgesia; the mannequin's blood pressure will improve once intravenous fluids are commenced and so on. The quicker this response is obtained then the student sees a more favourable result in the simulation and hopefully these actions and reinforcers are then transferred to practice.

The behaviourist approach is useful in simulation because it supports the development of clinical skills and can attempt to produce a constant response when learners are in similar circumstances. Performing an airway manoeuvre in an unconscious patient can be practiced on mannequins in simulation before being put into practice in the clinical setting. More recently medical educators have returned to behaviourist ideals and introduced simulation-based mastery learning (McGaghie et al. 2014) and deliberate practice (Marcus et al. 2013) whereby clinical skills are repeated until competence is achieved.

Whilst very useful in healthcare professional's education, behaviourism cannot cover all the learning required because it is less concerned with critical thinking, problem-solving, autonomy and emotive responses. Although behaviourism is valuable to address the more skills-based simulation required of a nurse or

healthcare professional then the cognitivist and constructivist philosophies have added dimensions more concerned with cognitive processes like decision-making.

1.6.2. Cognitivism

Cognitivism expounds the notion that learning is the reorganization of experiences; so, while behaviourists stress the role of the environment, cognitivists are more interested in what students do with the information. Piaget (1896-1980) and Vygotsky (1896-1934) are classed as leading cognitivists; Piaget, who was from western culture and Vygotsky from eastern, both explored child development and the optimum conditions for learning. The sense of Vygotsky's work, which was primarily about developing theories of language development, is often lost in translation from Russian to English and can therefore be open to misinterpretation. It is widely accepted that Vygotsky's theories were based on the existing Marxist philosophies of his era. Learning is seen to evolve through language as a response to the social world where social class is determined by who owns, who produces and who uses the tools (Smagorinsky 2011). Despite the translation issues some key principles seem to be accepted, the first is that environment is critical. The second is the idea of a 'zone of proximal development' (ZPD); this is the difference between what a learner can do without help and what they cannot do without help. The premise being that a child will follow an adult's lead. This concept was not fully developed by Vygotsky as it was introduced in the last ten years of his life. Nevertheless, he saw the role of education was to give a child experiences within their ZPD thus promoting individual learning. These experiences should be built, one on top of another, like 'scaffolding' (Smagorinsky 2011). Transposing this ideology to simulation gives us again the importance of environment and psychological fidelity. It explains the crucial role of the facilitator, which is to provide experiences through which a learner can learn, providing pre-learning and repeated practice. This is especially pertinent when we need students to practice rarely occurring events or ones they may get little exposure to in clinical practice.

Piaget proposed that the motivation for cognitive development is the concept of 'equilibration'. That is the drive in a child to produce an optimal state of equilibrium between cognitive structures and the environment. If internal conflict occurs in thought, then an individual can use either assimilation or accommodation to

achieve equilibration. Accommodation is the child's ability to adapt to the environment; for instance, standing on a stool to reach a toy. Assimilation is the child's ability to change the environment; this may be achieved mentally by pretence; or, the child may change the environment physically – as an example - making 'pies' out of mud. Piaget terms the concepts the child develops to understand his environment as 'schema' (Sutherland 1995).

During simulation both these processes occur as it is normal for a student to strive to achieve equilibrium. Simulation provides opportunities for students to engage with scenarios using mannequins or simulated patients. They are provided with information in the form of case notes and vital signs, verbal and non-verbal cues (a patient holding their chest and complaining of chest pain) that then require actions and decisions to be made. Which patient to see first, what vital signs to record, when to call the doctor and so on. Cognitive theory then underpins simulation particularly in developing clinical reasoning and problem solving – the learning that involves making choices and decisions rather than just following a rigid pattern or framework.

The role and importance of observation is identified by Bandura (1977) who recorded that students could learn new actions by observing others perform, even if those observing did not have to perform the actions at the time of learning. For the purposes of simulation this rationalises the need for pre-briefing material and the use of video to showcase professionals undertaking skills or delivering aspects of patient care. The student can then build this learning into cognitive schema before attending simulation sessions. This also means that groups of students can be exposed to a simulation activity in different roles, some as actors, and some as observers while others act in the actual healthcare professional role. Schaar, Ostendorf and Kinner (2013) demonstrate the usefulness of the observer role but the effectiveness of being a main role player compared with that of an observer is still unclear due to lack of evidence (Stull and Mayer 2007).

Piaget's theory although often seen as separate to constructivism, does have similar ideology. For instance, Piaget believed children constructed their own schemata (knowledge) from their own experiences in their surrounding environments. However, his views on the importance of genetics and the concrete

stages of children's development are not adopted by constructivists. Rather they view cognitive development as a gradual process of modifying existing concepts.

1.6.3 Constructivism

Constructivists such as Dewey, Bruner, von Glasersfeld, Mezirow and Knowles argued that knowledge develops by a process of active construction and reconstruction of theory and practice. Their belief is that learners have their own knowledge and experience, and can use this to problem solve as they build their own unique understanding (Murphy 1997).

During simulation constructivism has the learner at the centre of the education as the learner constructs meaning in a team-based, collaborative learning environment. This is a very different approach from behaviourism where the learner is passive. For constructivists, learners become an active participant in the learning process. Naturally this then affects simulation design, for Dewey (2012), the construction of meaning in learning environments happens through experiences and interactions with others – simply telling students what to do will not embed new ways of thinking or acting. This he termed '*experiential learning*'. For simulation, we can see that activities can be constructed that facilitate a team approach, groups of students deciding on the correct actions, inter-professional activities and so forth, all examples of experiential simulated learning (Bearman et al. 2013).

For both Piaget and constructivists, the teacher employs the role of facilitator rather than a mere provider of knowledge. This role means that an appropriate and stimulating learning environment needs to be provided. The challenge for the constructivist is to understand each student's prior learning so this can be built upon. For the providers of simulation this can be partly met by providing pre-learning materials but also by scaffolding (Smagorinsky 2011) simulation sessions throughout the curriculum. Pre- simulation and post-simulation briefing sessions can assist the facilitator to be aware of students' existing knowledge.

Many of the learning theories are based on child development but as can be seen connections can be made to adult learning. Adult learning was a term proposed by Knowles (1968) to make a distinction for learning that took place after school years. He makes six key assumptions about an adult learner who he suggests:

> *"has an independent self-concept and who can direct his or her own learning, has accumulated a reservoir of life experiences that is a rich resource for learning, has learning needs closely related to changing social roles, is problem-centered and interested in immediate application of knowledge, and is motivated to learn by internal rather than external factors"* (Merriam 2001 p.4).

Still based on Vygotskian social constructivism, Lave and Wenger (1990) developed these ideas about adult learning by describing learning as occurring when it is within an activity set in context and culture. This contrasts with classroom-based learning activities which usually involve abstract knowledge. They describe it as a largely unintentional process rather than a deliberate one. Lave and Wenger call this phenomenon 'legitimate peripheral participation.' (1999 p.22). This 'situated learning' relies on settings and situations that normally need certain knowledge. The crucially important factor in situated learning is social interaction and collaboration. Learners first see specific behaviours and beliefs being displayed as a novice, in the periphery. Then as they become more involved with this 'community of practice' they develop into the experts themselves (Kneebone 2005). What is crucial is the participation as a way of learning "*of both absorbing and being absorbed in the 'culture of practice'*" (Lave and Wenger 1999 p.23). Situated learning can be seen to clearly describe the professional learning of nurses and simulation often seeks to emulate this approach. The whole experience of simulated learning can be seen to correspond to active learning as Jeffries (2005) suggests. Also based on Vygotskian notions of social constructivism, Collins et al. (1987) propose '*cognitive apprenticeship';* as in the apprentice model where an apprentice learns from his master, so examples are given to students to model responses on real life scenarios.

Under these conditions then simulation allows the student to be an active learner and central to the learning process, it allows them to demonstrate self-motivation and direction. Moreover, simulation affords students the opportunity to practice, in a safe environment, rarely occurring events or procedures that would be dangerous to do for the first time on a real patient. This allows students to make mistakes from which they can learn; but Jeffries (2007 cited in Levett-Jones et al.

2011) make clear the importance of establishing roles and ground rules, so that students know that they can make errors in a safe and non-threatening environment.

Once these opportunities have been engaged with, feedback is then the singularly most important feature of the learning process and has been recognised as crucial in simulation-based education (Norcini 2010; Issenberg et al. 2005). This can be referred to as the 'debrief' or reflection part of the session. Reflection has recognised benefits for professional practice and self-assessment (Jasper and Rosser 2013; Schon 1991). Issenberg et al. (2005) outline that these debriefing sessions should follow each simulation episode and should be learner focussed and facilitated by an instructor. Suggested strategies to conduct these debrief sessions include videotaped review, informal participant discussions, instructor feedback and direct simulator feedback. The latter can include feedback from patient volunteers and this can be a very powerful, emotive learning tool (Webster et al. 2012).

Three main seminal philosophical approaches to learning, along with their adaptations, underpin simulation: behaviourism, cognitivism and constructivism. The strong message emerging from all these theories is the value of experience and the pedagogic setting "*the practice that a teacher (or teachers), together with a particular group of learners, creates and enacts and experience*" (Leach and Moon 1999 p.267). Simulation then is a complex method with reliance on a multitude of theorists explaining how it might be effective as a learning strategy and deserving of being named a pedagogy. This chapter has included some of the more renowned theorists and shown how they link to simulation; it is recognised that this list is not exhaustive. What is suggested is that theories can guide facilitators to provide the right environment and conditions for the achievement of a plethora of learning outcomes.

To summarise, the maxim in this thesis is that simulation is a way of facilitating learning, a method rather than the underpinning methodology, it is a technique using a range of equipment and human resources and rehearsal and relying on all the main theories of learning. As a recognised method of teaching it can be reasonably described as a pedagogy.

1.7 Rationale for Current Research

Simulation has already become an established pedagogy for teaching clinical skills to healthcare professionals and has been incorporated internationally into nursing curricula (Cant and Cooper 2010). In nurse education, simulation facilitates learners to practice clinical skills, team and interprofessional working, clinical decision-making, and rarely occurring events in a safe manner before practicing on real patients (Ricketts 2011; Department of Health 2007). The United Kingdom (UK) Nursing and Midwifery Council (NMC) and Council of Deans for Health (2007) have recognised it as an inherent part of the nursing pre-registration curriculum and allowed it to replace clinical practice hours in a pre-registration nursing programme (NMC 2007). It is projected that the use of simulation will rise as placement opportunities fall (Wilford and Doyle 2006; Maran and Glavin 2003). Therefore, it becomes incumbent on educators to demonstrate the effectiveness of simulation (Walton et al. 2011; McCaughey and Traynor 2010).

The research concerning simulation to date offers key messages that are repeated throughout the literature. It is popular with many educators (McCaughey and Traynor 2010; Akhtar-Danesh 2009) and students alike (Hope et al. 2011). In an integrative review performed by Foronda et al. (2013) sixteen articles (in English and Chinese) from 2007-2012 were found to convey student nurse satisfaction with simulation as a learning approach. Students recounted that they "*enjoyed the simulation experience and felt that it facilitated their learning*" (Partin et al. 2011 p.88).

Evidence is also available that shows gains in student self-confidence. Cant and Cooper's systematic literature review in 2010 found student self-confidence was improved by simulation. These findings were supported by Foronda et al.'s later integrative review in 2013 which found twenty-six studies showing that confidence or self-efficacy increased because of a learner' simulation experience. Conversely, Yuan et al.'s (2012) systematic review suggested that there was not enough evidence to claim a correlation between simulation and students' higher confidence level. Of course, an increase in self-confidence can have negative consequences if this outweighs ability, knowledge and skills.

The goal of any teaching and learning activity is permanent knowledge acquisition (Decker et al. 2011) so it is unsurprising that knowledge and skills attainment is perhaps the prevalent area of simulation research. Twenty-nine studies, out of the one hundred and one sampled, showed simulation facilitated skills attainment or knowledge (Foronda et al. 2013). Knowledge and skills are often tested together as simulation demands both spheres of learning. Research studies examining improvement in skills performance after simulation is usually assessed by objective structured clinical examination (OSCE) (Merriman et al. 2014; Alinier et al. 2004).

Halpern and Hakel (2003) recognised that it is important to ascertain if the curricula that has been taught is then applied. There is limited empirical evidence on the benefits and outcomes of simulation as a teaching and learning strategy (Handley and Dodge 2013; Henneman et al. 2010) and to date no synthesis of all the available evidence to assess its effects on clinical practice (Ewertsson et al. 2015; Aebersold and Tschannen 2013). As simulation is very resource intensive such evidence would be useful, to both budget holders and educators, to establish whether it is an effective educational strategy (Gaba 2007). Its identification as an effective strategy depends on patient satisfaction, safety and survival as these are ultimately dependent on the behaviours and skills of those working in healthcare (Kim et al. 2016).

Bleakley's (2006) warning is still pertinent - we must ensure that we do not promote '*simulation of learning'* rather than '*learning by simulation.'* Moule (2011) asserts that we need evaluative research to examine the impact of simulation and to see what extent learning is transferred to practice. Zitzelsberger et al. (2017) confirms there is still a paucity of evidence available around the transfer of skills from simulation to the clinical area. It became apparent that not only the 'how' did learning occur but also the 'how much' learning was adopted was of importance - how much learning was transferred to clinical practice and how can we best measure this.

1.8 Overall Aim of Research

Therefore, the overall aim of my research is to extend the knowledge base about the transfer of clinical skills to clinical practice after simulation in pre-registration nurse education. Dissemination of key findings from this thesis has commenced and in **appendix 1** the conference proceedings delivered to date are outlined.

At the core of the thesis is the question: did learning clinical skills using simulation transfer to practice and how can we evaluate such skills transfer? Nursing is concerned with direct patient care; so, it is important to establish if the transfer of learning has occurred from the simulation experience to clinical practice to enhance the safety and well-being of patients. It is critical, when using simulation as an educational intervention '*to get it right'* (McGagie et al. 2006).

The aims of the thesis overall and of each study are now presented to demonstrate the inductive process, and how the research developed from the broad remit to the individual specific studies. Also, the chapter they are presented in will be outlined and the individual study objectives.

Chapter One: Introduction

The overall aim of my research is to extend the knowledge base about the transfer of clinical skills to clinical practice after simulation in pre-registration nurse education

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Chapter Two: Broad literature review

The main aim of this literature review was to identify what evidence exists to support transfer of learning following simulation activities to clinical practice for healthcare professionals.

- What evidence at level three and four of Kirkpatrick's training evaluation is there that simulation of clinical skills in healthcare education transfers to clinical practice?
- What are the methodological strengths and weaknesses of this evidence?
- What evaluation tools do they use in the studies?

Chapter Four: Integrative review

The main aim of this integrative review was to identify what evidence exists to support transfer of learning following simulation activities to clinical practice for student nurses.

- What are the effects (real or perceived) of learning clinical skills through simulation on student nurses' behaviours in clinical practice environments?
- What are the methodological strengths and limitations of research examining the effect of simulation on student nurses' behaviour in clinical practice?
- What evaluation methods have been used to assess whether student nurses' behaviour in clinical practice has changed following simulation?

Chapter Five: e-Delphi study and interviews

The aim of the e-Delphi was to see if there was consensus on the use of best practice statements for Scottish nurse academics. The aim of the staff interviews was to explain any that arose from the e-Delphi.

e-Delphi Objectives

- To explore the current use and practice of simulation and simulation best-practice statements across Scottish nursing schools.
- To determine Scottish-wide level of consensus on simulation best-practice statements for use in nursing curricula.
- To gauge Scottish nurse academics willingness to adopt the agreed simulation best-practice statements and be involved in further research on the effectiveness of simulation.

Interview Objectives (post e-Delphi study)

- To explore nurse academics' perceptions of staff training/education on the topic of simulation.
- To explore whether nurse academics perceive further staff training or education in simulation is required.
- To explore nurse academics views on barriers, enablers and 'blue sky' thinking about staff development in simulation.

Chapter Six: feasibility study

To conduct a feasibility study to explore the parameters of evaluating the transfer of learning respiratory assessment skills from simulation to clinical practice for physiotherapy students.

- Establish availability of and time taken to complete relevant placements.
- Identify whether students perceive that transfer of learning has occurred.
- Explore whether simulation activities, interview questions and questionnaires are fit for purpose.
- Establish recruitment and retention rates to a study of transfer of learning from simulation to practice and how to protect students as respondents.

Chapter One Summary

This preliminary chapter has provided a rationale for the focus of the study and route of study chosen. It has set out how the thesis will be presented, suggested key definitions used and explored the concept of simulation as a pedagogy. The need for the study and the overall aim have been identified. The next chapter will focus on the literature review undertaken to justify the focus the thesis.

Within the researcher's own sphere of practice, the education of student nurses, simulation is used as a vehicle for learning clinical skills and rehearsing their application. Often, as in stage one, this occurs before any contact with real patients – but how effective is the transfer of skills to clinical practice? Ensuring the safety and well-being of the patient is paramount and perhaps goes without saying. What is also critical is that students feel prepared to go on placement in the first place, confident to practice skills taught in university. Better preparation, I feel, contributes to students not been overwhelmed by placement and may prevent attrition. I became very aware that it was important on many levels to justify the use of simulation, morally, financially and educationally. This thesis aimed to look at the transfer of learning clinical skills by simulation to clinical

practice. It sought to establish what had been discovered so far, and what methods of evaluation had been employed and the strengths and weaknesses of the studies. This thesis represents this journey of discovery and consists of three central studies and an introductory literature review. The lessons learned will hopefully feed into a post-doctoral study examining transfer of learning skills by simulation to practice and inform the educational practice of both the researcher and other academics.

CHAPTER TWO: TRANSFER OF LEARNING SKILLS FROM SIMULATION TO CLINICAL PRACTICE FOR HEALTHCARE PROFESSIONALS: A PRELIMINARY LITERATURE REVIEW

Overview of Chapter Two

This chapter presents the preliminary literature review conducted that provided a background for this thesis. It includes studies from a range of healthcare professionals that both examine the perceived effectiveness of simulation to change clinical practice and those that evaluate the transfer of learning skills to clinical practice. An iterative approach was adopted for the literature searches over the doctoral study-time (Sebastian and Dubravka 2010). The final search was completed in March 2019. The key messages from these searches were used to inform the next phase of the thesis the integrative review, e-Delphi, interviews and feasibility study. It was important to explore the wider healthcare contexts before focussing on student nurses specifically. It was important to establish if there was evidence of transfer for other healthcare professionals before looking at student nurses in order that comparisons might be made. In addition, research studies involving other health care professionals may contain important guidance on how research may best be structured to evidence transfer of learning. What tools were used to evaluate transfer and might these be used for student nurses. By evaluating the research studies for methodological strengths and weaknesses lessons may inform future research.

2.0 Introduction

Educators of healthcare professionals are concerned with ensuring that their students are prepared for clinical practice; this preparation is key and is guided by professional bodies. In the case of nursing, this guidance is provided by the Nursing and Midwifery Council in the form of the Standards for Education (NMC 2018). Nursing students are required to spend half of the 4,600 hours, required to become a registered nurse, in clinical practice. Students should be adequately prepared for clinical practice so they can engage safely with patient care and apply the knowledge and skills they have learned and practiced. But students often get

limited access to certain patients, procedures or conditions due to a high turn-over of patients and shorter admission times (Issenberg et al. 2005). Clinical areas are often very busy and are frequently reported as being short-staffed; this can result in the attention of clinical staff being less focussed on student learning. Currently the Royal College of Nursing are campaigning for legislation on safe staffing levels (RCN 2019). These factors, together with increasing student numbers set by the government to replace the high numbers of nurses that are leaving the profession (Scottish Funding Council (SFC) 2019), indicate educators should endeavour to prepare students fully for clinical placement and attempt to ease the pressure on clinical colleagues.

The NMC recognise that simulation can aid that preparation and can also promote safety:

> *"Simulation: an artificial representation of a real-world practice scenario that supports student development and assessment through experiential learning with the opportunity for repetition, feedback, evaluation and reflection. Effective simulation facilitates safety by enhancing knowledge, behaviours and skills"* (NMC 2018 p.14)

If simulation does form part of that preparation it is essential to ascertain whether it is an effective pedagogy because it must be recognised simulation is resource intensive requiring equipment, space, people, and time (Lapkin and Levett-Jones 2011). As discussed in Chapter One the 'gold' measurement of healthcare simulation evaluation is - has the learning of clinical skills been transferred to directly to patient care and clinical practice? Have we got it right? Therefore, how simulation effectiveness is being evaluated requires exploration, to accomplish this aim a broad literature review was undertaken.

The appropriate evidence will be identified using Kirkpatrick's (1959a) steps that he developed to encourage the evaluation of management or human resource training more thoroughly. Kirkpatrick himself originally referred to these four evaluation points as 'steps' but they are more frequently described as 'levels' and in this thesis, this is how they will be referred to forthwith. Kirkpatrick's levels have been adopted by educationalists to evaluate educational experience

(Praslova 2010) and both medical and nursing evaluations of educational experiences have made use of them (Abdulghani et al. 2014; Lee et al. 2014).

Kirkpatrick outlined four levels that could be evaluated to ascertain if training outcomes had been met and improve the thoroughness of that evaluation. These were reaction (1959a), learning (1959b), behaviour (1960a) and results (1960b). Reaction (level one) involved the satisfaction of attendees with the course, their feelings about it – for example did they like it. This is recognised as being straightforward to measure, consequently, it is carried out extensively, often by using questionnaires and rating charts. Level two of learning is concerned with what knowledge has been acquired, for example finding out what principles and facts have been understood. This could be assessed by performance in class or written exam questions, multiple choice questions and so forth. The next level is behaviour (level three), for example whether the person changed their behaviour in the workplace, which can be assessed by observation. In Kirkpatrick's original work, business organisations were targeted and behavioural criteria were typically operationalised as supervisor ratings or objective indicators of performance such as job outputs (Landy and Conte 2007; Arthur et al. 2003; Alliger et al. 1997). Kirkpatrick (1976) proposes that a 'before and after' approach is recommended to evaluation, with a wide a range of different groups of evaluators being involved as possible. This could include the individual themselves, their superiors, their subordinates and their peers. In nurse education, it would be useful to add the recipient of care, the patient as a customer. Kirkpatrick also advocates the use of a control group, for instance those who have not received any training. The fourth level of 'results' could be determined by profits, drop in absenteeism, fewer complaints, quicker delivery times; things that could be measured at an organisational level.

Other theorists have made adaptations to Kirkpatrick's original ideas but the four levels have mainly stayed integral to the model. Hamblin (1974) proposed a fifth heading as he divided the 'results' level into two: 'intermediate' classified as job behaviour, and 'ultimate' classified as the results. When conducting an evaluation this allows discernment between the outcomes for the organization in terms of productivity, sales, and absenteeism; and secondly, the effects on costs and cost effectiveness (Bee 1994).

Warr, Bird, and Rackham (1970) presented an alternative four-level framework, consisting of context, input, reaction, and outcome (CIRO). This model takes us back a step to consider the training needs of a group (context) and secondly what resources are required (input). Reaction evaluation is like Kirkpatrick's level one. Outcome evaluation is like Kirkpatrick's level two, three and four: immediate, intermediate, and ultimate outcomes (Reio et al. 2017).

Kirkpatrick's framework is not without criticism, with suggestions that it is too linear and the levels are assumed to build on one another. Indeed, only a moderate relationship has been found between learning criteria and behavioural criteria (Arthur et al. 2003; Alliger et al. 1997). Arthur et al. (2003) suggest this is because post-training environments may not guarantee opportunities for the learned skills to be demonstrated. This may be especially true for student nurses who may not be given certain opportunities or be responsible themselves for initiating patient care and may affect the amount of opportunity to collect robust evidence. The link between learning and behaviour change is not straightforward, as of course the individual must also want to change. Kirkpatrick quoted Katz (1956) who stated that five predispositions must be present for behaviour change in human relations skills. An individual must want to improve, they must recognize their own weaknesses, the workplace must be permissive, they must have help from an interested, skilled person and they must be allowed to try new ideas. These can all be seen to relate to clinical skills with the caveat that trying new ideas would not equate to making up different ways of performing an intravenous cannulation for example; rather, it should be recognised that an individual, such as a student, can be facilitated to try new skills post training.

Alliger and Janak (1989) recognise that Kirkpatrick's levels for evaluating training filled a need for evaluation criteria and that it became an accepted approach in industrial and organisational psychology (Cascio 1987). They outline that its advantages were the simplistic language and helpfulness in framing evaluation using a 'rough taxonomy' (Alliger and Janak 1989 p. 331). This simplicity, they then argue, has led to the model being accused of three assumptions, which Kirkpatrick himself did not claim nor intend. Alliger and Janak (1989) outline these as follows, the first is that the levels are arranged in ascending value, the second that they are causally linked and the third that they are positively correlated.

Alliger and Janak (1989) argue that these are indeed just assumptions and not what Kirkpatrick himself intended the levels to be which was just a: "*first, global, heuristic training evaluation"* (1989 p. 339).

Holton III (1996) claims that the Kirkpatrick approach is flawed, opening a debate as to whether Kirkpatrick's levels are a model or a taxonomy. It may be argued that such semantics are superfluous to Kirkpatrick's (1996) original view, as these levels were merely proposed as an impetus for trainers to consider evaluating training more extensively. Holton's proposed model of evaluation replaces Kirkpatrick's level of behaviour with *'individual performance'*. This Holton claims is because individual performance is a '*broader construct'* and a more appropriate descriptor of a human resource development objective. However, the nomenclature seems irrelevant, as what remains constant is what is being measured. What Holton usefully proffers are the influences on performance outcomes, which he describes as being consistent with the findings of Baldwin and Ford (1988) and Noel (1986) and this influence: motivation to transfer, transfer conditions (environment) and transfer design (ability).

Others from the medical profession have described methods of training evaluation that all fit with Kirkpatrick's original criteria of behaviour. Miller's (1990) pyramid assessment of clinical skills performance or competence begins with '*knows'*, *'knows how'*, *'shows how'* and then '*does'* which equates to Kirkpatrick's level three of behaviour change. This level Miller accepts is a very difficult entity to measure as it is the '*action'* behaviour of individuals engaging in professional practice.

McGaghie (2010) maps the '*translational science'* approach (Dougherty and Conway (2008) to medical education evaluative research

> "*T1 translational science is when results show trainee skill and knowledge improvement in laboratory settings. Research is T2 translational science when its results yield measurable improvements in clinical skill and knowledge of physicians at all levels, which are transferred and used in patient care settings. T3 medical education research demonstrates measured improvement in the health of individuals and*

populations as a result of education and training" (McGaghie 2010 p.3).

These more recent evaluation strategies have used different terminology but the essence of Kirkpatrick's levels remain constant. Hence, T2 is equivalent to Kirkpatrick's level three of behaviour change and the 'does' in Miller's pyramid. These behavioural criteria are also referred to as '*transfer criteria*', a terminology change proposed by Alliger et al. (1997). This was to emphasise that knowledge and skills had been taken from the training room and then applied in practice.

New taxonomic models are available that contain additions from cognitive psychology, for example, Kraiger et al. (1993); such factors are not addressed in Kirkpatrick's framework. However, the purpose for using Kirkpatrick as a theoretical framework in this thesis is merely to *identify* studies that are concerned with a change in practice rather than to perform an evaluation.

Although Kirkpatrick's original idea started in the 1950's it is still as relevant and useful today. It has stood the test of time and adaptations exist with the central tenets remaining true. If you want to evaluate training holistically then there are still four main areas to consider (Kirkpatrick and Kirkpatrick 2016); these tenets have been adapted by Cox et al. (2015) for medical profession education. Also, in Stroup's (2014) integrative review, simulation usage in nursing is described using Kirkpatrick's levels. Studies exploring student or teacher satisfaction with simulation are classed as Level one. Level two studies focus on learning attained by simulation and include both psychomotor skill development and knowledge attainment as well as self-confidence surveys. Changes in behaviour that is transferred to the patient care setting are Level three. Finally, studies evaluating simulation outcomes or the impact of simulation are classed as Level four. Level four can be determined by impact on patient safety, such as infection reduction or medication errors (Adamson et al. 2013). It is acknowledged that there is limited research available relating to Levels three and four (Stroup 2014). Simulation is used in the curriculum with the intention of students being enabled to transfer skills to clinical practice. Whilst it is worthwhile asking students if they are satisfied, feel more confident, and essential to assess what knowledge and skills they have acquired; the aim is to transfer all this learning to clinical

practice. Prion (2008) considers that an observed change in practice, of any participant, can be viewed as the '*gold standard*'. For nurse educationalists, this would mean observing student nurses out in the clinical environment after a simulation experience. Gathering evidence at level three is very challenging. Arthur et al. (2003) suggest this is because post-training environments may not guarantee opportunities for the learned skills to be demonstrated. For the population of student nurses under scrutiny in the thesis, high patient turnover, more acutely ill patients, care in the community and a lack of training places can mean access to certain patients and procedures is scarce and competitive. These factors add pressure to providing simulation of as high a standard as is possible to prepare students adequately for placement. For this thesis, any evidence at Level four will determine that behaviour change at Level three must have occurred. Level for would be more difficult than Level three as student nurses are not solely responsible for patient care. Also, the terms behaviour change, performance or transfer of learning will be used synonymously.

Kirkpatrick and Kirkpatrick (2006) levels of training evaluation, have been used to select studies exploring transfer of behaviours to practice. Cox et al. (2015) constructively links Kirkpatrick's levels to medical simulation using an evaluation proposed by Bewley and O'Neil (2013):

> *"Level 1: Reaction: Did the learner perceive value in using a simulator or participating in simulation training?*
>
> *Level 2: Learning: Did the learner's knowledge, skill, or attitude improve as a result of simulation training?*
>
> *Level 3: Behavioural Change: Did the knowledge, skills and attitudes acquired during simulator training* [or any simulation] *transfer to the clinical environment?*
>
> *Level 4: Results: Did the simulation training programme lead to improved patient outcomes?"* (Cox et al. 2015 p.828).

For transparency, in this thesis, level one includes student perception and satisfaction and level two includes knowledge, self-confidence and self-efficacy. For the purposes of this study the level three statement has been modified with

'all simulation' being added to 'during simulator training' because simulation may occur without a simulator with volunteer patients for example. Level four includes any patient outcomes such as lower infection rates. Throughout this chapter when levels one to four are discussed they refer to Kirkpatrick's levels of training analysis (Kirkpatrick and Kirkpatrick 2006) as illustrated by Cox et al. (2015).

The impact of knowledge is inextricably linked with the performance of skills. Knowledge underpins the skill and provides the healthcare professional with information on which to base decision-making. Educators are continually testing knowledge gained through a student's progression on any healthcare programme of study. Nevertheless, it can be asserted that knowledge alone will not change practice. In a study by Ford et al. (2010) the educational approaches of didactic lecture were compared with simulation based-training on the topic of medication administration. The mean quiz scores on medication (knowledge) of both the control and intervention group significantly improved. Meanwhile the observations of medication errors in clinical practice only significantly reduced (30.8% to 4.0%; $p<0.001$) for the group that had received simulation. For the control group, taught by didactic approaches, error rates were constant and even went up in the final post-training observation phase. Knowledge, as Kirkpatrick (1985) confirms is easy for a trainer, or educator, to assess. Conversely, evaluating transfer of skills to workplace environments is not. Whilst acknowledging that skills also require underpinning knowledge to perform them safely this review sought studies that evidenced the actual transfer to clinical practice of skills at level three or four of Kirkpatrick's training evaluation levels (2006).

In summary, evaluative research is needed to examine the impact of simulation and to see what extent learning is transferred to practice (Moule 2011). Does learning by simulation transfer to clinical practice, does it change the behaviours of healthcare professionals, and does it improve patient experiences and outcomes? It was considered worthwhile to establish what evidence was available at level three and four for healthcare professionals in general before proceeding to explore student nurses as a discrete population.

2.1 Aim

The main aim of this literature review was to identify what evidence exists to support transfer of learning following simulation activities to clinical practice for healthcare professionals.

2.1.1 Preliminary Literature Review Research Questions:

1) What evidence at level three and four of Kirkpatrick's training evaluation is there that simulation of clinical skills in healthcare education transfers to clinical practice?
2) What are the methodological strengths and weaknesses of this evidence?
3) What evaluation tools do they use in the studies?

2.2 Method

The research topic and questions were formulated before the search strategy was developed (Aveyard 2014).

2.2.1 Literature Search Strategy

PICOT

The PICO framework is sometimes adapted, and 'T' is added to include time-range of studies (Debono et al. 2013)

Participants: healthcare professionals and healthcare professions' students

Intervention: simulation

Context / comparators: Comparators - teaching methods other than simulation / clinical practice is the context

Outcome: evidence of transfer of learning at level three or four as described by Kirkpatrick (2006) / Cox et al. (2015).

Time 2009-2019 for individual studies and more recent dates for systematic reviews 2014–2019 because the reviews naturally included older studies.

The literature search that is presented in this chapter was last updated in March 2019. Bibliographic searches were made using the electronic databases listed below. Peer-reviewed studies published in English, from 2009 to 2019, were included in the search. **Table 2.1** summarises the inclusion and exclusion criteria

and the search terms used in the search strategy and lists the databases employed.

Table 2.1: Search Criteria and Terms

Inclusion Criteria	Exclusion Criteria
In English Systematic reviews, meta-analysis, integrative reviews or studies on clinical /motor skills (that may include cognitive skills).	Not in English Reviews or studies focusing solely on communication, teamwork, critical thinking, decision-making interprofessional working.

The inclusion criteria were designed to focus on clinical, psychomotor skills as the area of interest in the thesis rather than softer or cognitive skills alone. The intention is to inform clinical skills teaching and research practice

Search terms used:

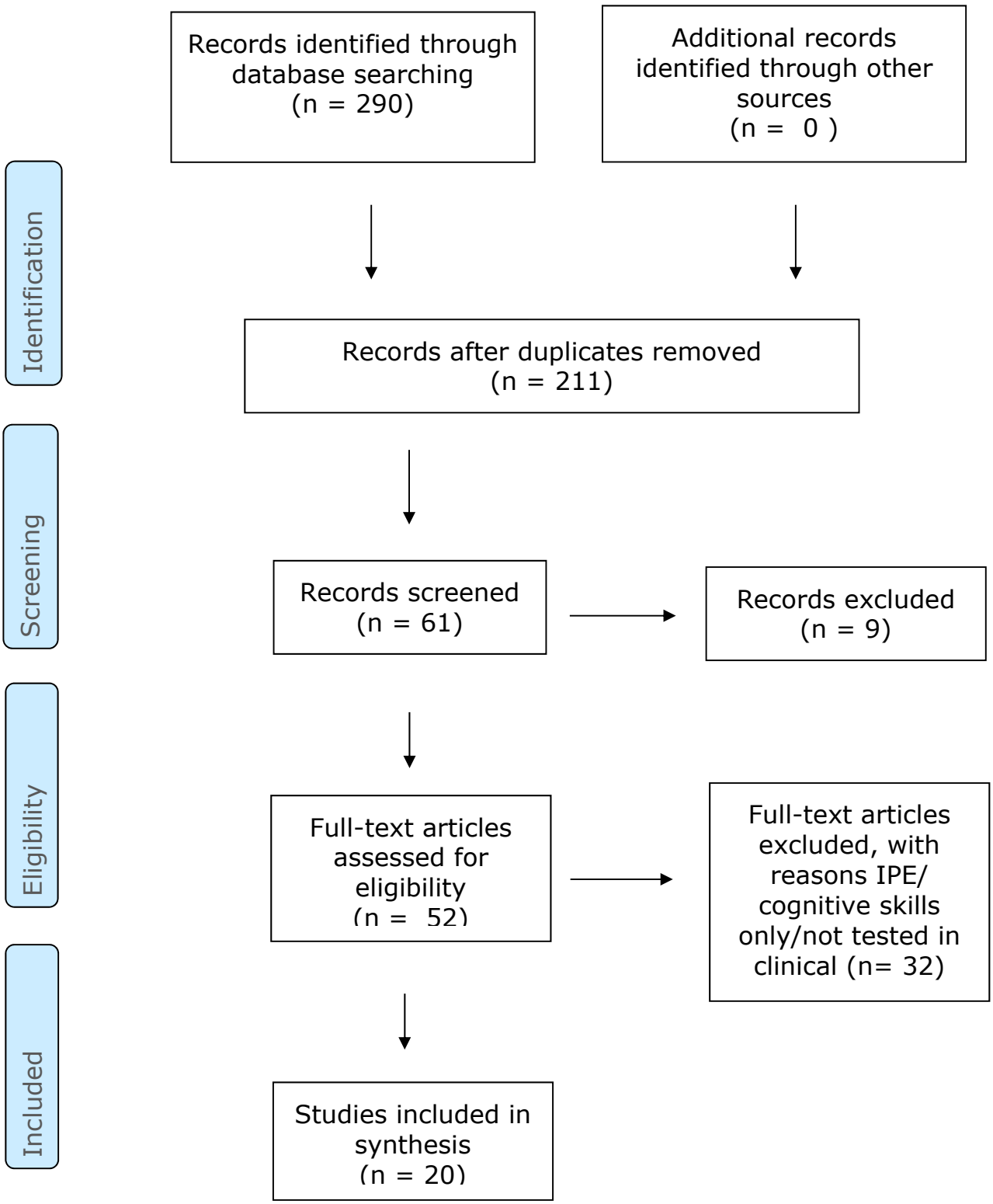
simulat*, AND systematic review OR meta-analysis OR integrative review.

Databases:

MEDLINE, AMED, SocIndex, Psychindex, CINAHL via EBSCOHOST, ERIC and JBI databases.

Initial searches were broad and used the term healthcare professionals but only two studies were generated. Therefore, specific healthcare profession's titles were used such as physiotherapist and searches completed individually. First the titles were screened and then the abstracts that were deemed relevant were selected and read before a final selection of full manuscripts were read and assessed by the primary researcher for eligibility. Studies were all peer reviewed and none were excluded due to their methodological quality because this also informed the goals of the literature review. **Chart 2.1** shows the numbers of studies found and reasons for exclusion represented in a Prisma flow chart.

Chart 2.1 Healthcare Professional/ Simulation/ Transfer/ Literature Review Prisma Flow Chart



2.3 Results

The results will be displayed in a narrative format (Cronin 2008). Tables are used to help present the selected studies clearly.

2.3.1 Types of Studies Found

In total eight reviews and twelve studies were found: Two literature and six systematic reviews 2014–2019 focusing on simulation were found linked to four different discrete professions: physiotherapy, nursing, occupational therapy, the medical profession and one that looked at healthcare professionals in general. In addition, twelve studies were found that looked specifically at transfer of learning from simulation to clinical practice. The study designs adopted for these twelve studies ranged from four randomised control trials and one that was not randomized; two pre and post-test studies; one descriptive observation and four qualitative studies. Each study or review was evaluated for methodological quality using a relevant critical appraisal tool JBI Critical Appraisal Checklist (2018) the results of which are presented in **table 2.3** (**appendix 2**). JBI quality appraisal tools were used as they provide thirteen tools each suitable for a range of research methods. The tools themselves have been peer reviewed, and their internal validity asserted by consensus. They are published widely and freely available. The questions posed in each tool are clear and unambiguous for a novice researcher to use (Buccheri and Sharifi 2017). For qualitative studies, JBI, suggest Hannes et al. (2101), offer a more coherent analysis because the tool focusses on congruity.

2.3.2 Summary of Results

Reviews: Four of the six systematic reviews (Roberts and Cooper 2018; Hegland et al. 2017; Bennett et al. 2017; Jansson et al. 2013), (see **table 2.4**) were in the fields of physiotherapy, registered nursing, occupational therapy and registered nursing respectively. Out of the studies the reviews included only seven studies (out of 79) looked at transfer of learning to clinical practice (level three Kirkpatrick 2006). One review (Cook et al. 2011) examined simulation research involving a range of healthcare professionals and reported on 45 transfer of learning to clinical practice studies out of a total of 609. The three medical profession reviews contributed a further 43 studies: Cox et al.'s (2015) review

looked specifically at patient outcomes; it is proposed that if a level four outcome is achieved a level three must have occurred. If infection rates have reduced (patient outcomes) some behaviour change has predisposed this occurrence. The Vanderbilt et al. (2015) review was focussed on laparoscopic surgical interventions whilst the review by Singh et al. (2014) examined gastrointestinal endoscopy. [All the reviews are presented in **table 2.4.**]

Table 2.4 Reviews with Relevance to Transfer of Learning to Clinical Practice 2014-2019

Main review, authors and date, profession and type of review	**Studies looking at transfer to clinical practice / total number of studies**	**Conclusion**
Bennett et al. 2017. Occupational therapy Literature review	2 out of 57 studies	There is limited evidence on the transfer of learning to clinical practice.
Cook et al. 2011 Healthcare professionals Systematic review and meta-analysis	Direct effect on patients 32 out of 609 studies 45 studies looked at transfer to clinical settings	Large effect for skills (but not all assessed in clinical) and moderate effect for patient effect
Cox et al. 2015. Medical profession: surgical interventions. Literature review	12 studies reporting Kirkpatrick level 3 and 4 outcomes	Simulation as an effective approach that allowed participants to transfer learning to practice (Kirkpatrick level 3), with patient benefits (Kirkpatrick level 4)
Hegland et al. 2017 Registered nurses Systematic review and meta-analysis	3 out of 15 studies	Limited evidence available for transfer of learning to clinical practice.

Jansson et al. 2013 Registered Nurses (critical care) Systematic review	1 study found	Jansson concluded we need more research, the one study (Ford et al. 2010) found did support transfer of learning and increased patient safety.
Roberts and Cooper 2018. Pre – registration physiotherapists Systematic review	1 out of 6 studies	No high-quality evidence that HFS improves motor skill performance in pre-registration physiotherapy students.
Singh et al. 2014 Surgical Systematic review and meta-analysis	39 studies (21 were RCT) gastrointestinal endoscopy 13 at level 3 (and 10 of those 13 were at level 4)	Simulation-based education in gastrointestinal endoscopy is associated with improved performance in clinical setting and improved patient outcomes.
Vanderbilt et al. 2015 Laparoscopic surgery skills Systematic review	21 RCT studies	Simulation can lead to demonstrable benefits of surgical skills in the Operating Room (OR) - decreased procedural errors and positive effects on overall patient safety.

One review on simulation in pre-registration physiotherapy students concluded there was no high-quality evidence to support simulation and transfer of skills (Roberts and Cooper 2018). It is worth noting that the focus of the review was very specific as it aimed to identify high-fidelity simulation studies compared to low-fidelity simulation ones in developing clinical skills in pre- registration physiotherapy education. There were only six studies selected and only one of the six examined transfer to clinical practice.

Three reviews (Hegland et al. 2017; Bennett et al. 2017; Jansson et al. 2013) found limited, low quality evidence of transfer to practice. Finally, four reviews found more evidence of simulation being an effective approach to facilitate transfer of clinical skills to practice (Vanderbilt et al. 2018; Cox et al. 2015; Singh et al. 2014. Cook et al. 2011). The medical profession and specifically, surgical interventions lend themselves to being practiced on a simulator before the skills can be transferred to a real patient and this is where most of the positive results are found.

Studies: Twelve healthcare studies were found that focused on transfer of learning from simulation to clinical practice 2009 – 2019; these are presented in **table 2.5**. Four studies were from Australia, two from the USA and one each from Brazil, Canada, China, Finland, Sweden, and the UK. All the studies were single site and the sample size ranged from nine to 112.

Five studies were randomised controlled trials (Cannon et al. 2014; Jensen et al. 2014; Fraser et al. 2011; Jiang et al. 2011; Domuracki et al. 2009). Two studies were pre and post- test interventions (Lavelle et al. 2017; Barsuk et al. 2016), four were qualitative studies (De Melo et al. 2018; Kumar et al. 2018; Aura et al. 2016; Buckley and Gordon 2011) and finally one was a descriptive observational study (Rutherford-Hemming 2012).

All the studies had positive outcomes and indicated that transfer of learning had occurred after simulation apart from the study by Jensen et al. (2014) which did not show improvements in the practice of cardiac angiography after simulation.

The studies used a range of evaluation tools: Four studies used self-reports or perception to evaluate transfer of learning skills to a clinical setting (De Melo et al. 2018; Aura et al. 2016; Kumar et al. 2016; Buckley and Gordon 2011). One study relied on observation / clinical evaluation by others (Rutherford-Hemming et al. 2012) and the remaining seven studies relied on evidence such as clinical documentation or clinical results such as accurate diagnosis or accurate performance of a procedure.

Table 2.5: Summary of Transfer to Clinical Practice Studies – Level Three and Four

Author, year, country	Participants, setting, design	Intervention	Comparators	Outcome measure
Aura et al. 2016 Finland	14 Radiographers in hospital Qualitative descriptive	simulation-based pharmacotherapy	None	Perception of students – interviews
Barsuk et al. 2016 USA	112 internal medicine residents and hospitalist physicians at a medical centre Pre and post test	Simulation-based mastery learning (SBML) thoracenteses (level 3 and 4)	Non-SBML trained	Survey: more bedside thoracentes es performed and less referrals
Buckley and Gordon 2011 Australia	50 Medical-surgical graduate nurses Qualitative	High-immersive simulation patient deterioration	None	Perception of staff collected by questionnai res
Cannon et al. 2014 USA	48 post-graduate year-3 orthopaedic residents RCT blinded	Simulator, knee diagnostic arthroscopy procedure	Normal institution specific education	Diagnostic knee arthroscopy procedure on a live patient.

				(level three/four)
De Melo et al. 2018 Brazil	12 obstetrics/ gynaecology healthcare practitioners Qualitative	Simulation post-partum haemorrhage	None	Self-reports
Domuracki et al. 2009 Australia	101 medical and nursing staff including students RCT	Cricoid pressure on a simulator	No training on simulator, didactic approach	Statistically significant results: Measurement of correct pressure on a real patient with a force plate
Fraser et al. 2011 Canada	86 first year medical students Hospital RCT	3 different simulations	Simulation on mitral valve regurgitation (MVG)	Group who had received simulation on MVG diagnosed more accurately o a real patient

Jensen et al. 2014 Sweden	54 residents RCT	Simulator training in cardiac angiography (CA)	No simulation	Results of real-life CA compared. No improvement in simulation group
Jiang et al. 2011 China	52 medical students Longitudinal control group of 32 students	Thoracentesis task simulator	Control group not had training on simulator	Clinical performance evaluations of thoracentesis
Kumar et al. 2018 Australia	N = 9 (7 midwives plus 1 simulated patient/1 simulation educator) Qualitative	Simulated birth emergencies	None	Self-reports through interview
Lavelle et al. 2017 UK	53 healthcare professionals 2 psychiatric triage wards Mixed-methods pre and post intervention design	Simulation: managing medical deterioration in mental health settings	None	Incident reporting increased by 33%

Rutherford-Hemming et al. 2012 Australia	14 acute care nurse practitioner students Descriptive observation	Simulated patient	None	Competency scores in clinical setting showed growth in clinical competency

Key: shaded dark blue = self-report/perception; grey = objective evidence, green = evaluation by others; red = no evidence of transfer found.

2.4. Discussion

The discussion will be presented in three sections: (i) an analysis of the evidence of healthcare professional's transfer of skills at level three and four (Kirkpatrick 2006) and considerations for the population of student nurses; (ii) an appraisal of methodological approaches used and appropriateness to student nurse education research and finally (iii) a critique of the evaluation tools used in relation to undergraduate nurse education.

2.4.1 Discussion: Evidence of Transfer at Level Three or Four

There is still relatively limited evidence available that implements post simulation transfer of skills for healthcare professionals as an outcome. One of the reviews (Roberts and Cooper 2018) reported no robust evidence in support of transfer of skills at level three for physiotherapy education. Indeed, only one study in their review assessed transfer of skills to clinical practice, a randomised control trial. This was by Jones and Sheppard (2011) who explored if simulation could replace clinical time by providing simulation prior to clinical placement for 31 students whilst the remaining 31 did not receive any simulation. A validated tool was used to evaluate student performance. They did not find any improvements in cardiorespiratory skills of students after simulation but as they only obtained data from 21 students, however, the sample size was underpowered (a sample size of thirty was required) so this may have affected the results.

Three reviews found limited evidence of achievement of level three and four outcomes (Hegland et al. 2017; Bennett et al. 2017; Jansson et al. 2013). The studies were often of poorer quality, mainly due to the lack of a control group in six of the studies (Gerrish and Lacey 2010). The study by Lavelle et al. (2017) did not have a control group; even though there was an opportunity because there were two wards involved in the study. However, ethical considerations of equity may have precluded this choice because it would have meant treating staff and patients differently. Staff on one ward would have had extra training, which may have benefitted patient care whilst the other area would have not been exposed to this potential advantage. When a control is used it is not always clear what form the control may have taken, for example, in the Cannon et al. (2014) study it refers to 'usual education' but does not outline what this entails which affects the transparency of the study.

However, the reviews from the medical profession generally found evidence to support level three and level four outcomes (Cox et al. 2015). This may be because skills such as surgical procedures or tasks are relatively straightforward to isolate and evaluate: A laparoscopy can be planned and observed whilst care of a deteriorating patient is not planned and can involve multiple professionals and is open to more extraneous variables. The use of simulators to hone a skill are becoming common practice before that skill is then performed on a real patient (Vanderbilt et al. 2015).

Of the individual studies eleven out of the twelve reported positive outcomes on transfer of skills to clinical practice. Only one, Jensen et al. (2014), did not report any evidence. However, the study design was a retrospective non-randomised study and as such is open to flaws and claims of bias. Poor performance on the course could not be adjusted for as groups were non-randomised. There was also different time lapses for participants between attending the course and performing a coronary angiography. Due to the retrospective nature it is unclear how much help and support each participant received in practice from other personnel. Of more concern perhaps was that the simulation session was not regulated, and criteria were not set for performing the simulated cardiac angiography. Therefore, very poor practice could have simply been replicated from simulation to clinical practice. The cruciality of what happens during simulation is resonant here as well as the importance of transparency about the simulation when publishing.

In summary, seven of the reviews and eleven individual studies all found evidence that transfer of learning had occurred. Key themes from the systematic literature reviews were positive outcomes of increased patient safety, lower training and patient care costs at Kirkpatrick levels three and four. Satisfaction with simulation, greater self-confidence, or self-efficacy, or knowledge were also found at Kirkpatrick levels one and two. Limited evidence was found around replacing clinical hours with simulation. How robust this evidence is can be appraised by examining their methodology and methods.

2.4.2 Discussion: Methodological Robustness of the 12 Research Studies

To achieve robust research studies there are challenges that need to be overcome as identified previously by scoping the healthcare professional reviews.

Previously, McGaghie et al. (2006), in a meta-analysis of medical simulation-based education, identified six consistent flaws:

> *1. "Poor knowledge of literature beyond the scope of the speciality.*
> *2. Lack of awareness of basic research design for education, behavioural science and clinical discipline.*
> *3. Poor attention to the measurement properties of the educational and research variable, particularly reliability.*
> 4. *Properties of educational intervention, such as strength and integrity, seldom described.*
> *5. Inconsistent statistical reporting conventions, with failure to report indices of central tendency (e.g. mean), dispersion (e.g. standard deviation) and effect size.*
> *6. No attention to statistical power."*
>
> (Cited in Garden 2008 p.229).

Of the flaws outlined in medical education research by McGaghie et al. (2006) several are replicated in the current review of healthcare studies.

These studies often had small sample sizes ranging from nine to a larger sample of 112. Studies using too small sample sizes may not achieve the power required to produce accurate results, and may produce a false significant outcome. In addition, to claim generalisability to the target population then enough power will be needed to make the study valid (Gerrish and Lacey 2010 p.149).

Moreover, all the studies were conducted on a single site, apart from the control group in the Jiang et al. (2014) study which came from a different institution but in the same country. Research incorporating multi-sites albeit different regions or countries is considered more generalisable to the target population (Parahoo 2014).

The study design may have also affected the results stated in the twelve studies. Randomised-control trials (RCT) (Cannon et al. 2014; Jensen et al. 2014; Jiang et al. 2011; Domuracki et al. 2009) are considered a higher quality evidence not only because there is a control acting as a comparator to the intervention group but

also selection bias is negated. However, only one of the RCT's, (Cannon et al. 2014), highlighted they had avoided measurement bias by blinding the assessors to which intervention the participants had been exposed to (masking the allocation) (Gerrish and Lacey 2010). Studies that have not masked allocation can produce inflated estimates of the effectiveness of the intervention (Schulz and Grimes 2002). Masked allocation is often difficult to achieve, when students are the participants; assessors may be, by necessity, aware students have been receiving further training perhaps because they have been absent from clinical placement. It would be beneficial to consider ways in which masked allocation can be achieved for future studies that have a control versus intervention group.

Two studies were pre and post- test interventions (Lavelle et al. 2017; Barsuk et al. 2016). Albeit a simple study design to implement, in which a change in outcome is reported after an intervention, it does not assure cause and effect. The outcome could have been affected due to three reasons: temporal effects, testing effects and regression to the mean (Gerrish and Lacey 2010). Temporal effects might be changes that would have happened over time anyway. This is unlikely in either of Barsuk et al.'s or Lavelle et al.'s (2017) study because the reporting rates for a deteriorating patient would have already reduced in Lavelle et al.'s study or less bedside thoracenteses performed and more referrals in Barsuk et al.'s study if time was the motivating factor. Testing effects may have affected their outcomes because the initial measurement highlighted to staff the importance of infection control and reporting incidences safety. Regression to the mean explains how when a variable is measured in a group more than once the highest scores will reduce, and the lower scores will inflate because participants have been exposed to the intervention on more than one occasion and results have been found to converge towards the average score (Gerrish and Lacey 2010). This would not be applicable to these two studies because the scores were not generated by the participants but were from external verifiable evidence.

Of the four qualitative studies included that explored transfer of learning by student perception (De Melo et al. 2018; Kumar et al. 2018; Aura et al. 2016; Buckley and Gordon 2011): Aura et al. (2016), Kumar et al. (2018) and De Melo et al. (2018) all described themselves as qualitative and relied on interviews to collect data. Buckley and Gordon (2011) used a survey questionnaire with a Likert

scale for perceptions on transfer of learning. These methods are considered by positivists as being less valid because they rely on the participant's perception of transfer rather than observable evidence. Often data collected in this way is triangulated with other evidence to assure its validity and lack of bias (Gerrish and Lacey 2010). Kirkpatrick (1984) gives the example of a management training programme, one Human Resources manager reported that he was applying new techniques into his practice… meanwhile a colleague - who he managed - refuted this claim! It was considered prudent to consider all types of data when conducting the pre-registration nursing review; firstly, because it provides a fuller picture but also because it was anticipated that there might not be much quantitative data available.

Only one study was descriptive observational (Rutherford-Hemming et al. 2012). For this study student participants were assessed in clinical practice by one assessor using a checklist. Whilst this is observable data there are issues associated with this method. There may be bias if assessors are not masked to allocation and if there is more than one assessor they might not all rate individuals in the same way. Inter-rater reliability is enhanced by providing training and checking assessor's scores against each other for reliability. In the Rutherford-Hemming et al. (2012) study the assessor was not blinded to allocation and the observation by the one assessor was not verified by any-one else which could be open to bias.

Examining the literature evaluating level three (behaviour change) of Kirkpatrick's training analysis (2006), it is suggested that there may be more difficulties with providing this evidence for the population of student nurses because they are not autonomous practitioners. In a study by Domuracki et al. (2009), it was demonstrated that learning on a simulator transferred to clinical practice. In the study the skill of applying cricoid pressure was taught. Often during attempted intubation applying cricoid pressure is recommended to prevent lung damage from stomach content aspiration; if this is not performed correctly or practiced, it puts patients at risk. Medical staff, nurses and student nurses who had been taught the skill in simulation were then measured in practice by standing on a force plate whilst they performed the task. Significantly, more participants applied the correct pressure from the intervention group than the control group. Domuracki et al.

(2009) seem to have overcome the ethical barriers to including student nurses in their study. They would have had to have permission from the student's own institution, make the training available to the student and seek informed consent from the patient to allow a student to be part of their care. Domuracki et al. (2009) point out that those participants who did not achieve the correct pressure may have struggled as they were in a new environment (theatres) and unfamiliar with engaging in such direct patient care; essentially this was referring to the student participants.

The difficulties of applying certain outcome measures to pre-registration nurses is also evident in the study by Buckley and Gordon (2011) where thirty-eight registered nurses completed immersive high-fidelity simulation on care for a deteriorating patient. Three months after this, and after being exposed to patients in their normal work environment, they were surveyed to gather their perceptions on usefulness of the simulation and the number of times they had used the skills they practiced in simulation. Participants related 164 clinical patient emergencies, a mix of mainly cardiac, respiratory, and neurological issues. Improvements were related as:

> *"The ability to respond in a systematic way, handover to the emergency team and airway management were identified as the skills most improved during patient emergencies following simulation" (*2011 p.718).

Undoubtedly, for a researcher to be present at all the 164 episodes of deteriorating patient care a constant presence would have been required to secure witnessing of these unpredictably occurring events. This would be time-consuming and costly. Coupled with the issue of gaining ethical permissions and patient consent, it is clear why direct observation is very demanding to achieve for this type of study explaining why often self-reports are used as evidence of transfer of learning. To use self-reports on care escalation for student nurses would be more difficult because they would neither have autonomy for escalating care nor for providing direct emergency care themselves without supervision. Thus, it makes it more challenging to assess student nurses' performance of skills in clinical practice. So, the appraisal of the healthcare professional literature led to question not only *what*

evidence was available for pre-registration nursing students but also how it could be evaluated.

2.4.3 Discussion: Methodological Robustness of the Eight Reviews

In the occupational therapy review by Bennett et al. (2017) most of the studies included were descriptive. Creswell (2013) defines descriptive studies as using one of three methods: observation, case study method or survey method. The purpose of a descriptive method is to describe the 'what is' not the 'why'. Most of the studies included in Bennett et al. (2017) reported student perceptions of the value of simulation, and its effect on knowledge and confidence were explored - all of which showed simulation is welcomed and appreciated by students. Two studies examined transfer of learning to practice using fieldwork (placement) supervisors' comments: Lindstrom and West-Frasier (2004) and Tomlin (2005). Supervisors reported students were more client-focused, independent and able to work collaboratively following simulations using standardised patients; and in Tomlin's research higher grades were awarded. Tomlin's (2005) study reports that students who received higher scores on the simulation received better grades on placement, however, this may be merely an indication of a superior student. Indeed, the rationale for the study was to see if a better performance in simulation predicted better performance in clinical skills.

Hegland et al.'s review (2017) revealed three studies investigating transfer: Schneider et al. (2006); Jansson et al. (2016); Rutherford-Hemming et al. (2016). Jansson et al. (2016) conducted a randomised control trial with 17 critical care nurses in an intensive care ward, concentrating on a ventilator bundle used for intubated patients. Participants were tested in clinical practice at 6- and 24-months post-simulation intervention. Statistically significant improvements were found for the intervention group. However, Hegland et al. (2016) argue that no firm conclusions can be made from the studies they reviewed because they are methodologically unsound. Even though there are statistically significant effects when simulation is compared to other strategies, the results are uncertain, mainly due to heterogeneity of the studies. This leads to the suggestion of using multi-site studies using homogenous simulation as an intervention, measured as such

by adopting simulation best-practice statements; and by using validated evaluation tools.

Rutherford-Hemming et al. (2016) recruited 64 registered nurses who were assessed in clinical practice in post-partum care. A blinded randomised control trial was designed where half the participants engaged in simulation with actors trained as standardised patients, and the other half engaged in online study. The participants were tested for skills and knowledge: a 1.3-point difference was found in favour of simulation for knowledge (out of 12), and an 18.6 difference for skills on a scale 1-100. This provides evidence of simulation effecting skills in clinical practice and as a blinded randomised control trial was considered a robust study.

Schneider et al. (2006) recruited 30 medical/surgical registered nurses to a randomised control trial. One group received a simulation experience via an interactive CD ROM, and the others no intervention. The nurses were then observed in their own clinical areas for medication errors by using a performance measurement tool. Medication errors were significantly reduced for the intervention group in some of the steps of medication administration. This provided evidence of transfer of learning to practice. For student nurses, who always must be supervised administrating medications, these would have to be recorded as potential errors as hopefully the supervising nurse would prevent the error occurring (NMC 2018).

It is acknowledged that study design and methods of measurement are more complex and difficult to achieve for level three and four outcomes (Cox et al. 2015). Despite Cox et al. (2015) finding the acquisition of a surgical skill on a simulator enhanced performance in clinical areas and demonstrated patient benefit, they acknowledge more high-quality research is needed to confirm the evidence. They suggest that there is a paucity of robust studies because most studies were single site, retrospective, and with inadequate controls that could lead to bias.

Accepting these difficulties there is a need to improve the research around simulation pedagogy. Larger sample, multi-site, longitudinal studies are indicated. Although, these criteria are more difficult to achieve, nevertheless, as Hegland et

al. (2017) concludes, more robust studies of a reasonable size are required to show an effect that could be accepted with confidence.

Despite Cox et al. (2015) finding the acquisition of a surgical skill on a simulator has enhanced performance in clinical areas and has demonstrated patient benefit, they acknowledge more high-quality research is needed to confirm the evidence. Bennett et al. (2017) propose that randomised controlled trials are needed to understand the effects of simulation for occupational therapy students themselves, and for longer term outcomes in clinical practice.

Although it is recognised that studies adopting randomised controlled trials may be more rigorous, quasi-experimental studies may be more appropriate for educational contexts (Cooper et al. 2012). Many factors are difficult to control for, such as previous training, experiences, culture, self-confidence which affects internal validity. Nevertheless Beard et al. (2005) suggests these differences exist in the real world anyway; therefore, their inclusion enhances external validity and generalisability.

What may be more easily altered is to increase sample sizes (which were generally small in the selected studies) and engaging multiple sites rather than single sites; this will rely on a collaborative approach between institutions. The key suggestions for improvements in simulation research, proposed by authors of the studies discussed in this chapter, have been summarised in **table 2.6**

Table 2.6 Summary of Suggestions for Improvements in Simulation Transfer Research

Improvements	Study support
Larger / adequate samples required. Lack of effect size.	Cook et al. 2011; Fraser et al. 2011; Hegland et al. 2017; Lavelle et al. 2017; Roberts and Cooper 2017; Rutherford-Hemming 2011Vanderbilt et al. 2017.
Need for longitudinal studies (looking at long term effects of simulation).	Pinto de Melo et al. 2017.
Multi-site studies required / advocated.	Barsuk et al. 2016; Fraser et al. 2011; Jansson et al. 2013; Jensen et al. 2014.
More robust studies, including a greater control to reduce bias for example: allocation concealment, and blinding of the personnel analysing the results or conducting the assessments.	Aura et al. 2016; Cannon et al. 2014; Cox et al. 2015; Hegland et al. 2017; Roberts and Cooper 2017.
Need for randomised controlled trials OR quasi-experimental trials may be more suitable for educational settings	Aura et al. 2016; Bennett et al. 2017; Hegland et al. 2017; Jansson et al. 2013; Jensen et al. 2014; Roberts and Cooper 2017; Rutherford-Hemming 2011.
Mixed-method studies that relate to observed outcomes such as behaviour.	Bennett et al. 2017; Cook et al. 2011; Lavelle et al. 2017.
Consider a pre-/post-test design or use a control group versus an intervention group / compare different simulations.	Singh at al. 2014; Vanderbilt et al. 2017.
More information on data collection and intervention itself.	Jensen et al. 2014; Vanderbilt et al. 2017.

Given that in this literature review and McGaghie's (2006) review flaws were found in simulation research leads us to question the robustness of pre-registration nursing education research on simulation. In a review of reviews, that included level one and two of Kirkpatrick's evaluation levels, by Doolen et al. (2016), limitations of existing studies include: "*Weak design, mixed samples, lack of valid and reliable evaluation tools*" (e290). But what of studies exploring transfer to clinical practice for student nurses at level three and four? This led to the development of the question that can be focussed on in the following integrative review: *what are the methodological limitations of studies looking at transfer of learning for pre-registration nurses?*

2.4.4 Discussion: Evaluation Tool

The twelve studies relied on a variety of evaluation tools which included interviews, questionnaires (self-reports), observation and clinical assessment by others and evidence such as clinical documentation or clinical results. Kardong et al. (2009) suggest evaluation methods must be closely aligned to the learning objectives of a simulation activity; they realised this when they had evaluated learning a skill by a knowledge acquisition test.

Self-reports alone, although useful and achievable for student nurses, generally do not carry the same credibility as more quantitative methods. Often a mixed-methods approach which triangulates the evidence is considered more robust (Creswell and Creswell 2018 p.40).

Assessment or evaluation by a third party is achievable for student nurses. Issues to overcome are reliability in terms of inter-rater bias and reliability (Gwet 2014). It is important that the statistics to measure inter–rater reliability are reported in published articles and are sound choices (Hallgren 2012).

The last way of evaluating, direct observation, is more difficult to achieve for student nurses. As well as the Buckley and Gordon (2011) study highlighting the difficulty with assessing students escalating care, Lavelle et al. (2017) also supports this. Lavelle et al. (2017) measure Kirkpatrick's (2006) level three change by examining incident reports/documentation. Lavelle found incident reporting had increased by 33% post simulation, thus, demonstrating that participants had increased skills in managing medical deteriorations in mental

health settings. However, 'reporting' evidence is more difficult to utilise for student nurses as they neither have the same autonomy as registered nurses nor have the same access to reporting procedures.

It is clear then that consideration needs to be given to the evaluation tools used to assess the effectiveness of simulation in clinical practice because some methods of evaluation may not be appropriate for student nurses. Not only are they unable to apply the same escalation procedures in practice they require the decision of a supervisor to do so. This could perhaps not be measured by analysing reporting tool but by observation by other staff supervising the student. This led to the development of the following research question, to be used in the subsequent integrative review: *what evaluation tools are used to evaluate student nurses' behaviour change in practice*?

To summarise, additional well-designed, robust studies are required to examine the effects of simulation on the transfer of clinical skills to clinical practice measured at Kirkpatrick's levels three and four for healthcare professionals. The review outlined in Chapter Two has examined transfer of learning in healthcare professionals other than student nurses and some key areas have emerged that will now be explored in a more focused way in the pre-registration student nurse population. Of interest is not only the evidence available but by evaluating the methodology used guidance may be available to assist future educational and research practice.

2.5 Strengths and Limitations

There are several limitations to this literature review, firstly all the studies selected were written in English. Research presented in other languages may have produced different results. Also, the amount of literature found may have been restricted by only using databases available in the university. Publication bias also indicates that often studies with positive outcomes are published rather than those with negative results (Murad et al. 2018). One researcher selected the literature so selection bias may have occurred; using two independent reviewers to select studies can reduce *'errors of judgement'* (Creswell 2009 p.292). To mitigate against this in the subsequent integrative review two researchers will scrutinise

all the literature. Setting the more recent time-frames naturally excluded less recent studies. However, being transparent about search terms and limiters adopted is helpful so the reader can appraise or repeat the search (Fink 2019). This review was useful because it focused on level three and four of Kirkpatrick's training evaluation levels in healthcare education. Key areas to explore within pre-registration nursing research were identified: study design, evaluation tools, and simulation as an intervention.

2.6 Conclusion

It becomes increasingly incumbent on educators to demonstrate the effectiveness of simulation to change behaviour and transfer skills to clinical practice. Future research should attempt to use as robust methods as possible. My area of practice is pre-registration nurse education - a good starting point is to ascertain the current evidence of pre-registration student nurses' transfer of learning and assess methodology and evaluation tools used to guide future research and educational practice for pre-registration nursing.

2.6.1 Research Questions to be addressed

1) *What are the effects (real or perceived) of learning clinical skills through simulation on pre-registration student nurses' behaviours in clinical practice environments?*
2) *What are the methodological strengths and limitations of research examining the effect of simulation pre-registration on student nurses' behaviour in clinical practice environments?*
3) *What evaluation methods have been used to assess whether pre-registration student nurses' behaviour in clinical practice environments has changed following simulation?*

These three research questions will be explored in the integrative review presented in Chapter Four of this thesis.

Chapter Two Summary

This preliminary literature review has highlighted a paucity of robust evidence around Kirkpatrick's (2006) levels three and four in healthcare education and practice in general. This raised questions around available evidence for pre-registration nursing students; and the methodological robustness of available evidence and the evaluation tools used. The next chapter sets out the methodological approach and methods adopted in this thesis leading onto Chapter Four: an integrative review of transfer of learning from simulation to practice in pre-registration student nurse education.

From a personal point of view, because I am a nurse lecturer, it was important to find out what specific evidence exists related to student nurses. Could the same evaluation tools be used as ones used for healthcare and what were the methodological issues? This was especially pertinent as I hoped to conduct a post-doctoral study looking at transfer of skills learning from simulation to practice. Having read around the topic of simulation over the past few years to support my role as an educator I was aware that most of the research in the field had been carried out by the medical profession. My decision to expand the search to all health care professionals was probably an attempt to address the balance of literature and see what all healthcare professions had discovered.

Overview of Chapter Three

This chapter will provide an insight into the paradigm (worldview) and 'methodology' adopted in this thesis. The thesis comprises three related studies: (i) an integrative review exploring evidence of transfer of learning of skills from simulation to clinical practice for pre-registration nurses; (ii) an e-Delphi study and semi-structured interviews exploring nurse academics' views on simulation best-practice statements and staff development needs and (iii) a feasibility study examining the parameters for conducting a transfer of learning study. The paradigm adopted for the thesis is pragmatism which allows a degree of reflexivity. The researcher is viewed as part of the research process whose presence influences the multiple realities of truth. As the primary researcher personal views and the research decision-making process will be commented on in the overviews and summaries of each chapter and the first person will be used to highlight the axiology.

3.0 Introduction

It is recognised to be good research practice when a researcher is transparent about their individual worldview; therefore, it is important that assumptions and preconceptions are made explicit to the reader (Gerrish and Lacey 2010). This chapter will present the worldview or paradigm underpinning this thesis justifying both this and the methodology adopted.

Definitions of terms used in the thesis:

Paradigm: A worldview or paradigm can be described as an "*accepted model or pattern*" (Kuhn 1962 p.23). It is a method of organizing how we think about social phenomena and it informs the way we conduct research. A worldview tries to assert itself to the exclusion of other worldviews, and to support the theories it already has established (Kuhn 1962). Creswell and Creswell (2018) suggest that there are other research terms used to explain worldview: for instance, 'paradigm' is used by Lincoln, Lynham and Guba (2011); and 'epistemologies' (*how we know*

what we know) or 'ontologies' (*the nature of reality*) is used by Crotty (1998). In this thesis the term paradigm will be used throughout and is taken to mean a worldview, an accepted model or pattern, "a *basic set of beliefs that guide action*" (Guba 1990 p.17).

Ontology: is the "nature of reality, being, and truth" (Teddlie and Tashakkori 2009 p. 86).

Epistemology: is how we know what we know and involves the relationship between the researcher and the subject themselves. It refers to the researcher's view on the value of objective or subjective data, where they place themselves on the objectivity /subjectivity continuum.

Methodology: is described by Creswell and Creswell (2018) as the process of research, how we carry it out.

Axiology: is engaged with assessment of the role of researcher's own value on all stages of research.

3.1 Paradigms

My research approach does not fit with either of the two traditional dominant paradigms of positivism / postpositivist or of constructivism / interpretivism (Creswell and Plano Clark 2017) and the reasons for this will be explained.

With regards to ontology: that is the nature of reality; positivism purports that there is a single truth waiting to be discovered by objective and value free enquiry that uses quantitative methods and is not influenced by the researcher. Constructivism has the opposite view, that there is no objective reality, and that subjective inquiry using qualitative research methods is the only approach (Feilzer 2010). It can be argued that these dichotomous paradigms, and subsequent converse methodologies behind data collection, can constrain "*intellectual curiosity and creativity, blind researchers to aspects of social phenomena, or even new phenomena and theories*" (Kuhn 1962 p.24), and limit the '*sociological imagination'* (Mills 1959).

Post-positivism evolved from the strictures of positivism and embraced a more flexible view towards the absolute truth of research findings. Post-positivism also acknowledges the difficulty with objectivity, recognising the researcher themselves may influence the research and that the views of the respondents are flexible and open to change (Teddlie and Tashakkori 2009). Therefore, the approach purports validation of findings using methods such as triangulation. Post-positivism's acceptance of both single and multiple realities is featured also in the philosophy of pragmatism.

3.2 Pragmatism

Pragmatism developed in the USA from the work of Charles Sanders Peirce (1838-1914). Peirce's ideas are complex at best, Plowright explains the basic tenets of Peirce's work in his book based on pragmatism and education. Peirce asserted that although the world exists as one reality there are many ways of perceiving that reality. These all depend on an individual's experience and the 'signs' they choose to recognise. Multiple realities or perceptions of reality exist, the crux of this is that we learn by experiences or 'signs'. The truth Peirce seeks is not one that matches existential reality (positivist), nor one that relies on an individual's view (interpretivist) but one that allows us to navigate a challenge or problem. A truth that is reflected in consensual understanding following a period of logical inquiry and is open to change. Actions and consequences are viewed as critical rather than rationale. When linked to education, Plowright suggests

> *"We understand our experiences of the world because the pragmatic maxim enables us to look at the effects that ideas have. No matter how well we define, for example, effective learning or the characteristics of a good teacher, the proof of the pudding, as they say, will be in the eating. In other words, we will know a good teacher by his or her actions and through the effects they have on their students"* (2016, p.90).

Dewy and James were contemporaries of Peirce but developed different perspectives on pragmatism. These were developed later in the twentieth century by Rorty and Putman, who are sometimes referred to as neo-pragmatists. In fact, there are numerous nuances to be found between pragmatists. However, the conditions of pragmatism, as summarised by Creswell (2016), and supported by Cherryholes (1992) and Morgan (2007), underpin this thesis:

1. Pragmatism is not committed to any one philosophical stance or view of reality; qualitative and quantitative data are equally useful.
2. Researchers are free to choose any method of data collection/ approach and design.
3. The world is not seen as an absolute unity.
4. Truth is what works at the time.
5. Researchers look to the what and how to research depending on their intended outcomes.
6. Research takes place in a variety of contexts, for example, social, political, historical.
7. There is an external world as well as independent views of reality - but we need to stop searching for reality.
8. Pragmatism opens the door to using mixed-methods, different world-views and so on.

As an alternative to pragmatism, critical realism has developed as a research choice. Critical realism has been endorsed by many disciplines, including nursing, especially in research which focusses on real problems (Williams 2016). Both paradigms have emerged over the last few decades and both embrace mixed-methods. Pragmatism and critical realism both suggest that there is one world and one reality (ontology) however, they have different ways of understanding that reality (epistemology). The essential difference between them is that critical realism seeks to understand why something happened, the causality. For instance, how does simulation enable transfer of skills to practice, what makes it work? This was not the focus of my thesis hence the adoption of pragmatism rather than critical realism. This thesis asks does simulation enable transfer of learning to clinical practice, rather than how or why.

Pragmatism in this thesis and ontology: Johnson and Onwuegbuzie's (2004) assert that truth, meaning and knowledge are not constant; that they change over time and, in the meantime, we live by provisional or instrumental truths. Perhaps because there may be a reality that is never fully understood. The pragmatic paradigm allows this thesis to accept both the notion of multiple realities that are specific to the actors who hold them and accepts that these realities are best checked with those who contribute to this reality to give it some credibility.

Pragmatism in this thesis and epistemology: Pragmatism's view of epistemology is a dichotomous one, valuing both objective and subjectivities data, both are considered equally useful. Indeed, pragmatists uphold that it is impossible to be either totally objective or subjective (Morgan 2007). For this thesis both objective and subjective relationships between the inquirer and the subjects exist and are necessary because the researcher has experience of the complexities of simulation and the context of nurse education (Teddie and Tashakkori 2009).

The topic under investigation in this thesis is practice-based; nestling between education and nursing practice. The question of interest is simulation in pre-registration nursing education and transfer of skills to clinical practice: what evidence exists and leading on from this investigation what improvements can be made to research and educational practice. To apply a pragmatic approach to the initial research question in this thesis, the action would be simulation and the consequence would be the changed behaviour in clinical practice.

3.3 Fit of Pragmatic paradigm to aim and methods

Creswell (2009) argues that research should flow logically from research aims to paradigm to method. The aim of this thesis was to extend the knowledge base around transfer of learning by simulation to clinical practice; to inform future research and educational practices. The initial literature review highlighted the dearth of good quality literature exploring transfer of knowledge. To include all the available evidence studies using mixed-methods, rather than solely qualitative or quantitative data, were required. As the doctoral journey evolved it became evident that a mixed-methods approach to the individual studies themselves was also required. The suitability of the pragmatic paradigm emerged as the research process developed. Indeed, Saunders, Lewis and Thornhill (2007) suggest that for pragmatism, the research questions then determine the epistemology, ontology and axiology of the research. Rosiek (2013) reminds us that Dewey suggests we as the researcher are part of the reality we investigate. As such the pragmatist view of reflexivity is that the researcher; by their participation in solving real problems, by social

experimentation and through the learning process, so extend their own reflexivity (Popa et al. 2015).

As previously elucidated, traditional paradigms such as post- positivism and interpretivism were not suitable for this research as each demands a view of truth that is inflexible. Conversely, pragmatism does not condone any beliefs about reality but gives freedom to the researcher to identify the area for research and adopt whichever methodological approach suit the research question needs; thus, providing results for the researcher and research participants (Gibson 2008; Leigh and Star 2008).

Rorty (1991) asserts knowledge gained from a pragmatic inquiry will provide a framework for understanding the given topic, which can then be usefully applied. Indeed, the essence of pragmatism is that the focus is the desired outcome not the research process itself (Dewey 2012; Peirce 1998; Rorty 1991).

Whilst this focus does not suggest exclusivity to mixed-methods, where qualitative and quantitative methods can be applied to answer the research question, mixed-methods is often the researcher's choice. This pluralistic approach can facilitate triangulation of different data types to meet the research needs (Morgan 2007). Pragmatism acknowledges that the knowledge produced by research is not absolute but relative, open to shift and change, and is dependent on unpredictable occurrences (Morgan 2007).

The pragmatic mixed-methods approach is appropriate because to gain a holistic view of this educational and nursing phenomenon the available evidence may involve both qualitative and quantitative data. **Figure 3.1**: The research onion illustrates where pragmatism fits within the research cycle.

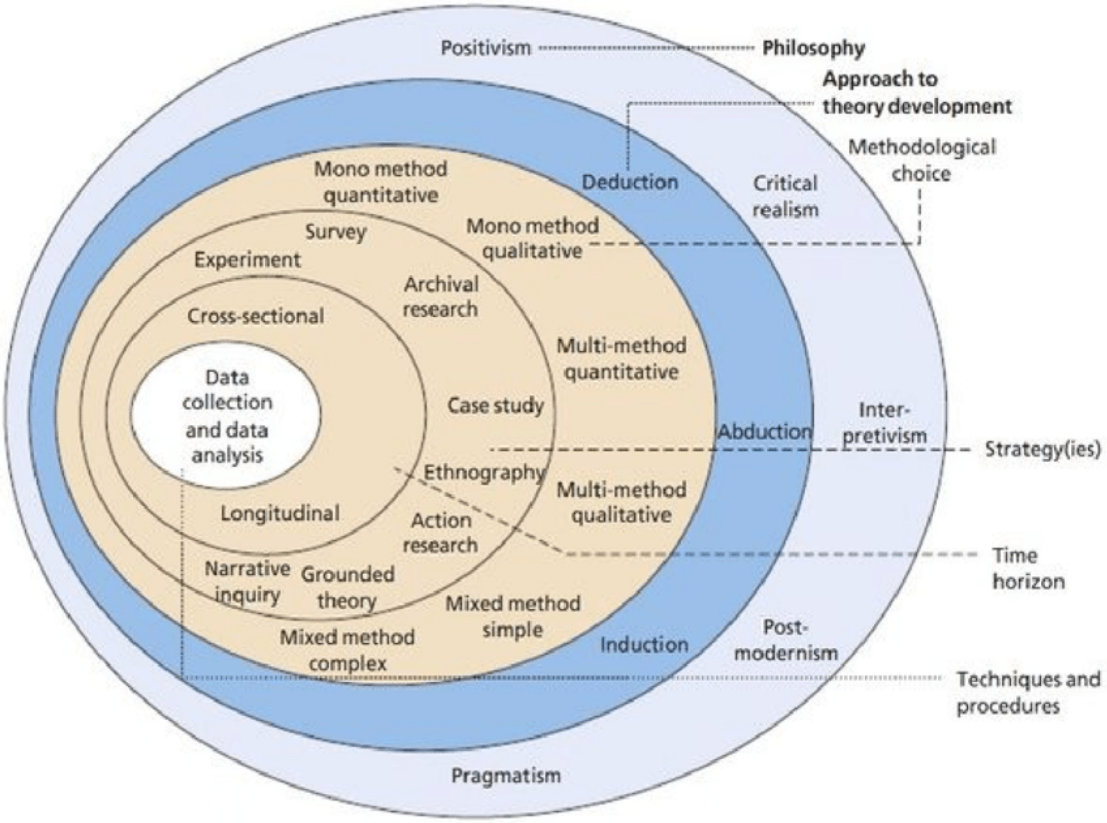


Figure 3.1: The Research Onion: Saunders et al. (2007).

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Pragmatism is shown as adopting a longitudinal approach to data collection rather than cross-sectional; a bent towards narrative inquiry rather than experiment; mixed-methods rather than mono-method; inductive rather than deductive approach to theory development; and the opposite to positivism as a philosophical stance. Naturally, pragmatism receives criticism from dominant paradigms, both positivism and interpretivism, claiming whilst it may be a practical solution it cannot be a logical solution (Johnson and Onwuegbuzie 2004). However, it is this ability to allow the researcher to make the most of both subjective and objective data which makes it appealing.

Creswell (2009) outlines the advantages of pragmatism as being the acceptance of different worldviews, assumptions, data collection and analysis techniques Creswell describes pragmatism as being concerned with the establishment of consequences after actions, it is 'problem-centred, pluralistic, and realist-world practice orientated' (2009 p.6). These tenets are clearly represented in this thesis.

It is problem-centred as the thesis asks does learning skills by simulation transfer to clinical practice? How can we evaluate if it has? Pluralistic because two types of approach, qualitative and quantitative data are required to achieve a holistic view. Realist-world and practice-orientated because the thesis is set in the researcher's world of nurse education and simulation. The pluralist methodology will now be discussed in more detail.

3.4 Justification of 'Mixed-Methods' Approach.

Methodology is the term given to the research design, process or approach to research. This is distinct from the method which is the way data is collected, consequently, the same method may be used for different methodologies (Gerrish and Lacey 2010).

In this thesis a mixed-method process will be adopted guided by the philosophy of pragmatism. It is accepted that some consider that mixed-methods is now one of three major research paradigms: interpretivism using qualitative data, positivism using quantitative data and mixed-methods that uses both types of data (Johnson et al. 2007). Other researchers, such as Creswell and Creswell (2018) propose two more paradigms: transformative, based on political agendas and change; and pragmatism which normally adopts mixed-methods.

To answer the questions in this thesis both types of data, quantitative and qualitative are required. Using one or the other would be considered a constraint. Mixed-methods research which seeks to use both quantitative and qualitative research strategies and data is considered a solution. Definitions and understanding of a mixed-methods approach are continually being developed. Mixed-methods, by using two disparate data sets, does not fit into either of the two main paradigms. Subsequently researchers have tried to construct an alternative framework - about which there is still little agreement (Creswell and Plano Clark 2007). However, the framework most frequently associated with mixed-methods research is pragmatism (Teddlie and Tashakkori 2009). This is the approach adopted by this thesis.

Mixed-methods involves the collection and analysis of both qualitative and quantitative data in "*rigorous and epistemologically sound*" ways (Watkins and Gioia 2015 p.10 - who draw on support from Creswell 2015; Hesse-Biber 2010; Johnson, Onwuegbuzie and Turner 2007). Secondly, a mixed-methods approach should 'integrate' both qualitative and quantitative data so the advantages of both can be gained and our understanding of any given phenomenon enhanced (Watson and Gioia 2015). This is particularly useful in nursing as it is a complex and diverse discipline. Health, medicine and education are identified as the greatest users of mixed-methods (Creswell and Creswell 2018).

Criticism about mixed-methods, and therefore also of pragmatism, is that studies are often perceived to lack rigour by failing to formulate an overarching mixed-methods question and that few provide integrated results (Ivankova and Kawamura 2010). Despite these criticisms Sandelowski (2014) states that, in nursing, mixed-methods are used to solve problems. It is also recognised that in educational design research (EDR) the mixed-methods research design forms part of an approach used to gain a holistic view (Getenet and Beswick 2016; Cheung 2013). In this thesis some of the studies that have been selected also adopted a mixed-methods' approach, combining data from both qualitative and quantitative data collection methods. Creswell suggests that mixed-methods is:

> *"an approach to research in the social, behavioural, and health sciences in which the investigator gathers both quantitative (closed-ended) and qualitative (open-ended) data, integrates the two, and then draws interpretations based on the combined strengths of both sets of data to understand research problems."* (Creswell 2015 p.2)

It is important to note that in chapter four, the integrative review incorporated studies using qualitative, quantitative data and those adopting a mixed-methods approach.

To summarise; pragmatism and a mixed-methods approach offers an alternative paradigm to the traditional approaches. Pragmatism is useful because it focuses on the research problem and then the consequences of the research (Creswell and Plano Clark 2017; Miller 2006; Brewer and Hunter 1989; Tashakkori and

Teddlie 1998). Therefore, the paradigm of pragmatism using a mixed-methods approach will be adopted to fulfil the aims and objectives of this thesis. To return to Plowright's explanation of pragmatism and education "*we will know a good teacher by his or her actions and through the effects they have on their students"* (2016, p.90). Following this premise, we need to know the effects of simulation; do students transfer skills to clinical practice after simulation.

Chapter Three Summary.

This chapter has made explicit the paradigm adopted in this thesis is pragmatism. The methods of data collection chosen are justified as being those that follow a pragmatic and mixed-methods approach: an integrative review, an e-Delphi study with follow up interviews, and a convergent mixed-methods feasibility study. The next chapter presents the first of these studies, the integrative review, which explores evidence on transfer of learning clinical skills by simulation to clinical practice by student nurses.

Underpinning the thesis with a paradigm and appropriate methodology was especially pertinent because three separate studies were combined to make the whole piece. It was important to me as the researcher that the reader could appreciate how the separate studies, like pieces of a jig-saw puzzle were united with a common purpose. I acknowledge that there are still pieces of the jig-saw to create that will further add to the knowledge base around simulation effectiveness.

Overview of Chapter Four

Chapter Four presents the integrative review conducted to examine transfer of learning clinical skills from simulation to clinical practice by student nurses. The review findings will be discussed and suggestions will be made about their relevance and impact on educational practice. The results from the integrative review informed the next stage of the thesis: the e-Delphi study and staff interviews that explored nursing academic staff views on simulation-best practice statements and staff development.

Two main research decisions impacted on this study. The first was to explore research involving nursing students alone. Primarily, this was due to my own role as a nurse educator. This was what mattered to me. The second was the decision to perform an integrative review, whilst common in nursing, education and to a lesser extent, other healthcare professionals, it is not often used in medical research. Conjecturing there may be limited evidence and the fear of missing something led the decision to examine qualitative and quantitively data.

4.0 Introduction

Simulation is defined by the Nursing and Midwifery Council (NMC) as

> *"an artificial representation of a real-world practice scenario that supports student development and assessment through experiential learning with the opportunity for repetition, feedback, evaluation and reflection".* (NMC 2018 p.14).

As the context for this thesis is pre-registration nursing student education using simulation - the NMC view is imperative. The new standards framework for nursing and midwifery, part one of realising professionalism: standards for education and training (NMC 2018) sets out that students should be facilitated to learn and should be assessed with a range of methods. These methods include simulation-based learning appropriate for the programme of study. Furthermore, the NMC

stipulate this simulation is required to ensure safe and effective practice (NMC part one 2018 p.9). Indeed, there is recognition from the NMC that

> *"Effective simulation facilitates safety by enhancing knowledge, behaviours and skills"* (NMC 2018 p.14).

Simulation is endorsed throughout the new education standards

> *"Nursing students will learn and be assessed in theory, simulation and practice environments." (NMC 2018 p.5)*

Simulation can be used in university or practice learning environments and is viewed as a way of creating a learning experience within learning and assessment strategies. However, approved education institutions along with practice learning partners must ensure that simulation is integrated in a blended approach to learning and used to address specific learning or clinical needs (NMC 2018).

Simulation is also viewed as a way of addressing the theory practice gap because newly qualified nurses feel that they do not spend enough time on clinical skills moreover additional simulation is advocated in pre-registration nurse education (Monaghan 2015).

With such endorsements by nursing's professional body and research it is timely to examine the current evidence examining how effectively learning clinical skills by simulation is transferred to clinical practice.

4.1 Background

Broad definitions of the terms that are used in this review, such as simulation, were provided in Chapter One. However, clearer boundaries are necessary to define the scope of this review. With regards to simulation the review will include studies on low-range fidelity, such as part task-trainers, but will not include paper-based simulation case-studies, this is because it is the clinical practical skill that is of interest, rather than just the cognitive skills (such as decision-making) alone that could be achieved by paper-based exercises. Likewise, computer-generated simulation will be excluded, such as virtual reality trainers, as they are not readily available or used routinely in pre-registration nursing curricula. Of interest is the practical clinical skill plus the associated cognitive higher order thinking skill

(communication, decision-making and so forth). Any simulation involving simulated patients, be they volunteers or actors, will be included. The studies selected needed to show evidence of Kirkpatrick's (1959b) level three of '*behaviour change*', relating to a clinical skill and associated higher order skills, to demonstrate transfer of learning from simulation to clinical practice.

To address the gap in the literature, highlighted in Chapter Two, an *integrative* review was proposed to synthesise evidence that assessed if skills were transferred to clinical practice by student nurses after simulation.

An integrative literature approach was preferred to perform this review as it has a broad scope seeking to summarise a range of literature, both qualitative and quantitative data, to gain a more thorough understanding of an issue (Broome 1993). In this review the focus will be on asking the question whether student nurses learning skills by simulation can transfer these skills to clinical practice environments.

Historically, over the last twenty-five years, types of literature reviews have developed from Cochrane reviews, which focused solely on synthesising evidence from RCT's. Grant and Booth (2009) identified fourteen different types of review each with its own specific purpose, and nuances of appraisal, synthesis and analysis. Interestingly they do not mention an integrative review per se. Nevertheless, Grant and Booth's (2009) description of a mixed-methods review seems to replicate an integrative review as it

> "*refers to a combination of review approaches for example combining quantitative with qualitative research...*" (p. 94)

However, JBI qualify the classification further by stating that a mixed-methods review is where the data is combined and integrated in a more formalised approach (JBI 2019); whereas an integrative literature review has limited formal methods on combining data (Broome 2000). JBI first published guidance on mixed-methods reviews in 2014 and have recently updated their guidance in 2019 to include eleven different types of review; including qualitative and mixed-methods. At the time of commencing this thesis, mixed-methods review methodology was in development by JBI and because conducting integrative reviews in nursing was established this was the adopted method of review.

Neither a systematic review approach that dealt with purely quantitative data, where randomised control trials and research hierarchies of evidence are evident nor a meta-analysis (requiring heterogeneous quantitative studies); or a purely qualitative approach were deemed to be appropriate because initial searches indicated that there was likely to be limited evidence available.

Combining different sources of evidence such as qualitative and quantitative can improve the richness of the data and promote understanding of a given phenomenon (Evans and Pearson 2001). A mixed-methods approach that presents a varied perspective on a phenomenon is advocated in nursing practice generally due to the complexity of nursing (Evans and Pearson 2001; Estabrooks 1998; Kirkevold 1997). The dichotomous contributions of art and science contained within the nursing discipline means nursing is multi-faceted. As this review is concerned with nurse education and nurse practice, it is appropriate to use a method of performing reviews that combines both qualitative and quantitative approaches.

Kirkevold (1997) suggested that integrative literature reviews should be undertaken from an explicit philosophical perspective. For clarity, this review is based around Locke, as described in Cooper (1989), which is inductive in nature, and assumes that data comes before theory. This review sought to use existing research to draw together their conclusions and "*to highlight important issues that research has left unresolved*" (Cooper 1989 p.13).

An integrative review should follow the same rules of rigorous objective inquiry just as any primary research study. For a review to be objective and believable, a rigorous research review methodology is essential. As in any research, a researcher makes countless decisions along the way that will naturally affect the outcome and the trustworthiness of the findings (Cooper 1984).

Integrative reviews are conducted with the potential of fulfilling three discrete purposes, or a combination of these. The first is an integrative *research* review, which has the purpose of summarising past research by finding studies that are asking the same things and then drawing overall conclusions. During this process, new knowledge is presented because important issues or gaps in knowledge may be realised (Cooper 1984). The second is a *theoretical* review; the reviewer will

have the aim of presenting all the theories about a phenomenon and highlight any similarities and inconsistencies. The third type is a *methodological* review, which critically examines the research methods applied to an area and considers if conclusions drawn are limited by how the results have been generated (Cooper 1984).

The integrative review in this thesis will be a combination of research review and methodological review; this approach will be made clear by the three questions proposed which have their focus on simulation based-education used in nursing and the subsequent transfer of knowledge and skills.

The steps of conducting any review are accepted as an iterative process of problem formulation, literature search, data evaluation, data analysis and finally presentation of the synthesised data (Cooper 1998). This process has been modified by Whittemore and Knafl (2005) to meet the needs of an integrative literature review. Research reviews should meet the same methodological rigour as any primary research process because they are essentially '*research of research*' (Conn 2003).

However, combining different methodologies can lead to claims of lack of rigour, inaccuracy and bias (O'Mathuma 2000; Beck 1999). To counter these claims Garrard (2004) and Conn et al. (2003) developed methods to improve the data collection and data extraction. Whittemore and Knafl (2005) claim that methods of conducting analysis, synthesis and reaching conclusions have been less developed and sought to address this by producing an updated integrative literature review methodology with the intention of improving academic thoroughness.

As there have not been any recent iterations, perhaps because the mixed-methods review has gained precedent, it is this framework, that will be adopted to conduct an integrative literature review on the effect of simulation on the behaviour in clinical practice of pre-registration student nurses as using only either qualitative or quantitative data would mean that some research exploring the effect of simulation on behaviours in practice, would be unnecessarily excluded. This was especially pertinent for this review as many of the selected studies themselves

use mixed-methods. The limited focus of the integrative review on transfer of learning to clinical practice required a framework to identify relevant studies.

Transfer of skills, and being prepared for practice, is recognised by nurse academics and the NMC as a main goal of pre-registration nurse education. To add to the body of knowledge, methodological strengths and limitations of the available studies were appraised and the evaluative methods discussed which enabled suggestions for future research to be offered.

4.2 Aim and Review Questions

To synthesise the evidence of learning clinical skills through simulation on student nurses' behaviours in clinical practice environments. To critically appraise the selected studies' methodologies and methods of evaluating student nurse behaviours.

1) What are the effects (real or perceived) of learning clinical skills through simulation on student nurses' behaviours in clinical practice environments?
2) What are the methodological strengths and limitations of research examining the effect of simulation on student nurses' behaviour in clinical practice?
3) What evaluation methods have been used to assess whether student nurses' behaviour in clinical practice has changed following simulation?

4.3. Methods

The PICO framework was used to frame the research question (Moher et al. 2009; Richardson et al. 1995).

Participants/population: The population was pre-registration student nurses, or equivalent, such as pre-licensure, who have been engaged in simulation for the development of clinical skills.

Intervention(s), exposure(s): The intervention was described as an educational experience that uses simulation, excluding computer and paper-based simulation such as case studies, to teach clinical skills.

Comparator (where relevant) / Context: Pre-registration student nurses who have not been involved in any simulation for the activity being studied but who have engaged with an alternative teaching method. The context for the simulation is in a purpose-built simulation centre. The area of practice for the nursing student is anywhere they engage in clinical practice (be it hospital or community settings).

Outcome one: The first outcome was evidence to support a change in behaviour in clinical skills practice such as improved performance/ changed practice/ increased competence of the student nurse in practice. Outcomes will be distinguished by using Kirkpatrick's levels of training evaluation with a focus on "behaviours" with patients (not simulated patients). Time and process measures (Cook et al. 2011) were used to measure behaviour change; examples of measures include compliance with hand hygiene and patient identification, safety in administration of medicines and the assessment of a deteriorating patient.

Outcome two: The second outcome appraised the methodology to inform future research.

Outcome three: The third outcome examined evaluation tools used to evaluate transfer of learning.

In chapter two, the same questions were promulgated for a wider look at health care professionals which initiated this focussed review. These outcomes were considered important to establish what current evidence base existed for transfer of learning for student nurses, how was this transfer measured and what was the quality of the available evidence? It was proposed that the answers to these questions could be used to inform future educational and research practices.

4.4 Inclusion/Exclusion criteria

4.4.1 Inclusions: Studies that focussed on pre-registration student nurses who have engaged in simulation in clinical learning centres or in health care environments were included that examined the learning outcome around Kirkpatrick's (1976) level of training evaluation of behaviour change. Quantitative, qualitative or mixed-methods studies were considered for inclusion.

4.4.2 Exclusions: For this integrative review, studies that involved registered nurses or other healthcare students or professionals were excluded, as were studies that solely examined the learning outcomes around Kirkpatrick's (1976) levels of training evaluation of reaction and knowledge acquisition.

4.5 Primary Data Extraction – Coding Sheets

Often, the first step in an integrative review would be to appraise the quality of studies before deciding whether to retain them in the review or not. However, as one of the review questions was to look at methodological strengths and weaknesses this step was done after the preliminary data extraction, therefore, no study was excluded on terms of quality. The purpose of a review will guide whether studies are excluded due to methodological quality or included for comment, however, in either case, a summary of methodological quality should be provided to put the studies in context (Fink 2019).

The primary aim of the preliminary data extraction was to examine the study and ascertain what level of Kirkpatrick's levels were attained. For studies included in this review a change of behaviour had to occur in practice to evidence that transfer of learning had occurred from simulation to real life nursing practice. The blank template of the data extraction sheet is to be found in **appendix 3: table 4.1**.

4.6 Search Strategy and Terms

The search strategy was developed with guidance from the university's research librarian. CINAHL with Full Text (henceforth referred to as CINAHL) and MEDLINE databases on the EBSCOhost platform were used to scope the research question. Both databases encompass literature for and about pre-registration student nurses as a discrete population.

An initial scoping search was conducted in CINAHL using the CINAHL Headings encompassing "simulation", namely "simulations", "clinical simulation testing" and "patient simulation". While the CINAHL scope note definitions were helpful it was considered using headings might be too narrow and not inclusive of other types of simulation that are undertaken in healthcare settings for pedagogical purposes.

Further investigation of MeSH headings in the MEDLINE database also revealed that headings encompassing "simulation" there, namely "patient simulation", and "simulation training", did not sufficiently correspond with CINAHL headings in a way that gave confidence about the equivalence of a headings approach to the search.

That CINAHL and MEDLINE were not aligned in terms of a subject headings approach, therefore, it was considered prudent to search for "simulation" and its variants in both databases. Ultimately, the conclusion was drawn that using the terms simul* AND nurs* AND education focussed the search sufficiently. The data bases CINAHL, MEDLINE, SocIndex, AMED, ERIC, Embase, Psycinfo and Assia were then searched separately.

To summarise, the steps undertaken with the search strategy and decisions arising:

1] An initial scoping search of CINAHL and MEDLINE. Keywords/Headings: simulations (heading on CINAHL only) or "patient simulation" (subject headings on CINAHL and MEDLINE).

2] Adoption of keywords/phrases "simulated experience" or "simulated activit*" or simul* using CINAHL and MEDLINE. It was noted that "simul*" encompasses all occurrences of simulations, simulations, simulated and the inclusion or exclusion of the phrases "simulated experience" or "simulated activit*" made no difference to the number of hits retrieved compared with using "simul*" by itself.

3] Using the keywords: "simul*" and nurs* and education = [6114] hits CINAHL. "simul*" and nurs* and education = [4798] hits MEDLINE.

4] Following review of the results, introduction of additional concepts to the search to nuance the search in terms of impact on "transfer of learning" or "changing practice" or "changing behaviour in practice" or "changing behaviour in practice" or performance or competence or "enhanc* care" or "patient outcome*" or improve* or "clinical practice". This reduced the number of hits as follows: [2602] CINAHL; [2920] MEDLINE.

5] Finally, introduction of a date related limiting factor, hits were selected of sources published between 2010 and 2019. This further reduced the number of hits as follows: [2052] CINAHL, [2228] MEDLINE.

6] Expanding the scope of the search into additional EbscoHost databases SocIndex, AMED and ERIC, limiting the concepts to simul* and nurs* and education rather than the more nuanced search available applied to CINAHL and MEDLINE, both of which needed a more specific search strategy to produce a more manageable and relevant set of results. The date range was 2010 - 2019:

Amed = 29; SocIndex = 44; ERIC = 238; Web of Science = 2652; Knowledge Network: Embase = 3661; Psycinfo = 1012 Assia = 2158.

To summarise, peer-reviewed articles of studies published in English from 2010 until 2019 were considered for inclusion. Bibliographies of selected articles were scanned for additional relevant studies. The searches were re-run in March 2019 so that recent studies were retrieved for inclusion, one additional article was selected, Avraham et al. (2018).

Two reviewers (KG, KC) first independently screened titles and then abstracts, followed by full-text articles that appeared to fulfil the inclusion criteria. Consensus was reached by discussion in most cases, with involvement of a third reviewer (EH) in a few instances.

4.7 Risk of Bias (Quality) Assessment

The selected full-text articles were independently appraised by two researchers (KG and KC) using Joanna Briggs critical appraisal tools: Checklist for Quasi-Experimental Studies (non-randomized experimental studies), Randomised Controlled Trials, Qualitative research (JBI 2018) as appropriate to each individual study or relevant part thereof. All selected studies were included in the review, irrespective of methodological quality, to answer each review question and to make recommendations for future research. (The results of the quality scores are in **appendix 4** JBI Critical Appraisal Checklists **table 4.2.**

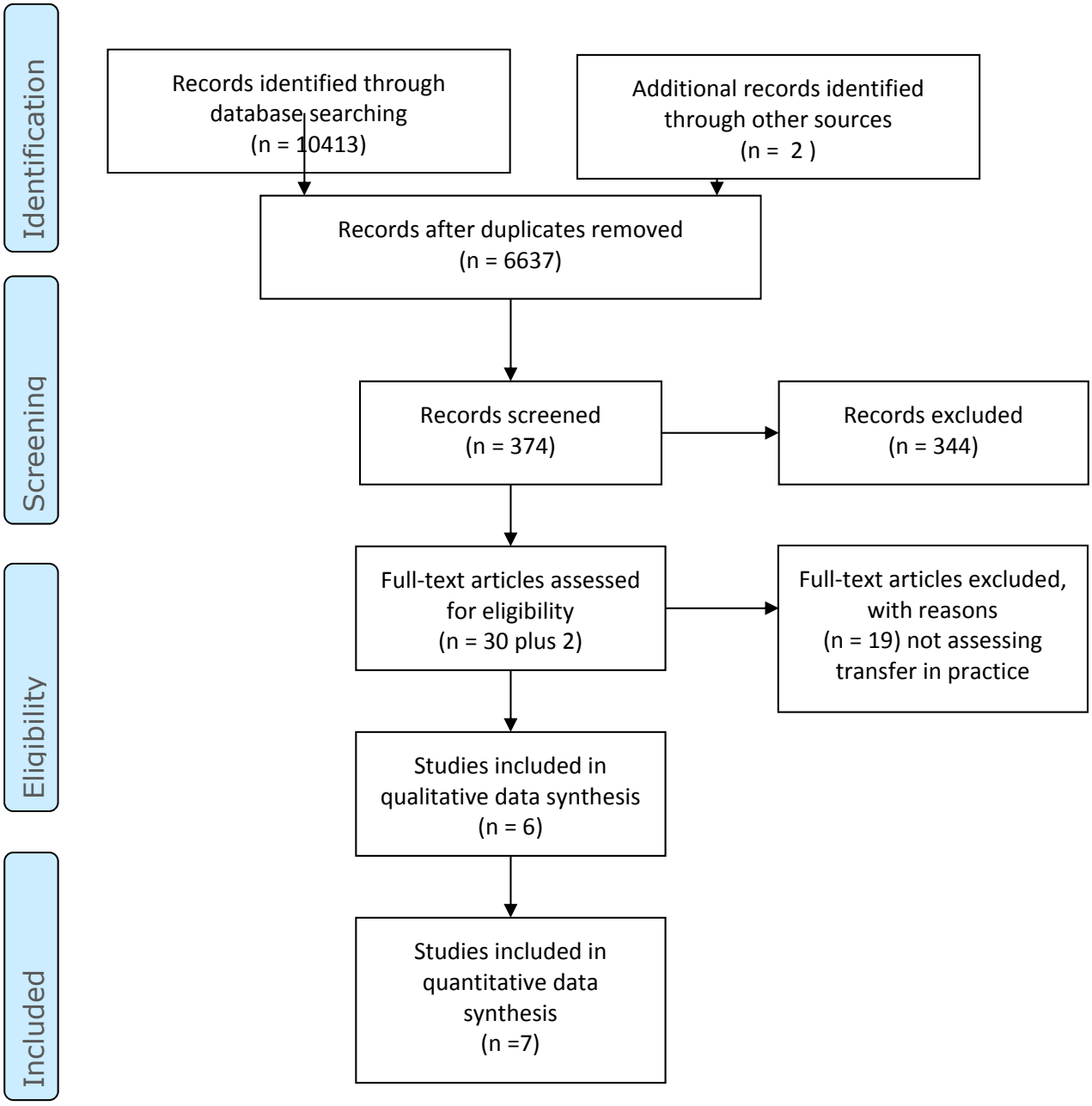
4.8 Data Extraction and Synthesis

The method advocated by Whittemore and Knafl (2005) follows Miles and Huberman's (1994) approach of: data reduction, data display, data comparison, conclusion drawing, and verification. To avoid bias these levels were prepared by KG and validated by KC.

4.9 Results

First, a PRISMA flow chart will display the decision trail that determined articles for inclusion (**4.3 Prisma flow chart**). (http://www.prisma-statement.org/).

4.9.1 Prisma diagram



4.9.2 Full reference list for included studies in integrative review:

AVRAHAM, R., SHOR, V., HURVITZ, N., SHVARTSUR, R., KIMHI, E. 2018. Transferability of medication administration simulation training to clinical settings, Teaching and Learning in nursing, 13, pp. 258-262.

DEBOURGH, G.A. and PRION, S. 2011. Using simulation to teach pre-licensure nursing students to minimize patient risk and harm. *Clinical simulation in nursing*, 7, e47-56.

EWERTSSON, M., ALLVIN, R., HOLMSTRÖM, I.K. and BLOMBERG, K., 2015. Walking the bridge: Nursing students' learning in clinical skill laboratories. *Nurse education in practice*, *15*(4), pp.277-283.

HARRIS, M. A., 2011. Simulation-enhanced paediatric clinical orientation, *Journal of Nursing Education*, 50 (8).

KIRKMAN, T. 2013. High-fidelity simulation effectiveness in nursing students' transfer of learning. *International journal of nursing educational scholarship* 10(1) pp. 171-176.

LIAW, S.Y., CHANA, S.W., SCHERPBIERB, A., RETHANSB, J. and PUAC, G.G. 2012. Recognizing, responding to and reporting patient deterioration: Transferring simulation learning to patient care settings. *Resuscitation* 83 pp.395– 398.

MEYER, M.N., CONNORS, H., HOU, Q. and GAJEWSKI, B. 2011. The effect of simulation on clinical performance: a junior nursing student clinical comparison. *Society for simulation in healthcare*. 6 (5).

NASH, R. and HARVEY, T., 2017. Student Nurse Perceptions Regarding Learning Transfer Following High-Fidelity Simulation. *Clinical Simulation in Nursing,* 13, pp. 471-477.

RAVIK, M., HAVNES, A. and BJORK, I.T. 2015. Exploring nursing students' transfer of peripheral venous cannulation from skills centre to the clinical setting. *Journal of Nursing Education and practice.* 5 (3).

ROSS, J.G., 2015.The Effect of Simulation Training on Baccalaureate Nursing Students' Competency in Performing Intramuscular Injection. *Nursing Education Perspectives* (National League for Nursing), pp.48-49.

SEARS, K., GOLDSWORTHY, S. and GOODMAN, W.M. 2010. The relationship between simulation in nursing education and medication safety. *Journal of nursing education*, 49 (1).

TUZER, H., DINC, L., and ELCIN, M., 2016. The effects of using high-fidelity simulators and standardized patients on the thorax, lung, and cardiac examination skills of undergraduate nursing students. *Nurse Education Today*, 45 pp.120–125.

VENKATASALU, M.R., KELLEHER, M., SHAO, C.H., 2015. Reported clinical outcomes of high-fidelity simulation versus classroom-based end-of-life care education. *International journal of palliative nursing*, *21*(4), pp.179-186.

Table 4.4 provides the data from the articles in relation to the three research questions. It was designed for this study in order that key information to address the research questions was recorded.

Table 4.4 Presentation of selected integrative review studies

Study descriptor	Aim	Method (for relevant results) and evaluation tool	Sample	Context	Results	Simulation	Methodological considerations
Mixed method							
Debourgh & Prion 2011	Develop student knowledge as primary advocate for patient falls safety.	Qualitative data applicable text on questionnaire **Self-report** after placement exposure	285 of 294 pre-licensure student nurses first year 264 completed	USA	74% of the students said that they had used information from the simulated learning environment in placement.	3-hour Patient scenarios with added falls intervention required No model Active and passive roles Debrief undertaken	To note: Only part of study applicable to review question. Use of self-reporting prone to bias, the student responses not coded/themed but were provided in the article

					Comments from students provided to illustrate.		
Tuzer et al. 2016	Compare the effects of standardized patients were more effective than high fidelity simulator on the knowledge and skills of students conducting a thorax-lung and cardiac examination	Qualitative data applicable skills of students conducting a thorax-lung and cardiac examination – **score sheet**	52 fourth year	USA	Performance scores increased following both sets of simulation activities and were statistically higher on real patients compared to post simulation scores	Thorax-lung chest examination HFS Pre-work Debrief No model	To note: Only part of study applicable to review question. Knowledge part not relevant. Focus groups not relevant. Content validity only. Convenience sample in a single institution. Validity of test re test results.

Qualitative							
Ewertsson et al. 2015	To describe nursing students' experiences of learning in the CSL as a preparation for their clinical practice	Qualitative study using semi-structured interviews **Self-report**	16 fourth semester students	Sweden	Walking the bridge theme: 4 categories Conditions for learning Strategies for learning Tension between learning in the CSL and in the clinical setting Development of professional and personal competence	No information other than the students had completed 3 course which included simulation. No model	Self-report high risk of bias

Liaw et al. 2012	To explore nursing students' experiences of how a simulation programme has prepared them to transfer their performance to clinical practice, in their encounters with deteriorating patients in wards.	Qualitative study using a critical incident technique interview **Self-report**	15 undergraduate student nurses	Singapore	4 main themes: memory, mnemonics transfer tools. Recognizing similar situations, emotional response and 2 themes what would help transfer of learning: realism (in simulation) and self-directed learning. Impact of	Pneumonia Post-operation haemorrhage Hypoglycaemia Sepsis to septic shock 1.5 hours each total 6 hours No model	Interviews 1-2 months after placement. Interviewer also simulation facilitator No examination of prior experience Based on student's own perception so could be biased. No control group

					simulation seen on nursing student's performance in clinical practice		
Nash et al. 2017	An initial exploration of the transfer of simulation learning to the practice context from the perspective of undergraduate nursing students.	Descriptive qualitative research design using focus group methodology **Self-report**	25-year 3 semester 1	Australia	3 themes: it's not the same as practice, making better connections, having opportunities	Used a model Four observers, four active roles Scenario: abdominal pain/vomiting Debrief undertaken	Self-report bias. Active versus passive roles Not immediately after simulation ? length of time in simulate and debrief No control group and no codes provided.

Ravik et al. 2015	To explore practical skill transfer from skill centre to clinical setting	Qualitative descriptive observational study Video: content analysis with a **score sheet**	5 undergraduate nursing students	Norway	Low fidelity simulation was found to provide familiarity with equipment used in the clinical setting, but also lacking opportunity to discern differences encountered in the clinical setting.	Practice on cannulation arm Low fidelity No model	Small sample. However, the detail of steps missed/incorrect/correct illuminated simulation efficacy.
Venkatsalu et al. 2015	To design, use and assess the effectiveness	Qualitative phemonography approach.	12 first year student nurses	UK	Comparative data analysis revealed 4 key themes:	EoLC scenarios: a dying patient and a	Small sample, one cohort, single site Researcher also lecturer.

	of high-fidelity simulation versus classroom-based end of life care (EoLC) for first year nursing students experience in clinical placements.	Individual in-depth interviews **(self-report)**			recognizing death and dying, knowledge into practice, preparedness for clinical eventualities, emotional preparedness	deceased patient 60-75 minutes 1 active role 11 observers Debrief No model	Self-report bias

Study descriptor	Aim	Method (for relevant results) and evaluation tool	Sample	Context	Results	Simulation	Methodological considerations
quantitative							
Avraham et al. 2018	Examine the impact of one-on-one simulation for medication administration	Prospective quasi experimental	77 nursing students (half in 1:1 the other in 2/3:1	Israeli pre-licensure nursing students	Simulation increases medication administration performance in clinical.	One to one medication administration	Equity of education provided. Need to repeat with a control group. Developed own checklist.

	(MA) on pre-licensure student preparedness for and performance of MA in the clinical setting.						Assessed by researcher.
Harris 2011	Determine the effect of simulation enhanced orientation on paediatric exam scores and course grades	Quasi experimental pilot study comparing **clinical grade results**	71 junior students total. Intervention group 16 Control group 55	Midwestern USA s	Clinical grades of the intervention group (mean 3.7 SD 0.1) were statistically higher than grades of the control group (mean 3.4 SD 0.3)	Clinical orientation with patient scenarios 2 weeks Paediatric scenarios No model	To note: Only part of study applicable to review question as assessed knowledge as well. Not measuring orientation. Control and intervention group from different cohorts. High risk

							of bias as assessors not blinded to groups. No assessor inter-reliability testing.
Kirkman 2013	Determine whether undergraduate nursing students were able to transfer knowledge and skills learned from classroom lecture and a High-fidelity simulation to the traditional clinical setting	Students were observed and rated on ability to perform a respiratory assessment with **score sheet**	42 novice nursing students	USA	Significant difference in transfer of learning demonstrated over time.	Asthma scenario leading to anaphylaxis No model No debrief Prep work given	Convenience sample from a single university participating in one simulation scenario. Inter rate reliability and content validity assessed.

Meyer et al. 2011	Evaluate the effects of a theory-driven paediatric simulation curriculum on nursing students clinical performance	Prospective study: quantitative but used Likert scale **work-based assessment**	116 junior baccalaureate students	Midwest USA	On second clinical evaluation students with sim scored significant higher	Replaced practice with 2 weeks of simulations 1week prep 4-day paediatric scenarios Debrief conducted No model	Assessors not blinded to when students had simulation. No mention of inter rater reliability.
Ross 2015	Ability to transfer psychomotor learning to practice _ IM injection	Pre-test post-test 44-point score sheet for IM skill	37 second year Some second degree some baccalaureate	USA	Those in simulation (SP) did not do as well as part task trainer higher scores but not statistically significant	Part task trainer versus scenario SP with trainer And pad No model Debrief conducted	Both methods ae simulation but one low and one high No mention internal validity/interrater reliability

Sears et al. 2010	Can clinical simulation in nursing education help reduce medication errors	Randomized control trial Observed practice with a **score sheet**	54 nursing second year bachelor of nursing students Intervention group 24 Control group 30	Canada	Control group 24 medication errors Treatment group 7 medication errors	8 hours including preparation, debrief. No model.	To note: Only part of study applicable to review question. Exam scores not relevant. Face, content validity and inter rate reliability tested. 2 different hospitals and different instructors

4.9.3 Summary of Results

A total of thirteen studies were included in the review: five qualitative, six quantitative and two mixed-methods. Of the mixed-methods studies only certain parts of each study were relevant: The qualitative data from Debourgh and Prion (2011) and the quantitative data from Tuzer et al. (2016). The results are displayed in tables under the three separate question headings: evidence of transfer of learning; methodological appraisal and evaluation methods used.

Key findings from **table 4.4** are as follows: the dates of the selected studies ranged from 2010 to 2017. Six studies were conducted in the USA, one each in Canada, the United Kingdom (UK), Singapore, Australia, Norway, Israel and Sweden. Sample size ranged from five to the largest of 285. The qualitative studies sample sizes ranged from five to 25. In qualitative studies sample size is usually determined by when data-saturation is considered to have occurred (Fusch and Ness 2015). The quantitative studies samples size ranged from 37-285. As simulation is one of many teaching and learning methodologies a student will be exposed to it can be claimed that a small effect would be expected. This then requires a larger sample to confirm treatment effect. None of the studies discussed sample size in detail or had performed a power analysis (Creswell and Creswell 2018).

Of the thirteen studies simulation activities included low to high fidelity and lasted from one hour 45 minutes to two weeks, both active and passive roles were engaged in during the simulation. Only one study used a model but most conducted pre and debrief sessions. When the simulation is not homogenous, perhaps there are different topics being taught, different time allocations, different roles being used and levels of fidelity it becomes difficult to compare and synthesise results.

4.9.4 Evidence of Transfer of Learning

Evidence of transfer of learning is presented in the tables below. **Table 4.5** deals with quantitative data and presents the mean scores where they were available. There were six studies that quantitatively evaluated transfer of learning as shown in: Avraham et al. 2018; Tuzer et al. 2016; Ross 2015; Kirkman 2013; Harris et al. 2011; Meyer et al. 2011 Sears et al. 2010. The sample sizes ranged from 37

to 116. Meta-analysis was not possible due to the heterogeneity of the studies therefore results were presented in narrative form.

Kirkman (2013) demonstrated a significant difference in the ability of student nurses to perform respiratory assessments on clinical placement post intervention. The study by Sears et al. (2010) showed a reduction in potential medication administration errors post intervention and thus a positive account of transfer of learning.

Conversely, the study by Ross (2015) found no significant difference post intervention, however, there is an anomaly in the study. The control group consisted of students practicing intramuscular injections using a part task trainer, which is still classed as simulation albeit low fidelity. The intervention group had the addition of simulated patients and scenarios. Importantly both groups, low and high fidelity, showed improved performance in practice, although still the results were not statistically significant.

Tuzer et al. (2016) had two groups; one used a mannequin and the other standardised patients, both groups had statistically significantly improved chest, lung and thoracic examination scores on real patients. Like Tuzer et al.'s study, Avraham et al. (2018) had two groups one which received one to one simulation and the other group received one tutor to two to three students. The group receiving one to one received better transfer scores on a medication assessment in practice.

Both studies using clinical assessment placement grades: Harris (2011) and Meyer (2011), showed a significant improvement in grades awarded post simulation. These results should be treated with caution as the assessors were not blinded to group allocation which could lead to bias.

The evidence supplied by the quantitative studies is positive that skills learned by simulation transferred to clinical practice. However, the results need to be accepted with caution as there are weaknesses within the studies.

Table 4.5 Quantitative Studies Result

Year	1st author	Measurement tool	Research design	Sample size	Statistics	Probability < 0.05
Significant difference in skills checklist scores						
2018	Avraham	Medication assessment	Quasi-experimental	77		
2013	Kirkman	Respiratory assessment checklist	Time series repeated measures	42	Mean -1.76	0.000
2016	Tuzer	Chest, lung, thoracic examination checklist	Mixed-methods explanatory sequential design	52	t=0.767	0.447
Stated no significant difference						
2015	Ross	Medication administration checklist	2 group repeated measures pre-test /post-test experimental quantitative research design	37	Mean score in simulation 36 Mean score in practice 36.263 Mean score of part task trainers 34.111 Mean score in practice 35.444	0.001
Significant difference in placement grades						

2011	Harris	Clinical grade	Quasi experimental pilot study	71	t (75.3) = 5.2 Mean score 3.4 (control group) 3.7 (intervention group)	0.001
2011	Meyer	Clinical grade Likert scale based on Massey and Warblow	Prospective study staggered timing model	116	Mean 1.74	0.02
Fewer errors for simulation intervention group						
2010	Sears	Randomised control study of medication errors	RCT using a Checklist	54	Reduced errors for intervention group (7) compared to control group (24).	

The six qualitative studies/qualitative data also highlighted that students perceived transfer of learning had occurred (Debourgh and Prion 2011; Liaw et al. 2012; Ewertsson et al. 2015; Ravik et al. 2015; Venkatsula et al. 2015; Nash et al. 2017).

Debourgh and Prion (2011) facilitated simulation on patient safety and falls prevention; they used free text responses to ask students if they perceived transfer of learning had occurred. Liaw et al. 2012 used self-report of student nurses opinions if they had transferred skills in managing patient deterioration. **Table 4.6**. Data collection ranged from free text supplied on a survey, focus groups and interviews. Plus, an observational study.

Table 4.6 Perceptions: Evidence of Transfer

Free text on survey	Debourgh and Prion 2011	Comments were not themed – *"more than 74% of student respondents reported that they had the opportunity to apply information learned from participation in the SLE to their clinical practice"*
Focus group	Nash et al. 2017	*"But it's not the same on clinical practice" ; "Having Opportunities to Apply What We've Learned"; "Making better connections"*
Semi-structured interview	Ewertsson et al. 2015	*"walking the bridge"*
	Liaw et al. 2012	*"Memory"; "Mnemonics as transfer tools"; "Recognizing similar situations"; "Emotional response"; "Realism" ; "Self-directed learning".*
	Venkatsalu et al. 2015	*"Recognising death and dying"; "Knowledge into practice"; "Preparedness for clinical eventualities"; "Emotional preparedness*
Observational (video with content analysis and scoring sheet)	Ravik et al. 2015	*Low fidelity simulation prepared student for some aspects of skill. Need to improve simulation.*

The themes presented by the authors in the six studies above were then synthesised to create four new themes (**table 4.7**).

Table 4.7 Integrative review articles synthesised themes

Simulation Matters	Recognizing when to apply learning in practice	Holistic preparation for practice	Supported opportunities to practice
Memory Mnemonics as tools Self-directed learning Realism important Need to improve simulation Low fidelity simulation prepared student for some aspects of skill	"But it's not the same on clinical practice Making better connections Walking the bridge Recognizing similar situations Recognizing death and dying Knowledge into practice	Emotional response "Preparedness for clinical eventualities Emotional preparedness	more than 74% of student respondents reported that they had the opportunity to apply information learned from participation in the SLE to their clinical practice" Having Opportunities to Apply What We've Learned

4.9.5 Qualitative Studies Synthesised Themes

The themes identified in the qualitative studies, displayed above in **table 4.7** were synthesised in accordance with a six-step process: familiarisation with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes and producing the report (Braun and Clarke 2014). Four synthesised themes emerged:

i) **Theme one - Simulation matters: what happens in simulation is critical to the transfer of learning.**

Most student comments in the included studies were positive and appreciative about simulation (**table 4.7**): "*I personally would like to see a lot more simulations*" (Nash 2017 p. 475). Students were able to describe when and why they had been able to transfer skills from simulation scenarios to the clinical setting and highlighted perceived barriers and enablers.

It was evident that what happens during the simulated learning is critical to the successful transfer of learning: "*Simulation helps me remember better because I am a hands-on type of person who cannot just read and memorise. But once I practice something, I can remember stuff longer and relate it to a situation."* (Liaw et al. 2012 p.397). Conversely students recognised when things had not gone so well: "*It's just rushed …even the simulation… hardly any debriefing*" (Nash 2017 p.475). Perceived differences between simulation and clinical practice generally detracted from the likelihood of transfer occurring and factors such as realism of the simulation and level of fidelity affected this. This was evident in Ravik et al.'s (2015) study; using low fidelity cannulation arms meant that students then had difficulties with the softer patient communication skills like confirming patient identity when in clinical practice. Ravik et al. (2015) considered that the use of reflection and undertaking self-directed learning mitigated against these differences and should therefore be an encouraged activity for students.

ii) **Theme two - Recognizing when to apply learning in practice: it was important that students could recognise similar situations in which to apply their new skills:**

It was very clear from the included studies that it was important that students could recognise similar situations in which to apply their new skills: "*I could see similarity … that's why I went to do a blood glucose level"* (Liaw et al. 2012 p. 397). The evidence in Liaw et al. (2012) seems to suggest that concentrating on a single scenario, for instance, a diabetic patient, seemed to reduce transfer of learning whereas an approach such as ABCDE could then be applied more readily to any deteriorating patient because students reported being able to transfer this to practice more readily.

iii) **Theme three - Holistic preparation for practice: Feeling prepared gave students confidence to transfer skills they had learned**.

Feeling prepared gave students confidence to transfer skills they had learned. Moreover, being emotionally prepared "*'I did feel, yeah, that probably did help me emotionally, and because I wasn't probably as shocked as what I might have been had I not had that training session.'* (Venkatsalu 2015 p. 184) and less stressed encouraged students to put themselves forward into these opportunities: "I *did not feel very flustered…There was like a list in my mind that I had learned… that I can apply*" (Liaw et al. 2012 p. 397). These memory strategies, such as checklists, were highlighted as aiding the transfer, as did the use of mnemonics: *"I used SBAR every day at the clinical setting and I used the fall precautions on all of my patients*" (Debourgh and Prion 2011 p. e54).

iv) **Theme four - Supported opportunities to practice**: **exposure to certain patients and scenarios was critical and clinical staff had an important part to play to facilitate this.**

Finally, exposure to certain patients and scenarios was critical and clinical staff had an important part to play in encouraging students and giving them opportunities to transfer learning. This could go awry when clinical staff did things a different way: "*I was supposed to give an injection during my clinical training. I started to do it the way I learned in the CSL, but then my teacher told me to take apart the syringe and the needle, because that's how they do it. I became very unsure and it wasn't good for the patient either. I didn't know what I was supposed to do."* (Ewertsson et al. 2015 p. 281).

The qualitative themes throw some light on why the transfer of learning has occurred. Identifying first and foremost that the simulation is crucial to starting the process and then that certain conditions must be in place before transfer can occur, students must feel confident, comfortable and supported in practice to apply what they have learned in simulation and they must be able to recognise when skills can be applied. Now the methodological rigour of the studies will be examined.

4.10 Methodological Appraisal

The relevant JBI critical appraisal tools (2018) were used to analyse the studies. This scrutiny revealed some limitations worthy of note, namely, a lack of blinding and the recruitment method adopted.

Of interest were limitations concerning educational research when staff are researchers and students are participants and the intervention is an education teaching method - simulation. The studies included in this integrative review demonstrated a breadth of innovative and thoughtful simulation activities on a variety of important topics from intramuscular injection to caring for a dying patient. It must be acknowledged that evaluative research at level three (behaviour change) is very difficult to accomplish as Kirkpatrick (1996) himself purports. All the studies obtained ethical approval which is important to report especially as students are participants and there is a perceived power-imbalance between researcher as educator and student as participant (Butler 2003). This led to two of the three main suggestions for improvements: Academics as researchers, students as participants'; and finally, heterogeneity of simulation activity (**table 4.8**).

Table 4.8: Methodological Limitations of Studies in the Integrative Review

Study design	**Academics as researchers**: ethical consideration required for researcher as lecturer/simulation facilitator. Convenience/purposive sample recruited by lecturers. Assessors not blinded. **Students as participants:** availability leads to single task, single site, small samples, not longitudinal studies
Simulation intervention	**Heterogeneity of simulations:** Limited information for replication, active versus passive roles, different time lengths in simulation/ different levels of fidelity, few follow standards of best practice.

The simulation in the studies were heterogeneous which makes comparisons difficult. Variations included different lengths of time, levels of fidelity and different roles adopted by the students, some passive and some active. Limited information about the simulation would make replication difficult and not all followed standards of best-practice.

4.10.1 Evaluation Methods Used

A range of evaluation methods were used to measure transfer of knowledge from simulation to clinical practice (**table 4.9**). These methods fell into two distinct types: self-reports or work-based assessment / observations of participants.

Table 4.9: Evaluation Methods Found in the Integrative Review Studies

Self-reports (post simulation/ placement)	Free-text in surveys Focus group Interviews	Debourgh and Prion, (2011) Nash et al. (2017) Liaw et al. (2012) Venkatsalu et al. (2015) Ewertrsson et al. 2015
Direct observation on placement	Video with content analysis/scoring sheet and assessor	Ravik et al. (2015)
Work-based assessment whilst on placement	Placement grading system Likert-style placement assessment	Meyer et al. (2011) Harris (2011)
	Scoring sheets and assessor	Kirkman (2013) Ross (2015) Sears et al. (2010) Tuzer at al. (2016)

Qualitative methods of evaluating simulation after a time in clinical practice, were predominantly self- reports; the views and perceptions of the participants themselves obtained through free text on questionnaires, focus groups or interviews (Nash et al. 2017; Venkatsalu et al. 2015; Ewertsson et al. 2015; Liaw et al. 2012; Debourgh and Prion 2011). Only one study used observation by video recording student performance (Ravik et al. 2015).

Quantitative methods were completed in the workplace and were either generic clinical grading assessments (Meyer et al. 2011; Harris 2011) or score sheets with skills broken down into levels to form checklists for an assessor to judge student performance (Avraham et al. 2018; Tuzer at al. 2016; Ross 2015; Kirkman 2013; Sears et al. 2010).

The merits of each evaluation method will be outlined in the discussion section.

4.11 Discussion

The discussion will be presented in three sections: evidence of transfer of skills learning; methodological strengths and weaknesses; and evaluation methods.

4.11.1 Evidence of Transfer of Skills Learning

Limited evidence was found for pre-registration nursing students of statistically significant higher scores on skills checklists and overall better clinical grading scores provide evidence that simulated learning can be transferred to clinical practice. Also, fewer errors were made in clinical practice after simulation. The robustness of this evidence will be discussed in the next section.

Evidence from other healthcare professionals support the transfer findings. Medical research by Domuracki et al. (2009), Boet et al. (2014) and Ahmad et al. (2015) all demonstrated that clinical skills learned by simulation were transferred to practice. Dunn et al. (2015) saw an arthroscopic shoulder surgical simulation training curriculum increase reliability and maintenance of skill over time. Barsuk et al. (2016) demonstrated that learning the skill of thoracentesis by simulation with mastery-learning was seen to increase skills and increase safety with bedside procedures, which were essentially cheaper than expensive referrals.

It could be suggested that less research exists involving students than qualified members of staff, from whatever discipline, because it is less easy to evaluate their practice for they are not responsible directly for decisions in patient care. For instance, in a nursing study by Liaw et al. (2016) deteriorating patient outcomes were screened after simulation. This measurement would not be possible for student nurses as they are not accountable for patient care. However, there clinical reasoning could be explained and assessors such as mentors in practice could evaluate their performance. A second issue when research involves students as participants and their lecturers as researchers is the ethical dilemma of an unequal power base (Ridley 2009). Students may fear their grades or progression on a course may be affected by their engagement or non-engagement with a research study. Reassurances need to be offered that this will not occur.

4.11.2 Methodological Strengths and Weaknesses

The methodological strengths and weaknesses of the studies were evaluated using the relevant tools from JBI (2018). Four main areas to consider are raised:

academics as researchers, students as participants and the lack of homogeneity in the intervention of simulation and finally, in the following section, the method of evaluation.

i) Academics as researchers: Educational research typically involves academics as researchers, this can be termed '*insider researcher*' (Mercer 2007). Ideally researchers should be independent from academic staff but as this is difficult to achieve the relationship at least needs acknowledging; and where possible, colleagues who don't know the student should facilitate data collection.

ii) Students as participants: The student teacher/researcher relationship creates a natural power imbalance (Butler 2003). This must be addressed by the researcher providing assurances that progression on the course, grades and so on will not be affected whether students choose to take part or not; Avraham et al. (2018) refer to this in their study. Venkatsalu et al. (2016) and Koenig et al. (2003) counsel against potentially provoking emotional reactions, especially for first-year nursing students. To compensate this additional post-study support could be offered to students engaging in educational research. Measures to reassure students about engagement in educational research must always be considered and made transparent in studies (Ridley 2009).

iii) Heterogeneity between simulations: Simulation carried out in the included studies were not homogenous. This made them very difficult to compare not least because they ran for different lengths of time (from three hours to two weeks). Multi-site studies following the same simulation patterns would provide more robust evidence.

Student role in simulation was also a major difference; some had active and some passive roles. Evidence around the effects of role are as yet inconclusive. Jeffries and Rizzolo (2006) found students in passive simulation roles rated themselves lower on clinical judgement than those with active roles. Others like Fluharty et al. (2011) showed no difference in knowledge gain between active and passive roles. Nursing students are usually from large cohorts which may affect an institution's ability to provide active roles for each student in simulation every time. To counter this Norman (2018) suggests using an observation checklist for those in a passive role during simulation; student satisfaction increased a small

amount when he used them in a study but there was no significant improvement in knowledge, self-confidence, or collaboration. More research is required to examine the effects of role type and skill acquisition during simulation.

A solution to standardise the simulation in research studies is to adopt simulation best-practice statements. Of the studies in this integrative review, Nash et al. (2017) was the only one that used best-practice statements to guide the simulation design provided, they used INASCL standards of best practice for simulation (2016). Using best-practice statements or quality indicators to guide simulation would enhance the homogeneity of the simulation across multi-sites; so like could be compared to like. It would also make transparency around the intervention of simulation easier to explain when writing manuscripts for publication (Arthur et al. 2013; Jeffries 2005). The INASCL standards were included in the next study in this thesis as choices in the e-Delphi study.

4.11.3 Evaluation Methods

A variety of methods were used to collect data in the studies selected for this review: self-report, direct observation, grading assessment tools and skills checklists.

i) Self-report

DeBourgh and Prion (2011) used self-reports in their study. Self-reports include data collected by free-text on questionnaires, focus group and interviews. Social scientists such as Fisher and Katz (1999) criticize this approach arguing that '*social-desirability bias*' may affect accuracy of views expressed. Using self-reports alone predisposes studies to '*mono method bias*' and this often jeopardizes the validity of research (Donaldson and Grant-Vallone 2002). Observations of behaviour are considered a more objective approach by positivist researchers. Liaw (2012) suggests self-reports validated by observation increases the veracity of the results. Indeed, if there is an incongruity between what participants say they do and what observers see the participant doing then the latter is considered a more exact definition of reality (Sandelowski 1995). Messages for future studies would seem to indicate a mixed-methods approach: an explanatory sequential; exploratory sequential; or convergent mixed-methods (Creswell 2016). As an example of an explanatory sequential approach could involve self-report (qualitative) followed by observation (quantitative). Exploratory sequential is a

quantitative method followed by qualitative and convergent both approaches are used simultaneously.

ii) Direct observation

Ravik et al.'s (2015) study utilised direct observation, which they describe as a qualitative study; however, the researchers then used a quantitative checklist of forty-seven levels required to perform a peripheral venous cannulation. Positivists would claim direct observation to be a quantitative method. Poor transfer of some parts of the skill of cannulation was observed by the researchers. This the researchers attributed to providing simulation with a low fidelity cannulation arm (this is often normal educational practice) because this meant that context: a real patient/ a real environment was absent. Uys and Treadwell's study (2014), involving student nurses, corroborates this, they compared intramuscular injection technique; one group used an injection pad to inject and the other group had a simulated patient with an injection pad attached to them. Patient-centeredness was observed to increase in practice for the latter group. Overall, Ravik et al.'s (2015) results of transfer of the skill of peripheral venous cannulation are supported by Madenci et al.'s (2014) systematic review and meta-analysis of the use of simulation to improve medical trainee's central cannulation technique. Synthesized results from the systematic review studies were positive highlighting an increased accuracy as the number of cannulation attempts were reduced for the simulation intervention group.

iii) Clinical grades

The use of placement grade systems, that are already in use to grade student nurses' performance, can be used to consider if simulation has been effective (Harris 2011)

> "*Clinical grades are an integration of performance, as well as documentation of clinical reasoning…*" (Harris 2011 p.464).

Meyer et al. (2011) study used a Likert-scale placement assessment based on Massey and Warblow's (2005) tool and evidence of transfer of learning was found. There is a caveat however, this is because the grading of student nurses and how clinical competence is measured and how accurate, consistent and reliable assessors are is a matter for debate. Both Duffy (2003) in Scotland and Hunt et

al. (2012) from England raised concern about assessors (called mentors) and questioned how fairly they assessed students. Grading is a subjective and difficult process to manage and leads to uncertainty over the validity of the grading used in the studies. Without access to the tools themselves (in the Meyer et al. 2011 study the tool was not publicly available) and knowledge of assessors' training and experience - a judgement cannot be made on the validity of student grade awarded. Moreover, assessors were not blinded to when a student had attended simulation so bias may have occurred; the effects of any intervention can become exaggerated if outcome assessors are not blinded (Poolman et al. 2007). However, in the case of students attending placement, or simulation, it would be difficult to hide this from mentors on the ward.

iv) Skills checklists: Scoring sheets / assessor rating

Good practice when using any scoring tool is to consider inter-rater reliability (Gwet 2014). Only two of the six studies that utilized a scoring sheet or grading had considered this (Kirkman 2013; Sears et al. 2010). Kirkman (2013) ensured training was delivered to assessors and conducted a pilot to evaluate inter-rater reliability (p.173). Sears et al. (2010) established inter-rater reliability through information sessions. Providing evidence of inter-rater reliability would improve the robustness of the results overall (Gwet 2014). Avraham et al. (2018) acknowledged this as a confounding factor in their study. Using a validated and transparent tool would ensure collective outcomes would be easier to assess (Cant and Cooper 2017). This would strengthen the evaluation of simulation nursing research (Kardong-Edgren et al. 2010).

It is clear there is a need for validated tools for evaluating transfer of skills to practice. Direct observation using a comprehensive and validated tool would strengthen the method of data collection. It is suggested that if HEI's collaborated then they could develop and validate such a tool and use it to conduct multi-site simulation research that would add to the evidence base.

4.12 Strengths and Limitations

A limitation is that the literature searches were restricted to studies published in English. Interestingly, a meta-analysis performed by Kim et al. (2016) on simulation doubled suitable studies when they included Korean databases rather than just studies available in English. In addition, search terms used will affect the

comprehensiveness of the literature search achieved. Conn et al. (2003) identifies the difficulty of comprehensive searches when using databases suggesting that computerised databases may provide only 50% of eligible studies. For this review, hand searches of selected articles' reference lists contributed two studies that had not been identified by electronic means. By excluding qualified nursing staff; inter-professional studies and other health care professionals in the search terms illuminating information may have been missed. However, this integrative review was intended to be focused on pre-registration student nurses hence the exclusion. Nevertheless, it is acknowledged that despite the researcher's best efforts, due to the reasons outlined some relevant literature may have been missed.

Finally, it must be acknowledged that the primary researcher is a nurse educationalist with a keen interest and involvement in simulation who had a positive view of simulation before commencing the review. The involvement of two co-researchers and the use of standardised appraisal tools were intended to mitigate against this potential bias.

The strength of this integrative review is the narrow focus: by only including studies that evaluate transfer of skills at Kirkpatrick's level three and its focus on pre-registration student nurses this adds to the growing body of knowledge about simulation and nurse education. In addition, evaluating the methodology and assessment tools used in the studies should prove a useful guide for future research in this area.

4.13. Conclusion and Recommendations

There is limited evidence demonstrating that learning in simulation by student nurses transfers to changed behaviours in practice. It is recognised that this is a challenging area to research because there are barriers to observing students in practice. Consequently, qualitative studies do tend to rely on self-report rather than direct observation and could be strengthened by adopting a mixed-methods approach which would also help prevent bias. Adopting best-practice statements to guide the simulation might increase transparency and strengthen the validity of the intervention being evaluated and allow replication by others. Higher

education institutions could then work collaboratively to facilitate larger sample, multi -site and longitudinal studies to build the evidence base to support the use of simulation in nurse education. Moreover, by working collaboratively evaluation tools could be validated and shared between academics.

Chapter Four Summary

The integrative review chapter has highlighted that the evidence-base around transfer of student learning clinical skills from simulation to clinical practice is limited but evolving. To strengthen future, much needed research, the use of simulation best-practice statements could standardise and describe clearly the simulation used. This premise led to an e-Delphi study to determine level of consensus for simulation best-practice statements preferred by nurse academics in Scotland and their willingness to adopt them. This was followed by staff interviews to explore staff development needs in simulation.

I was not particularly surprised by the outcomes of the integrative review; however, it did focus my attention on the heterogeneity of simulation and made me question are we comparing like for like. It started me really considering if a larger scale multi-site study was to be carried out what would need to occur to facilitate homogeneity between the simulations occurring in different institutions. This led to the e-Delphi study… would nurse academics across Scotland be able to agree on guiding principles for simulation.

CHAPTER FIVE: AN EXPLANATORY SEQUENTIAL MIXED-METHODS STUDY (E-DELPHI STUDY AND SCOTTISH STAFF INTERVIEWS)

Overview of Chapter Five

This chapter presents an e-Delphi study to determine a level of consensus on simulation best-practice statements that could be used for pre-registration nurse education and subsequent staff interviews that sought to explain issues raised in the e-Delphi. *Scottish nurse academics were targeted to ascertain a current picture of simulation practices in Scotland. It was important to me to establish what was happening in Scotland as my own practice as a nurse academic is in Scotland. Finding out the current practice with regards to simulation and best practice statements would enable me to consider changes to practice in my own teaching and colleagues within my own institution. Moreover, it could help plan a future multi-site study exploring transfer of clinical skills to practice after simulation.*

5.0 Introduction

It has been acknowledged by the Nursing and Midwifery Council since 2007 (NMC 2008), as well as international nursing bodies (Nehring 2008); that academics need-guidelines for effective implementation and integration of simulation into the curriculum (Sando et al. 2011; Wilford and Doyle 2006). Whilst there are of course no guarantees for the quality of simulation one way of attempting to assure best-practice is to adopt a model of simulation and/or quality indicators/ best-practice statements (Jeffries 2005; Jeffries and Rizzolo 2006; Sando et al. 2011). Mapping simulation activity against best-practice statements would ensure transparency of the intervention used and support repeatability between studies of simulation practice. This would be beneficial for multi-site research because simulation practice across different institutions would be more consistently standardised and therefore comparable. As the results from the integrative review demonstrated in Chapter Four, simulation is often poorly described in published research and multi-site studies with larger samples are required to establish if the skills learned through simulation can be transferred to clinical practice.

Four prevalent models, best-practice statements or quality indicators are cited in the literature against which simulation can be mapped; three originating from Australia and the USA (Arthur et al. (2013); Jeffries (2005) and International Nursing Association Clinical Simulation and Learning (INASCL 2017)) and one from the UK (ASPiH 2016). The Association for Simulation Practice in Healthcare (ASPiH) is a not-for-profit membership association dedicated to improving simulation in healthcare education. INASCL is an American federally recognised, non-profit organization whose aim is to advance the science of simulation and improve patient safety through simulation.

Different terms are used to describe how each organisation are guiding simulation so these will be defined. The terms 'quality indicators' and 'best-practice statements' are often used in healthcare synonymously, however, there are slight nuances. The National Institute for Health and Care Excellence (NICE) defines quality indicators as being used to:

> *… generally, measure outcomes that are considered to reflect the quality of care or processes linked by evidence to improved outcomes* (Bennett et al. 2014 p.482).

Conversely, best-practice statements aim to guide the practice of all health care professionals, providing protocols "*on the best and most comprehensive care*" - something to be aspired to (Cayless and Wengström 2008).

The difference between quality indicators and best practice statements is the guiding and aspirational aspect of best-practice statements while indicators measure outcomes 'with evidence'. For this reason, the resulting statements from this study will be termed best-practice statements rather than quality indicators.

There are many similarities between the four previously published standards and quality indicators that are used to guide simulation. However, they also contain some ambiguous statements and culture-specific words or phrases. This doctoral thesis aims to contribute to the design of a robust post-doctoral, multi-site, longitudinal study across Scottish schools of nursing. Therefore, obtaining a current picture of simulation practice across Scotland is an essential starting point. In addition, seeking a consensual view of whether the adoption of best-practice statements would be acceptable to nurse academics will help to guide educational

practice. It is proposed that if the use of simulation best-practice statements is adopted this could lead to improvements and enhanced transparency around simulation used to teach pre-registration nurses and reporting accuracy about simulation as an intervention would be clearer in published simulation research.

Succeeding the integrative review, a Delphi study was performed to investigate a limitation revealed in the review. Linstone and Turroff's (1975) seminal work aimed to provide a choice of philosophical underpinnings for the technique of Delphi study. They recognize that as a method of data collection it can be used for a variety of purposes that depend on your paradigm. They term these '*inquiry systems' (IS)*, the way we look at the world of theories and data collection. The Lockean inquiry system has a neat fit with a pragmatic approach to conducting research.

> *"The Lockean analyst or IS would ask something like: Since for me data are always prior to the development of formal theory, how can one independently of any formal model justify the assertion by means of some objective data or the consensus of some group of expert judges that bears on the subject matter of the assertions? What are the supporting "statistics"? What is the "probability" that one is right? Are the assertions a good "estimate" of the true empirical state of affairs?"* (Linstone and Turoff 1975 pp.18-19).

'Truth' asserted Locke and other philosophers in the 17th and 18th centuries (Bacon, Boyle, Locke, and Newton), can usually be derived from induction. This means that the researcher must gather data before making generalisations about the "laws of nature" (Linstone and Turoff 1975, p.19). In this tradition, the Delphi technique will be used to collect data about the usage of simulation best-practice statements in pre-registration nurse education.

5.1 What is the Delphi Technique?

The Delphi technique was first used by the RAND Corporation in the 1950's, to elicit expert opinions on critical military decisions. [The RAND Corporation is an

American non-profit global policy 'think-tank' created to offer research and analysis to the American Armed Forces]. The Delphi technique was developed by Dalkey and Helmer (1963), to seek the views of a group in addition to uncovering different opinions about any given topic (Linstone and Turoff 2002).

Since then wider definitions have evolved, with Linstone and Turoff (2002) defining it as a way of '*group communication*', allowing participants to deal with a complex problem. Hasson and Keeney (2011 p.1696) suggest the generic aim of the Delphi technique is '*to predict and explore group attitudes, needs and priorities."* It is to meet this goal that the Delphi technique was adopted as a research method for this study because the views of disparate educators involved in pre-registration nursing simulation were required.

5.1.2 Historical Background

"*Delphi*" is a site in Greece, found on the south-western slope of Mount Parnassus. In Ancient Greece, and Roman mythology, it was said to be where the high priestess '*Pythia*' lived, who was thought to be the god Apollo's Oracle. She was consulted on important decisions, especially on matters of war and invasion; hence, the link to decision-making in modern day warfare (Scott 2014).

5.1.3 Types of Delphi

Traditionally, there are three types of Delphi, each with its own objective: A "*Policy*" Delphi is used to formulate strategy or answer a specific problem; a "*Classical*" Delphi forecasts the future, typified by the RAND Corporation and finally a "*Decision-making*" Delphi is used to strengthen decision making. How these are carried out will depend on the aims of the research (Avella 2016). For this Delphi study a decision-making approach was adopted on round one and two. In round three the questions adopted a classical forecasting approach, asking the expert panel about future use of the best-practice statements.

5.1.4 Format of Delphi Technique

In its original format an expert panel is recruited after which a series of questions can be distributed. Traditionally, postal questionnaires were utilised; however, emails have been accepted as the new 'normal' method of delivery (McMillan et al. 2016). The method allows geographically disparate experts to give their specialist opinions on any given subject; useful to either determine the level of

consensus or to allow outlying views of a topic to emerge. The principle being that the collective opinion of the expert panel is more valid than individual opinion and that by engaging a panel of experts nothing will be missed (Hasson et al. 2000).

5.1.5 The Delphi Expert Panel

The experts constituting the panel are recognised as individuals who have the necessary knowledge and experience of the topic matter; the time, capacity and willingness to participate and possessing effective communication skills (Adler and Ziglio 1996). For this study the 'experts' are nursing academics in Scotland who are involved in simulation development and delivery. Baker et al. (2006) discuss the issues with defining 'expert' but for this study criteria were set around the level of engagement the participant had with simulation rather than them having achieved a set qualification or having reached a certain standard. Moreover, they were defined as being expert by their involvement and interest in simulation.

5.1.6 Uses of Delphi Technique

It is recognised that the Delphi technique has been used effectively for both healthcare (Clay-Williams and Braithwaite 2009) and educational purposes (Barton et al. 2009). In nursing research, the use of the Delphi method is continuing to rise: A database (MEDLINE, CINAHL, ERIC, Socindex, Psychindex) search using EBSCO*host*, for the years 2010–2018, found 2,821 nursing-related Delphi manuscripts in academic journals. In the last two years (2016-2018) the total was 1,119; indicating that 40% of the Delphi studies published over the last eight years have been published within the last two years. Recent examples include Roth et al. (2017) who used the method to identify human factors that contributed to nursing errors. Those used in nursing education include Schofield (2018), who examined entry to practice public health competencies and Lofmark and Martensson (2017) who used the Delphi technique to validate a nursing clinical assessment tool.

5.1.7 Rationale for Selection of Delphi Technique

The rationale for selecting the Delphi technique as a research method needs to be persuasive. An essential factor is that the results need to be more accurate than those achieved by either individuals or indeed other forms of group research methods (Rowe et al. 1991).

Vernon (2009) summarises other group approaches and each was considered for this study. '*Consensus development conference*' takes the form of a public forum for the discussion of distinct issues (Murphy et al. 1998). Negatively, these face-to-face meetings may be dominated by one or two individuals. The fact that only one person can speak at once limits the amount of responses, and therefore data, that can be achieved (Murphy et al. 1998). Jairath and Weinstein (1994) also stress the biasing effects that different personality traits or assumptions of seniority might have. This factor had the potential to skew this study's results because the expert panel are individuals with different roles and levels of seniority. Moreover, coming from competing institutions may have made individuals reticent about revealing information about their own, and their institutions', simulation practice. Schools of Nursing are in competition with each other to attract student numbers and to meet government targets for recruitment. This can restrict the sharing of institutional practices and ideas.

Another less well-known group technique is Glaser's '*state-of-the-art approach*': Glaser would invite other physicians to consider a position paper who would in turn invite others to consider it. Redrafts would be made until it was judged to be an acceptable paper (Fink et al. 1984). This method does not allow for anonymity between the participants which was a necessary factor for this study to encourage honesty and openness of responses without them having concerns about revealing an institution's identity or their practices being judged by others. Nor would it allow items to be considered simultaneously, which would extend the time the study would take.

'*Social judgement analysis*' (Murphy et al. 1998) focusses on the reasons behind a participant's decisions, giving feedback on why consensus has not been reached, but is not a consensus method. In this study the primary aim was to determine levels of consensus; although the participants' free-text comments did highlight some of their decision-making rationale.

'*Staticised group*' differs in that participants work individually on a problem and then the results are presented as a group view. In this method, there is no interaction between the participants, which was essential to this study's aims and objectives as maintaining confidentiality was important to allow participants to freely express their views, which may be different to the institutional view.

The method which is claimed to have the maximum alliance to the Delphi technique is the '*nominal group technique*' (Delbecq et al. 1975), this is because it is like the face-to-face (real-time) Delphi technique. This technique uses committee decision-making where participants are face-to-face in a structured group interaction. It has four stages: silent generation, round robin, clarification and finally voting by ranking or rating responses (McMillan et al. 2016). The anonymity required for this study would neither be facilitated by the nominal group technique nor indeed the face-to-face Delphi technique.

Focus groups also offer an alternative group approach (Krueger 2014); however, the concerns outlined above would still resonate with this method. Furthermore, recruiting individuals from different Higher Education Institutions (HEI's) and then conducting a focus group would mean that they would not have had anonymity from each other. In addition, getting everyone together face to face would be costly, time-consuming and with competing diaries and priorities difficult to achieve. An electronic focus group or blog approach might ease the cost and time issues but still would not allow for the same level of anonymity and freedom for individuals to express their opinion.

Conversely, the Delphi technique facilitates, at all stages of the process, anonymity of the panel members from each other. This allows the panel to speak freely, independently and will hopefully avoid "*groupthink*" (Janis 1972). These principles are required for this study as the population (Scottish nurse academics involved in simulation) are disparate; working in various locations around Scotland. Confidentiality, both for the individuals and their institutions, is essential to allow honesty and freely given opinions and critical to the success of the study.

Another crucial element that influenced the decision to adopt the Delphi technique is that the researcher neither contributes to the discussions, nor influences the participants. Instead, the researcher is both the '*planner*' and '*facilitator*' rather than '*contributor*' (Avella 2016). This factor, which aims to reduce bias, was useful in this study because the primary researcher is involved in simulation and naturally holds her own views about the development and delivery of simulation.

Decisions made by the expert panel were illuminated by the provision of comments in 'free-text' boxes. During the facilitation of the rounds, the researcher provided

summary feedback to the participants by collating the panel's individual responses, making changes to statements and additions as provided by the expert panel. It is this '*controlled*' feedback process that allows consensus to emerge by allowing participants the opportunity to amend their original viewpoints essential to highlight new ideas or areas of non-consensus (Vernon 2009). Most of the free-text comments related directly to the statements themselves, however, there was also considerable focus on staff development for simulation and it this was deemed an important topic to investigate further by conducting staff interviews.

5.2 Aim of the Study: Explanatory Sequential Mixed-Methods

The purpose of the explanatory sequential mixed-methods study was to ascertain and explore nurse academics views on current practice in Scottish HEIs in relation to the use of simulation best-practice statements. The e-Delphi was carried out not to impose a consensus but to see if it exists; to uncover what the shared views of nurse academics were and what the outlying opinions are (Linstone and Turoff 2011). The aim of the staff interviews was to explain any issues (or outlying opinions) that arose from the e-Delphi.

5.2.1 Objectives

e-Delphi Objectives

- To explore the current use and practice of simulation and simulation best-practice statements across Scottish nursing schools.
- To determine Scottish-wide level of consensus on simulation best-practice statements for use in nursing curricula.
- To gauge Scottish nurse academics willingness to adopt the agreed simulation best-practice statements and be involved in further research on the effectiveness of simulation.

Interview Objectives (post e-Delphi study)

- To explore nurse academics' perceptions' of staff training/education on the topic of simulation.

- To explore whether nurse academics perceive further staff training or education in simulation is required.
- To explore nurse academics views on barriers, enablers and 'blue sky' thinking about staff development in simulation.

5.3 Study Design: Explanatory Sequential Mixed-Methods

Creswell (2013) outlines the 'explanatory sequential mixed-methods' where quantitative data is collected and analysed before qualitative data is collected to help explain the quantitative data. This study consisted of these two parts: the mainly quantitative e-Delphi study was followed by qualitative data, collected by interview, which sought to explore issues raised in more detail using a qualitative descriptive approach.

5.3.1 Setting

The research setting was online for the e-Delphi and telephone for the interviews.

5.3.2 Population: Explanatory Sequential Mixed-Methods

The population selected was nurse academics in Scotland who were engaged strategically or operationally in simulation in pre-registration nurse education. The reasons for selecting this group were:

i. To gain a picture of current simulation nurse educational practice in Scotland.
ii. To gauge the opinions of Scottish nurse academics on simulation best-practice statements from world-wide sources, to contextualise them to Scottish simulation practice and assess their readiness to adopt them.
iii. To assess Scottish nurse academics willingness to be involved in future simulation multi-site studies.
iv. To ensure a sufficiently homogenous sample (e.g. curriculum same duration throughout Scotland).

The following institutions with Schools of Nursing were targeted:

- Abertay University
- Dundee University

- Edinburgh Napier University
- Glasgow Caledonian University
- Queen Margaret University, Edinburgh
- Robert Gordon University
- University of Stirling
- University of Highlands and Islands
- The University of Edinburgh
- University of the West of Scotland
- University of Glasgow

It was hoped that nursing representatives from key organizations such as the Nursing and Midwifery Council (NMC), NHS Education for Scotland (NES), and the Scottish Clinical Skills Network (SCSN) could also be recruited. At least one representative from each institution was preferred to get a good cross-section of participants.

5.3.3 Inclusion Criteria: Explanatory Sequential Mixed-Methods

Individuals were identified from HEI websites or SCSN membership and were employed by Scottish Schools of Nursing or Higher Education Institutions involved in delivery of pre-registration nursing education. The nursing academics(s) approached for the expert panel met the inclusion criteria listed below; they were responsible for the delivery of clinical skills to pre-registration nursing students and involved in using simulation or they were responsible for the strategic development of teaching skills in their institution if they had a senior role. Comparable to the requirements set out in the Delphi study by Arthur et al. (2013), the individuals invited to join the expert panel membership met one or more of the following criteria:

- Editors or chapter authors on simulation in nursing textbooks.
- Authors of peer reviewed nursing journal articles on simulation.

- Accepted as speakers/ presenters at national/ international conferences on simulation.

- Members of simulation groups, such as Association for Simulation Practice in Healthcare (ASPiH).

These criteria were set because not all academics in Higher Education Institutions are involved in simulation and to meet the conditions of 'expert' in simulation these criteria were considered appropriate.

5.3.4 Exclusion Criteria: Explanatory Sequential Mixed-Methods

Schools of Nursing not in Scotland or Higher Education Institutions not involved in delivery of pre-registration nursing education. Academics who are not involved directly with teaching clinical skills or simulation to pre-registration nursing students and who do **not** meet any of the criteria set out above.

5.3.5 Ethical Approval: Explanatory Sequential Mixed-Methods

Ethical approval was granted by the Robert Gordon University School of Health Sciences Research Review Group (SHS /18/04). The main ethical consideration for this study was confidentiality (NMC 2018) maintaining the anonymity of the expert panel members from each other and from wider audiences; McKenna (1994) terms this '*quasi-anonymity*' because the researcher must send follow up emails, they therefore know the panel member's email addresses. The responses in the e-Delphi were not linked to the email addresses and were deidentified for analysis. However, the anonymity from each other allows the experts on the panel to offer their opinion in privacy without fear of themselves, or their institution, being associated with certain views or data. This issue of confidentiality was pertinent for the interviewees as well, particularly because they discussed institutional practices as well as their own. It was made transparent to the interviewees that any quotes taken from the transcripts used in the thesis, conference proceedings or publications would not be attributable to anyone or be linked to any place (NMC 2018).

5.3.6 Recruitment and Sampling: Explanatory Sequential Mixed-Methods

Recruitment was aided by previous networks facilitated by the Scottish Clinical Skills Network (SCSN) and HEI websites.

Participants deemed likely to be eligible for the expert panel were sent an introductory email (**appendix 5**) and information sheet (**appendix 6**). They were also asked to nominate suitable participants and forward the email accordingly. Regarding the interviews members of the expert panel were targeted to see if they would be willing to be interviewed as well as other academics who met the criteria. If those contacted replied in the affirmative then a mutually convenient time was arranged for the telephone conversation to take place. Again, they were encouraged to pass on the request and information.

Therefore, sampling was purposive (Etikan et al. 2016a) because individuals who met the specific criteria were targeted who were known to have experience of and interest in simulation. After this snow-ball sampling (Etikan et al. 2016b) ensued as others were recommended by those initially targeted.

5.3.7 Data Collection: Explanatory Sequential Mixed-Methods

The e-Delphi data collection was conducted during March and April 2018. The telephone interviews took place during November and December 2018 and, due to illness of a confirmed interviewee, one was conducted in January 2019.

5.3.8 e-Delphi Pilot

Presser et al. (2004) recommends a pilot of the e-Delphi to reduce the likelihood of technical error and to test the content and face validity of the questions (in this case simulation best-practice statements). Therefore, a pilot (21-23 February 2018) was conducted of the first round of the Delphi technique with three academics and one e-learning advisor from one university to test functionality and clarity of the questions. Following the pilot and feedback from the participants, the panel members' instructions were amended to clarify their required actions. Also, grammar and spelling errors were corrected to ensure clarity of meaning and promote a professional appearance. However, the original statements from Arthur et al. (2013), Jeffries (2005), INASCL (2017), and ASPiH (2016) were meticulously copied from the originals without any alterations.

5.3.9 e-Delphi Rounds

This study was conducted in three rounds, which was considered adequate to gain consensus for a homogenous group (Briedenhann and Butts 2006). The number of rounds was specified at the start of the study so that participants were aware

of the commitment required. Most Delphi studies run for a specified number of rounds; Diamond et al. (2014) found 71% of the studies did so in their systematic review. In this study because round one delivered prepared statements only round one and two were used to obtain the level of consensus and the third round asked about their willingness to use and engage with the simulation best-practice statements. Based on recommendations each survey round was open for two weeks (Fan and Yan 2010). The premise for this time-period was that participants needed long enough to engage in the process but not too long, so that they forgot or did not prioritize it. Imperative for expert panel membership was that the participants had the expertise, the time and the interest to engage with the quite lengthy process.

It was recognized that it would be unlikely to obtain total agreement about the simulation best-practice statements; indeed, there is debate about what percentage should be accepted as consensus. Keeney and McKenna (2006) suggested that anywhere between 50-80% agreement could be viewed as consensus.

For this study, the target set for consensus was a weighted mean of 4.25 this was because it was considered that a high degree of consensus would be required to facilitate future research and influence and change current practice. If the simulation best-practice statements selected have the potential to be adopted by educational institutions and standardise the intervention (simulation activity) in future research there needs to be a high level of agreement that these statements are appropriate.

5.3.10 Likert-Type Scale

The Likert Scale was developed by Likert in 1932 as a way of measuring attitudes, character and personality traits; a true Likert scale had a series of questions that when grouped together might suggest you held a certain attitude, towards exercise for instance or indicate a certain personality type (Boone and Boone 2012). A Likert-type scale asks the respondent to respond to individual statements, as in this study. In both cases respondents indicate both direction of feelings (agree or disagree) and the intensity of that feeling (strongly or not) in one response to any given statement. Both the direction of feeling and intensity

of feeling were necessary in this study to allow respondents to deliver their opinion and strength of that opinion on the simulation best-practice statements.

Likert scales have usually five, seven or nine points of choice, which allows for a middle ground or neutral point. For a five-point scale for example, respondents are asked to 'strongly agree', 'agree', 'don't know/ have no opinion', 'disagree', 'strongly disagree' (McNeill and Chapman 2005). Burns and Grove (1997) suggest if the neutral option is not offered then the respondent may feel pressure to choose and therefore may opt to not respond at all, which in turn increases non-response bias. The middle option or neutral ground was therefore offered in this study; the available choices were: strongly agree, agree, neither agree nor disagree, disagree, strongly disagree.

SurveyMonkey® provides the web-base to set up Likert style questions so the Likert format was readily available. An alternative scale provided on SurveyMonkey® is the linear scale where respondents mark themselves on a line-scale between for example, 1-10, 10 - being I feel anxious about x to 1 - I never feel anxious about x. This visual analogue scale is particularly useful for subjective enquiries, how much pain someone is experiencing for instance. Another alternative to the Likert Scale is a content validity index (I – CVI) as described by Polit and Beck (2006). However, as this scale requires careful explanation and the expert panel must understand how the rating scale works it was considered prudent to use a scale that would be familiar to the expert panel members to promote engagement.

Consequently, it was decided to adopt the Likert-type scale questions as these would be easily recognisable by the expert panel members and accordingly easy to use. Moreover, the range of choice of responses, strongly agree to strongly disagree was felt to be appropriate to facilitate the respondent to consider the strength of feeling towards their selection and lastly, Likert-scale options were provided as a structure for the questions on the SurveyMonkey® site.

5.3.11 Definition of Consensus

Consensus is defined as the majority opinion or general agreement, concord or harmony (Oxford English Dictionary 2009). However, Heiko (2012) suggested that

three different criteria can be set for Delphi studies: Reliability, agreement and consensus and Heiko states that these terms should not be confused.

- Reliability - measures the proportional consistency of variance amongst raters.
- Agreement – measures the extent to which the participants agree with each statement.
- Consensus – measures the extent to which the participants agree with each other.

The final measure of importance for this study was consensus because a list of simulation best-practice statements that was endorsed by an expert panel was the goal. Participants individually demonstrated their level of agreement with each statement and these were amalgamated to see the extent to which the participants agreed with each other.

How consensus is defined is determined by the research question and implications of the research. This study was concerned with determining if consensus exists rather than it being used as a guide to when the survey should cease. For instance, some studies might determine a priori that the survey will end once 50% consensus has been reached. Consequently, the number of rounds could be set. In this study three rounds were used, so whichever statement had not reached a weighted mean of 4.25 in round two would not be included. The mean was set quite high because it was considered important that there was a high degree of acceptance of the selected statements.

5.3.12 Modified Delphi Approach

In a conventional Delphi, based on a three-round approach, the first round is when qualitative data is collected by the participants responding to open questions (Keeney et al. 2011) this is also known as a '*Responsive Delphi*' (Duffield 1993). In this study a '*modified*' approach was taken, distinct to a conventional one, because the initial statements were provided by the researcher rather than the panel members themselves responding to open questions set by the researcher. Careful selection of a range of previously published simulation best-practice statements were presented to the panel as options, thus reducing the need for them to produce their own at the outset (Custer et al. 1999) and reducing the

time required for panel members to participate in the survey. For example, in the ASpiH set of statements the three statements about 'insitu' simulation, which takes place in a hospital setting were removed as this study was about simulation conducted in the educational setting of a clinical skills centre. Insitu simulation occurs in the workplace where the participants are employed and is not typically relevant for pre-registration nurses.

In its original format the Delphi technique used pen-and-paper questionnaires. However, communication by email and electronic survey have reduced the cost and increased the speed and reliability of the technique, this adaptation of the Delphi technique, is known as an '*e-Delphi*' and was employed for this study (Cowman et al. 2012). To facilitate the online e-Delphi study an electronic survey instrument (Survey Monkey®) was used. This had the benefits of providing a questionnaire structure and analysis function and it also maintained participant privacy from each other.

5.3.13 Response Rates e-Delphi

Response rates in Delphi studies range from 8 – 100%; there is no agreed minimum response rate, but low response rates will compromise internal and external validity (Keeney et al. 2011). It is reported that online panel response rates can be lower than mail or telephone survey (Fan and Yan 2010). To enhance response rates to electronic surveys non-monetary incentives can be offered. To enhance response rates to electronic surveys non-monetary incentives can be offered. These include giving participants prompt feedback; succinct e-questionnaires; showing others have responded; interesting topics; using white backgrounds; offering survey results; personalising invitations; a simple header; use of visuals such as a picture; response categories displayed as text; providing a deadline for responses (Edwards et al. 2002). To attempt to increase responses and reduce drop-out rates a number of these techniques were adopted. In round one, previously published simulation best-practice statements were provided, instead of each participant developing their own. E-mail invitations were delivered to pre-inform potential participants. The information letters were comprehensive, and confidentiality of place and person assured. Through the platform of SurveyMonkey® the survey itself was intuitive to use because it was set out

clearly and professionally. SurveyMonkey® facilitated either reminders or thanks for completion/part completion to each participant, provided a link to the survey, notification of expected return dates and when the next rounds were going to be released. Once all the respondents had completed the survey round, each round had cut off dates, then summary feedback was provided on each statement, so the participants could see how others had responded. Finally, each participant was sent the final set of agreed simulation best-practice statements.

"Anonymity, iteration, controlled feedback and statistical aggregation of group responses" (Rowe and Wright 1999 p.126) are key features of a Delphi and these were all requirements for this study. To conclude this section, a Delphi technique provided the ideal method for this study; enabling the researcher to reach geographically disparate experts whilst assuring their anonymity from each other with no cost to the researcher.

5.4 Method: Explanatory Staff Interviews

Although the e-Delphi study established a level of consensus on simulation best-practice statements, it did not offer the scope to allow participants to discuss their perceived staff development needs in relation to simulation (Walker and Selfe 1996; Goodman 1987). During the e-Delphi study staff awareness around the use of models or best-practice statements in simulation seemed limited, however, all the expert panel recognised training and education in simulation was necessary and in need of improvement. As reported earlier, the importance of adequate staff and student training and support for use of technology is supported in the literature (McGaghie et al. 2010; Fetter 2009; Jones and Hegge 2008). Therefore, following the e-Delphi study, telephone interviews were conducted, with staff who are engaged in simulation, to explore their perceptions on simulation and staff development in more detail.

Following the Delphi study interviews were conducted to explore issues raised in the Delphi study. Pragmatism endorses mixed-methods and encourages methodological approaches that will provide the answers to practical questions.

Interviewing provided a medium to explore in detail staff development about simulation. A qualitative descriptive approach, using thematic analysis as a method for data analysis was used, this is based on the principles of naturalistic enquiry (Lincoln and Guba 1985) and applies a low-level of interpretation to the data. A useful and acceptable approach when a straightforward description of the phenomena is required (Lambert and Lambert 2012).

It is accepted that research findings can be placed on a continuum that will highlight the extent to which data has been transformed during analysis from description to interpretation (Sandelowski 2010; Sandelowski and Barroso 2003). Higher levels of interpretation would occur in grounded theory or hermeneutic phenomenology and lower levels in descriptive phenomenology, or a qualitative descriptive approach. The benefit of a qualitative descriptive approach is the knowledge and meaning that can be gained is closer to the original data, plus, it allows researchers freedom from adopting a recognised but potentially restrictive research approach (Sandelowski 2010).

As methods of data analysis, both content analysis and thematic analysis aim to make sense of large amounts of text by categorising it into smaller units (Sparkes 2005). Content analysis is a general term for a range of strategies to analyse text (Power and Knapp 2006) in which trends, patterns, frequency of words and their relationships are explored (Gbrich 2007). Bloor and Wood (2006) describe the purpose of content analysis is to "*describe the characteristics of the document's content by examining who says what, to whom, and with what effect*" (Vaismoradi 2013 p.400). This may involve generation of some quantitative data, frequency of a certain word for example. Colorafi and Evans (2016) give exemplars of how content analysis can be used successfully in qualitative descriptive studies. Meantime, thematic analysis is mainly described as "*a method for identifying, analysing and reporting patterns (themes) within data*" (Braun and Clarke 2006 p.79). Thematic analysis was selected for this study to identify common threads across the twelve interviews *(*DeSantis and Ugarriza 2000) and to provide a solely qualitative, comprehensive account of the data (Braun and Clarke 2006). Willis et al. (2016 p.1193) describes how the researcher

"Interprets common themes, moving beyond what individual participants reported, clustering together common ideas from multiple individuals to represent the data."

Semi-structured telephone interviews were conducted with participants who were nurse academics involved in simulation activity. Half the participants had also been involved in the e-Delphi. An introductory email was sent to the expert panel and additional academics engaged in simulation (**appendix 7**) and an accompanying participant information leaflet for the interview phase (**appendix 8**). Consent questions were recorded at the start of the interview (**appendix 9**)**.** Semi-structured interviews are the most common type of interview used in qualitative research (Holloway and Wheeler 2010). Pre-determined questions and prompts were planned (**appendix 10**); however, the interviewer was free to adapt questioning and explore issues as they occur - the interview can then become more conversational in nature – and it is anticipated the data richer (Vaismoradi et al. 2013).

The interviews were conducted by telephone as the interviewees were geographically disparate and this provided a low cost, easily accessible and managed method of collecting data. Some of those interviewed worked at the lead researcher's host institution, they were also interviewed via telephone to ensure all interviewees were treated equally. Twelve telephone interviews were conducted in total and each lasted no longer than 30 minutes. Each interview was facilitated by the lead researcher. Two audio-recorders were used to record the interviews, in case one device failed; the batteries were checked regularly and replaced as required. The interviewer ensured that a private room was used when interviewing in the workplace and a 'do not disturb' sign was put on the office door; some of the interviews were also conducted undisturbed from the researcher's home (**appendix 11** displays the interview itinerary).

5.5 Data Storage

Data collected from the e-Delphi and the interviews was stored safely on an RGU research-drive with password protection, in accordance with RGU guidelines: Research Governance and Integrity Policy (2016) and RGU Research Data Management Policy (2015). These standards are in accordance with the best-practice defined by the Research Councils UK (RCUK) Common Principles on Data Policy (2015) and with The EU General Data Protection Regulation (GDPR) 2018.

5.6 Data Processing e-Delphi

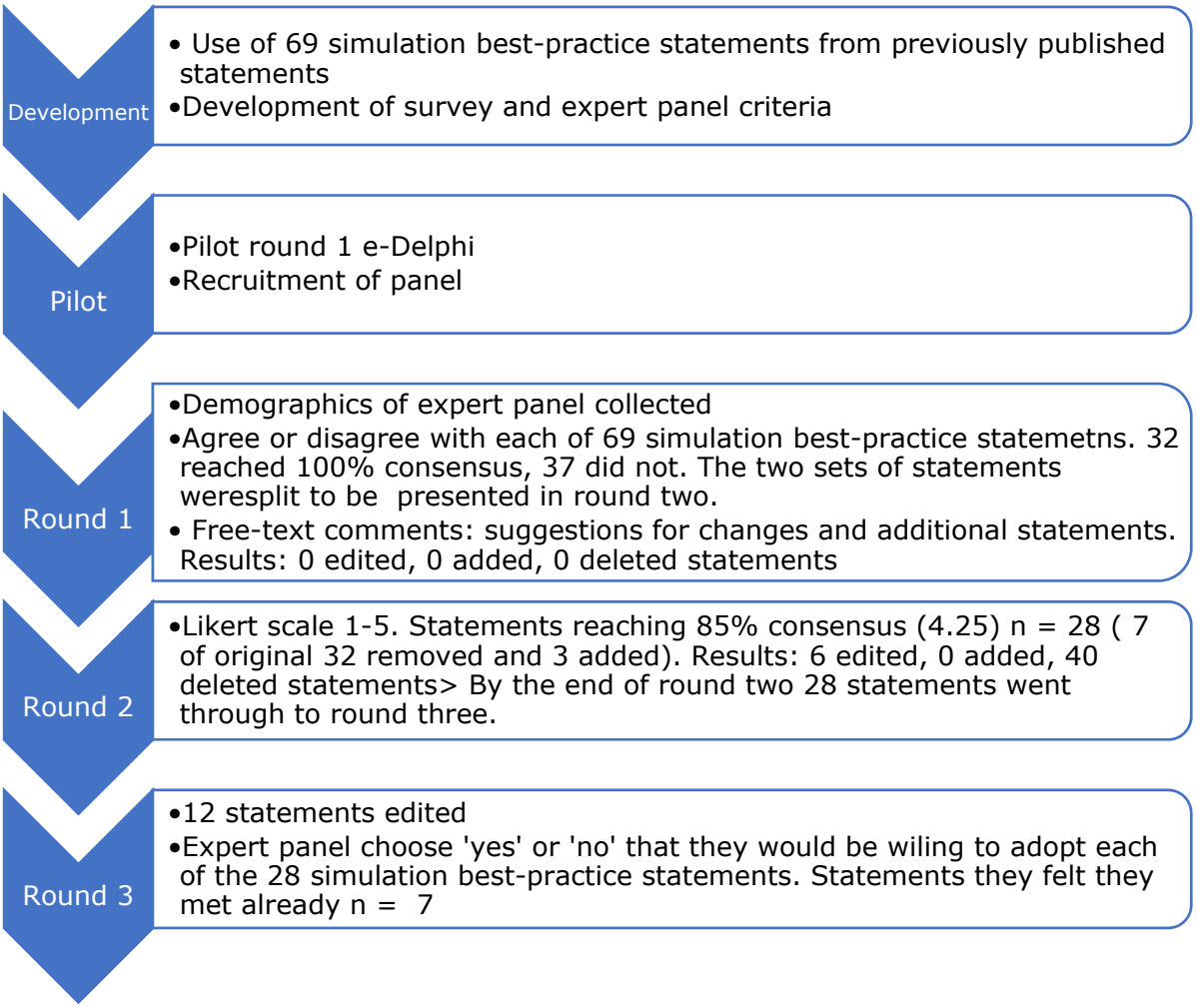
As each round of the e-Delphi concluded then the data was processed in readiness for the next round. **Figure 5.1**: Flow chart of e-Delphi data processing - illustrates the steps preceding and then taken in the three rounds of the e-Delphi study.

In round 1: In round one the expert panel members had to agree or disagree with the statements provided. These were the only two choices. The descriptive statistics showed the percentage of agreement the panel had with each statement.

In round 2: Those statements receiving 100% were presented on one p. and those not achieving 100% were presented on another p. each with a summary of comments made by the panel members. The expert panel members got the opportunity to review all the statements and the summary of their feedback comments. The panel could then see which statements they had rejected and which they had accepted. By voting on a Likert Scale the participants could re-evaluate their opinion on all the statements. The weighted mean results were applied to each statement, a weighted mean score of 4.25 and above was accepted as consensus.

In round 3: The final 28 selected statements were presented to the expert panel. They were asked to indicate if they followed each statement in their own institution by answering 'yes' or 'no'. They were then asked a series of questions about their willingness to adopt the statements and be involved in future research.

Figure 5.1 e-Delphi Round Process



5.6.1 Data Processing Explanatory Interviews

The interview transcripts were uploaded to NVivo11 before being coded and then manually themed.

5.7 Data Analysis e-Delphi

Data analysis took place of demographic information, Likert-type scale responses and free-text comments.

Demographic information: Age (range) gender (ratio) number of years teaching (range and mean).

Descriptive statistics: Percentages were applied to the expert panel answers in rounds one and three. In round two weighted mean scores were used.

Qualitative free-text comments: The free-text comments were added to NVivo11 for each individual round (1-3) and thematically analysed using the steps outlined by Braun and Clark (2014): familiarisation with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes and producing the report. Familiarisation with the data was achieved by the main researcher producing the rounds of the e-Delphi study using an iterative approach. The free-text comments from each round were inputted into NVivo11 before being coded. Themes from each individual round one to three were exposed and presented individually. The themes from round one to three were synthesised into final themes that represented all three rounds.

5.7.1 Analysis of Likert-Type Data

Likert-type scale data is an 'ordinal' measurement scale because the numbers express a 'greater than' or 'smaller than' relationship rather than representing a true numerical value (Gerrish and Lacey 2010). The distance between agree and disagree will not be the same for us all and will depend on the question being asked and our strength of feeling towards it. Although is not an exact measurement and does not have real numerical value; it does provide an indication of strength of attitude towards any statement.

Descriptive statistics advised for ordinal measurements are: Mode or mean can be undertaken for central tendency and frequencies for variability (Boone and Boone 2012) **table 5.2.**

Whilst Boone and Boone (2012) propose that the median or mode are optimum central tendency measures for Likert-type data SurveyMonkey® has the functionality to provide a weighted mean average; this when calculated, will furnish the researcher with a measure of central tendency. The mean is weighted against how many participants responded to the question.

Table 5.2 Suggested Data Analysis Procedures for Likert-Type and Likert Scale Data (Boone and Boone 2012).

	Likert-Type Data	Likert Scale Data
Central Tendency	Median or mode	Mean
Variability	Frequencies	Standard deviation
Associations	Kendall tau B or C	Pearson's *r*
Other Statistics	Chi-square	ANOVA, t-test, regression

One of the methods that can be used to show internal reliability or consistency is to ascertain the stability of the results between rounds: Frequencies of variability tests are adopted for this. Chi-squared can be applied to ascertain measure of association: Is there a difference between the observed (experimental value) and the expected (theoretical value). Chi-squared is a non-parametric test because it makes no assumptions about the normal distribution of the population. However, Holey et al. (2007) suggest the Chi-squared test *cannot be used to test stability in Delphi studies because it will only determine the "independence of the rounds from responses found in them"* not the stability of responses between separate rounds (Holey et al. 2007, p. 53).

An alternative test that is suggested is the Kappa statistic; with high or increasing Kappa values demonstrating the stability of individuals' views within a group. However, this is not a suitable test for this data because Kappa is a measure for nominal scale agreement and as such it assumes that rating does not have a natural order. A suitable test for ordinal data that can be used to test stability of response is the Wilcoxon matched pairs rank test. This works with paired data of the same group of individuals in a before and after scenario. When there is no significant change then responses are considered stable. However, there were issues with performing Wilcoxon matched pairs rank test on this study's data in that:

a) The two sets of data from round one and two were not paired. This was because the expert panel members were not necessarily the same for each

round so an individual's round one response could not be mapped to their round two response.

b) The data used was not the raw data but the summarised data of the agree/ strongly agree categories.

Greatorex and Dexter (2000) used means and standard deviations (SD) for comparing movement between Delphi rounds as a measure of both stability and convergence. However, because means were not used in this study's first round this was not possible. It would be a learning point for the future to use the same Likert-type scale for all rounds undertaken should this test be required to measure stability for future studies.

Securing advice from a statistician the basic statistical test of 2- sample proportion analysis for summative data was performed in Minitab 11. For each question statement the level of agree or strongly disagree was used. See **table 5.3** illustrating the 2 – sample proportion test lay out. Round one was dichotomous so was split into the choices of agree or disagree. And then round two had five choices so the two agree statements: agree or strongly agree where used to compare the results to round one's 'agree' statement.

Table 5.3: 2 – Sample Proportion Test Lay Out

	Sample 1 (round 1)	**Sample 2 (round 2)**
Events	Agree	Agree or strongly agree
Trials	9	9

If the statement results were statistically significant then there was not stability between rounds.

If the statement results were NOT statistically significant then there was stability between rounds. Probability was set at $p < 0.05$

Due to the data being summarised Fishers exact was used as the test of proportion analysis because this would be more accurate than the total approximation; both were available on Minitab 11.

Round One

The first round was in two sections (**appendix 12**), part one collected demographic information from each expert panel member and included questions about current simulation practice, how simulation is used in the institution's curricula, who facilitates the simulation, if best-practice statements are used, and if so which ones. Part two of round one, was a dichotomous style questionnaire (agree/disagree) against an amalgamation of best-practice statements from four sets of simulation best-practice statements. The purpose of round one was for the expert panel to be introduced to the statements and attribute a 'gut' choice of agree or disagree to each statement. The selection of original statements was displayed in categories: (i) Institutional and strategic delivery; (ii) staff preparation and evaluation; (iii) safety; (iv) professional and ethical behaviours; (v) learning outcomes, fidelity and resources; (vi) assessment and feedback; (vii) debriefing. Expert panel members could use free-text boxes to make comments on each individual statement. This gave them the opportunity to suggest word changes. At the end of the statements the panel members were also given the

opportunity to suggest additional/alternative statements that they felt should be included.

Round Two

Round two questions are shown in **appendix 13.** Due to the statements being similar a five-point Likert scale was employed for this second round: strongly disagree to strongly agree. This was to allow the expert panel responses to become more nuanced and an opportunity to change their opinion after reading comments and giving the statements further consideration second time around. Statements that reached a weighted mean of 4.25 out of 5 were retained. This facilitated the expert panel members to demonstrate a greater discernment between the statements. Free-text boxes were again available for any further comments. The statements that achieved 100% agreement in round one is displayed on one page and the statements not achieving 100% in round one on another. The comments made by the respondents were summarised beside each question, so the expert panel could see the debates/ queries. This second look at the statements gave the expert panel members an opportunity to reflect on their own responses after seeing a summary of the comments from the other panel members.

Round Three

In the third round, the expert panel members were asked how likely in the future their institution would be to adopt this final list of simulation best-practice statements after round one and two; and use it to guide the delivery of simulation in their institution. This round used a 'yes' or 'no' response. Some final housekeeping was carried out around choice of wording throughout the question. Free-text boxes were available for any further participant comments (**appendix 14**). Finally, the final set of simulation best-practice statements was emailed to each participant with a sincere thank-you for their participation.

5.8 Data Analysis Interviews

This was achieved by following the steps suggested by Braun and Clark (2014): familiarisation with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes and producing the report.

Familiarisation with the data was achieved by the main researcher listening to the audio recordings again after the interview was completed before transcribing. Codes were generated in NVivo11 before these were reviewed and themed by hand. A second researcher had access to the NVivo11 files to check coding and to minimise bias, referred to as 'analyst triangulation' (Patton 1999 p.1193).

5.9 Results e-Delphi

The pilot and rounds in this e-Delphi study spanned 2-months and completion took an average of 40-minutes (round 1), 33-minutes (round 2) and 8-minutes (round 3). In the first round there were 13 participants logged in, the second round 10 and the third round 9. In each round there were 9 fully completed responses. Over the three rounds seven different institutions, from the eleven listed, were represented, plus an interprofessional simulation centre.

5.9.1 Demographics

The expert panel consisted of experienced academics aged 35-64 years (**table 5.4**). The majority were female, and they had six to twenty years of experience in nurse education. They all met the inclusion criteria because of their involvement in simulation, which ranged from a strategic level to designing and delivering simulation activities. Twelve of the panel were directly involved in pre-registration nurse education and one was involved through interprofessional activity only. Of the eight institutions that took part seven were Schools of Nursing (out of a possible eleven in Scotland) and one was an interprofessional simulation centre.

Table 5.4: Demographics of Expert Panel Members

Age Range	Number of participants
35-44	3
45-54	9
55-64	1

Gender	Number of participants
Male	2
Female	11

Key: IPE Interprofessional Education

Table 5.5 shows the time in years spent in nurse education by the expert panel ranged from 6-20 years and the expert panel members hold a variety of roles.

Table 5.5 Time of Staff in Nurse Education

Time in nurse education	6-20 years Average time in nurse education as a nurse lecturer 12 years
Roles	Lecturer/ Senior Lecturer 12 involved directly in pre-registration nurse education simulation 1 only involved in IPE education (when student nurses join with medical students)

Table 5.6 shows the time spent in simulation varied between stages, fields and institutions, from 2 to 33 hours (**table 5.2**). For programmes running from 2016 none of the Higher Education Institutions (HEI) used simulation to replace clinical hours.

Table 5.6: Time Spent per Stage in Simulation in Pre-Registration Using Programmes in Scottish HEI's by Field of Nursing.

	Stage 1		Stage 2		Stage 3		Stage 4	
Hours spent in simulation in HEI's	Range Hours	Average	Range Hours	Average	Range Hours	Average	Range Hours	Average
Adult	2-30	15.5	2-30	16.2	3-30	21.4	2-10	6
Child	6-30	17.3	10-30	18	10-30	20		
Mental Health	2-30	13.2	2-33	16.6	3-33	17.4	6	6
Learning Disabilities	30	NA	30	NA	30	NA	NA	
Do you replace clinical hours with simulation					NO 90%		YES 10% (in the old 2011 programme but not the new 2016 programme).	

Key: NA not applicable as there was only one response for Learning Disabilities (LD) there could not be a range and the LD programme does not have a fourth year.

Table 5.7 shows the amount of staff involved in simulation and the availability and type of staff training. Naturally the size of the schools of nursing vary and consequently they have different numbers of students. Staff training was available in under half of the institutions, of this training most was provided in-house, sometimes by the manufacturers of equipment themselves.

Table 5.7: Staff Involved in Simulation and Training

Number of staff engaged in simulation	3-30 plus
Do you have Staff training	No 44% Yes 22% Unsure 34%
Who provides the Training	In-house x 3 Clinical Skills Managed Educational Network (CSMEN) x1 Manufacturers x 2

Table 5.8 illustrates that a model for simulation was utilised in just over half the institutions; however, this is misleading as the responses included two models of skills acquisition rather than a model for the whole of simulation. In response to the use of simulation best-practice statements the one positive reply was focussed on staff development rather than the actual delivery of simulation (CSMEN Three-Tier Framework for staff development 2017). Lack of staff awareness was cited as a reason for not using simulation best-practice statements. However, those that did not use simulation best-practice statements indicated that they would be prepared to use them in the future, although it was evident that there was much uncertainty about what was available. The research did not provide definitions of these key terms or ask the participants their understanding of them.

Table 5.8: Usage of Simulation Model and Simulation Best-Practice Statements

Use of a model	**Yes 56 %** **No 44 %** Jeffries (x2) Drefuss (x1) UK resuscitation 4 stage approach (x1) Depends (x1)
Use of best-practice statements (BPS)	NES CSMEN (x1) Unsure (x4)
Why do you not use BPS	Lack of staff awareness (x3) Lack of standards (x1) In process of deciding (x1)
Likelihood to adopt BPS	**Likely to use 78 %** **Already use 22 %**
Which would you consider using	CAE (x1) NES CSMEN (x1) Unsure (x2)

Key: NES = NHS Education for Scotland; CAE = CAE Healthcare CSMEN =Clinical Skills Managed Education Network

5.9.2 Consensus Results for Simulation Best-Practice Statements

Twenty-eight of the 69 simulation best-practice statements provided by Arthur et al. (2013), Jeffries (2005), INASCL (2017), and ASPiH (2016) reached consensus in this e-Delphi study (see **table 5.9**). In the first round 100% consensus saw statements through to round two and there was a second opportunity to revisit the other statements. In round two if a statement reached the weighted mean of 4.25 or higher (the set level of agreement) it went into round three. Round three asked if the expert panel's institution followed each statement's guidance and the likelihood for adopting them in future practice. The statements were presented

under seven main headings: (i) Institutional and strategic delivery; (ii) staff preparation and evaluation; (iii) safety; professional and ethical behaviours; (iv) learning outcomes, (v) fidelity and resources; (vi) assessment and feedback; (vii) debriefing. The free-text comments provided qualitative data.

5.9.3 Stability between e-Delphi Rounds

There was a high degree of stability between the rounds in the e-Delphi study. Two-sample proportion test showed a high degree of stability between rounds (**appendix 15**) only five statements out of 69 were significantly different (Holey et al. 2007) and this stability is further substantiated by the narrative evidence below:

In round 1: 32 statements out of 69 received 100%

In round 2: 25 of the 32 statements receiving 100% in the first round received a weighted mean of 4.25 or above in the second round and therefore reached the level of consensus target set in both rounds.

Therefore, seven statements from the original set did not reach consensus in round two that had done in round one. These are shown below along with their weighted mean score and comments from the expert panel when they were available:

1. ***The facility has a clear strategic plan which addresses wider organisational and stakeholders' needs***.

Weighted mean score is 4.22; no comments available or explanations offered.

However, the statement is possibly rejected as it attributes a 'facility' – an object with the ability to make plans rather than a person or group of people.

2. ***To preserve the integrity of simulation scenarios and provide an equitable experience for each participant, confidentiality is essential.***

Weighted mean score is 4.11; no comments available or explanations offered.

However, confidentiality is covered in other statements so would be repetition if used.

3. ***Consistent terminology provides guidance and clear communication and reflects shared values in simulation experiences, research, and publications. Knowledge and ideas are clearly communicated with consistent terminology to advance the science of simulation.***

Weighted mean score is 4.11; comments:

"*I think different professions using different terminology is acceptable as the principles are the same. For example, we call our simulated patient programme the Volunteer Programme even though it is a simulated patient programme."*

"Consistent terminology is essential".

"This would be challenging to come to agreements across disciplines. However, it is important that there is consistency - particularity in IPE simulation"

4. ***The patient perspective is considered and demonstrated within educational planning***. ('*Considered*' changed to '*central*' as suggested by the panel).

Weighted mean score is 4.11; no comments available or explanations offered.

5. ***Simulation design characteristics include objectives, fidelity, complexity, cues and debriefing***.

Weighted mean score is 4.22; no comments available or explanations offered; no comments available or explanations offered. ("*Objectives*" changed to "*outcomes*" added pre-briefing and preparation work as suggested by the panel)

6. ***Participant objectives should incorporate holistic care.***

Weighted mean score is 3.22; no comments available

7. ***A designated lead with organisational influence and accountability manages the simulation***.

Weighted mean average is 3.22; no comments available

In round 2: three statements reached consensus (4.25) which had not received 100% in round 1; these were as follows:

1. ***A staff member with expertise in simulation-based education oversees the simulation programme design and ensures that it is regularly peer reviewed, kept up to date and relevant to the organization goals, clinical needs and curriculum to which it is mapped***.

Weighted mean score is 4.33; no comments available

2. ***A designated individual oversees the strategic delivery of simulation-based education programmes and ensures that appropriate maintenance of simulation equipment is undertaken***.

Weighted mean score is 4.33; comments:

"Recently a senior lecturer has been appointed to work on the development of the clinical simulation strategy "

"this may be dependent upon the staffing resources available within each HEI. Maintenance may be devolved to technicians if available in the HEI "

"Agree but dependent on local resources regarding maintenance may be combined"

"It is important there is a dedicated person who is aligned to national developments, faculty and wider university directions. This would be wider than 'appropriate maintenance'"

3. Regular evaluation of programmes and staff is undertaken to ensure that content and relevance is maintained.

Weighted mean score is 4.44; no comments available.

This resulted in 28 statements reaching a level of weighted mean of 4.25 consensus in round two.

In the third round the simulation best-practice statements were finalised by asking some final questions about consistency of terminology to the expert panel. It was agreed to exchange the word '*faculty*' to '*staff*' and '*program*' to '*programme*'.

For clarity, the final 28 statements are presented in **table 5.9** without any statistics, under the headings provided by the researcher in the e-Delphi study and **table 5.10** shows round two the selected statements with the statistics and **table 5.11** shows round two the 'not' selected statements with the statistics.

Table 5.9: 28 selected simulation best-practice statements reached mean >4.25

Institutional and strategic delivery
There is a clear vision and mission statement to demonstrate aims and objectives of the simulation facility.
A designated individual oversees the strategic delivery of simulation-based education programmes and ensures that appropriate maintenance of simulation equipment is undertaken.
A staff member with expertise in simulation-based education oversees the simulation programme design and ensures that it is regularly peer reviewed, kept up to date and relevant to the organisation goals, clinical needs and curriculum to which it is mapped.
Simulation-based education programmes are developed in alignment with formal curriculum mapping or learning/training needs analysis undertaken in clinical or educational practice.
Simulation experiences are aligned with the course and module learning outcomes.
Staff preparation and evaluation
Staff engage in continuing professional development with regular evaluation of performance by both learner and fellow staff.
Staff who facilitate simulation sessions have relevant clinical knowledge, understand course and module learning outcomes, and possess expert clinical teaching skills to enable students to relate theory to practice during debriefing.
Regular evaluation of programmes and staff is undertaken to ensure that content and relevance is maintained.
Safety
Staff ensure that a safe learning environment is maintained for learners and encourages self-reflection on learning.
Staff have a responsibility for patient safety and to raise concerns regarding learner performance within educational settings, including simulation-based education interventions.

Professional and ethical behaviours

Professional integrity related to confidentiality of the performances, scenario content, and participant experience is required during and after any simulation. Confidentiality is expected in live, recorded, or virtual simulation experiences.
Facilitators' professional and ethical behaviours are required in the simulated environment.
Participants are expected to demonstrate professional integrity.

Learning outcomes, fidelity and resources

Evidence-based practice should be incorporated into simulation scenario development, implementation, and debriefing using appropriate participant learning outcomes.
Participant learning outcomes should be congruent with overall course and module learning outcomes.
The usage of simulation technologies and approaches used are consistent with course and module learning outcomes, resource availability and cost-effectiveness. These include but are not limited to, low, and medium or high-fidelity human patient simulation mannequin or part-task trainers.
Multiple methods of facilitation are available and use of a specific method is dependent on the learning needs of the participant(s) and the expected learning outcomes.
Learning outcomes guide all aspects of simulation design including: student preparation activities, clinical scenario, group size, inclusion of observers or students from other disciplines, selection of mannequin infidelity and other equipment, level of student support during the simulation, and method of debriefing.
Environmental fidelity is developed in line with the learning outcomes of the simulation session.
Contextually appropriate clinical equipment and the availability of hardcopy or electronic patient information and charts are used to enhance the realism of the simulation experience.

Assessment and feedback

Any assessment is based on the intended learning outcomes of the exercise, with clarity regarding the knowledge, skills and attitudes to be evaluated and is appropriately tailored to the professional curricula to be evaluated.
Formative feedback provides information for improving performance and behaviours associated with the three domains of learning: cognitive (knowledge), affective (attitude), and psychomotor (skills).

De-briefing

Staff are competent in the process of debriefing.
Structured debriefing is provided immediately following the simulation
Staff create a safe environment for participant debriefing
Feedback and debriefing to simulation participants must be constructive
Depending on the simulation objectives, opportunities for discussion of students' non-technical skills such as clinical reasoning, situation awareness, communication, leadership and teamwork are included in debriefing.
The debriefing facilitates students' reflection on practice, self-evaluation and feedback on their perceptions of the experience.

Table 5.10: After round 2 Selected simulation best-practice statements: with descriptive statistics (Percentages and weighted means ≥4.25)

There is a clear vision and mission statement to demonstrate aims and objectives of the simulation facility.						
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 4
0.00% 0	0.00% 0	0.00% 0	55.56% 5	44.44% 4	4.44 9	

A designated individual oversees the strategic delivery of simulation-based education programmes and ensures that appropriate maintenance of simulation equipment is undertaken.						
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 4.5
0.00% 0	0.00% 0	11.11% 1	44.44% 4	44.44% 4	4.33 9	

A staff member with expertise in simulation-based education oversees the simulation programme design and ensures that it is regularly peer reviewed, kept up to date and relevant to the organisation goals, clinical needs and curriculum to which it is mapped.						
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 5 Mode 5
0.00% 0	0.00% 0	22.22% 2	22.22% 2	55.56% 5	4.33 9	

Simulation experiences are aligned with the course and module learning outcomes.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 5 Mode 5
0.00% 0	0.00% 0	0.00% 0	22.2% 2	77.78% 7	4.78 9	

Simulation-based education programmes are developed in alignment with formal curriculum mapping or learning/training needs analysis undertaken in clinical or educational practice.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 5 Mode 5
0.00% 0	0.00% 0	0.00% 0	44.44% 4	55.56% 5	4.56 9	

Staff preparation and evaluation

Staff engage in continuing professional development with regular evaluation of performance by both learner and fellow staff.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 5 Mode 5
0.00% 0	0.00% 0	0.00% 0	44.44% 4	55.56% 5	4.56 9	

Staff who facilitate simulation sessions have relevant clinical knowledge, understand course and module learning outcomes, and possess expert clinical teaching skills to enable students to relate theory to practice during debriefing.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 4
0.00% 0	0.00% 0	0.00% 0	55.56% 5	44.44% 4	4.44 9	

Regular evaluation of programmes and staff is undertaken to ensure that content and relevance is maintained.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 4
0.00% 0	0.00% 0	0.00% 0	55.56% 5	44.44% 4	4.44 9	

Safety

Staff ensure that a safe learning environment is maintained for learners and encourages self-reflection on learning.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 5 Mode 5
0.00% 0	0.00% 0	0.00% 0	11.11% 1	88.89% 8	4.89 9	

Staff have a responsibility for patient safety and to raise concerns regarding learner performance within educational settings, including simulation-based education interventions.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 5 Mode 5
0.00% 0	0.00% 0	0.00% 0	33.33% 3	66.67% 6	4.67 9	

Professional and ethical behaviours

Professional integrity related to confidentiality of the performances, scenario content, and participant experience is required during and after any simulation. Confidentiality is expected in live, recorded, or virtual simulation experiences.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 5 Mode 5
0.00% 0	0.00% 0	11.11% 1	22.22% 2	66.67% 6	4.56 9	

Facilitators' professional and ethical behaviours are required in the simulated environment.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 5 Mode 5
0.00% 0	0.00% 0	0.00% 0	12.50% 1	87.50% 7	4.88 8	

Participants are expected to demonstrate professional integrity.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 5 Mode 5
0.00% 0	0.00% 0	0.00% 0	33.33% 3	66.67% 6	4.67 9	

Learning outcomes, fidelity and resources

Evidence-based practice should be incorporated into simulation scenario development, implementation, and debriefing using appropriate participant learning outcomes.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 5 Mode 5
0	0.00% 0	0.00% 0	11.11% 1	88.89% 8	4.89 9	

Participant learning outcomes should be congruent with overall course and module learning outcomes.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 4
0.00% 0	0.00% 0	0.00% 0	55.56% 5	44.44% 4	4.44 9	

The usage of simulation technologies and approaches used are consistent with course and module learning outcomes, resource availability and cost-effectiveness. These include but are not limited to, low, and medium or high-fidelity human patient simulation mannequin or part-task trainers.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 5 Mode 5
0	0.00% 0	0.00% 0	37.50 3	62.50% 5	4.63 8	

Multiple methods of facilitation are available and use of a specific method is dependent on the learning needs of the participant(s) and the expected learning outcomes.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 5 Mode 5
0.00% 0	0.00% 0	0.00% 0	44.44% 4	55.56% 5	4.56 9	

Learning outcomes guide all aspects of simulation design including student preparation activities, clinical scenario, group size, inclusion of observers or students from other disciplines, selection of mannequin infidelity and other equipment, level of student support during the simulation, and method of debriefing.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 4
0.00%	0.00%	0.00%	55.56%	44.44%	4.44	

0	0	0	5	4	9	

Environmental fidelity is developed in line with the learning outcomes of the simulation session.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 5 Mode 5
0.00% 0	0.00% 0	22.22% 2	22.22% 2	55.56% 5	4.33 9	

Contextually appropriate clinical equipment and the availability of hardcopy or electronic patient information and charts are used to enhance the realism of the simulation experience.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 5 Mode 5
0.00% 0	0.00% 0	0.00% 0	44.44% 4	55.56% 5	4.56 9	

Assessment and feedback

Any assessment is based on the intended learning outcomes of the exercise, with clarity regarding the knowledge, skills and attitudes to be evaluated and is appropriately tailored to the professional curricula to be evaluated.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 5 Mode 5
0.00% 0	0.00% 0	11.11% 1	33.33% 3	55.56% 5	4.44 9	

Formative feedback provides information for improving performance and behaviours associated with the three domains of learning: cognitive (knowledge), affective (attitude), and psychomotor (skills).

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 4
00% 0	0.00% 0	0.00% 0	55.56% 5	44.44% 4	4.44 9	

De-briefing

Staff are competent in the process of debriefing.						
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 5 Mode 5
0.00% 0	0.00% 0	0.00% 0	44.44% 4	55.56% 5	4.56 9	

Structured debriefing is provided immediately following the simulation						
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 5 Mode 5
0.00% 0	0.00% 0	0.00% 0	44.44% 4	55.56% 5	4.56 9	

Staff create a safe environment for participant debriefing						
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 5 Mode 5
0.00% 0	0.00% 0	0.00% 0	33.33% 3	66.67% 6	4.67 9	

Feedback and debriefing to simulation participants must be constructive						
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 5 Mode 5
0.00%	0.00%	0.00%	44.44%	55.56%	4.56	

0	0	0	4	5	9	

Depending on the simulation objectives, opportunities for discussion of students' non-technical skills such as clinical reasoning, situation awareness, communication, leadership and teamwork are included in debriefing.						
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 5 Mode 5
0.00% 0	0.00% 0	0.00% 0	33.33% 3	66.67% 6	4.67 9	

The debriefing facilitates students' reflection on practice, self-evaluation and feedback on their perceptions of the experience.						
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 5 Mode 5
0.00% 0	0.00% 0	0.00% 0	44.44% 4	55.56% 5	4.56 9	

Key: First line e.g. 0.00% = percentage been rejected, these have been identified by red text.

Note: If the mode and median had been used to select statements with a target of five, seven additional statements would have been selected.

Table 5.11 Simulation best-practice statements not selected: with descriptive statistics (percentages and weighted means below 4.25).

Institutional and strategic delivery

The facility has a clear strategic plan which addresses wider organisational and stakeholders' needs.

Did not consider stakeholder's needs any different

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 5 Mode 5
0.00% 0	0.00% 0	33.33% 3	11.11% 1	55.56% 5	4.22 9	

There is scaffolding of learning experiences throughout the curriculum; and the required knowledge, psychomotor skills, clinical reasoning and reflective thinking skills, and use of health care technologies are taught prior to their implementation into simulation experiences.

Preparation was very important but too multi-factorial a statement.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 3 Mode 4
11.11% 1	22.22% 2	22.22% 2	33.33% 3	11.11% 1	3.11 9	

A designated lead with organisational influence and accountability manages the simulation activity.

Ambiguous as to whose role? All simulation activity or individual simulation events?

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 3 Mode 2
0.00%	44.44%	11.11%	22.22%	22.22%	3.22	

0	4	1	2	2	9	

There is a clear alignment to the wider organisational and stakeholders' needs, acting as a quality and risk management resource for organisations to help achieve the goals of improved patient safety and care quality.

Focus in pre-registration nursing would be different.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 4
0.00% 0	22.22% 2	11.11% 1	44.44% 4	22.22% 2	3.67 9	

The patient perspective is central to simulation and demonstrated within educational planning.

'considered' changed to 'central to simulation'

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 5
0.00% 0	0.00% 0	33.33% 3	22.22% 2	44.44% 4	4.11 9	

Simulation design characteristics include pre-briefing, preparation work, outcomes, fidelity, complexity, cues and debriefing.

Objectives changed to outcomes pre-briefing and preparation work added

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 4.5
0.00% 0	11.11% 1	0.00% 0	44.44% 4	44.44% 4	4.22 9	

Consistent terminology should be used between simulation, theory and practice and different disciplines. This will provide guidance and clear communication and reflect shared values in simulation experiences, research, and publications. Knowledge and ideas are clearly communicated with consistent terminology to advance the science of simulation.

Added: should be used between simulation, theory and practice and different disciplines. Some terminology might be different.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 4
0.00% 0	11.11% 1	0.00% 0	55.56% 5	33.33% 3	4.11 9	

Simulation experiences, in some form, are integrated into all clinical courses and progress in complexity throughout the program.

Ambiguity around the term: clinical course. Complexity is important, so we should use a spiral curriculum approach. (decision: added to another statement)

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 3 Mode 3
0.00% 0	33.33% 3	22.22% 2	33.33% 3	11.11% 1	3.22 9	

Educational practices include active learning, feedback, student faculty interaction, collaboration, high expectations, diverse learning, time on task.

Ambiguity around 'high expectations' - what does that mean? How do you measure high?

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 4

0.00% 0	22.22% 2	11.11% 1	55.56% 5	11.11% 1	3.56 9	

Student programme, level and age are considered.

Issue with 'age' as students are not considered by age but by stage.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 4
11.11% 1	22.22% 2	0.00% 0	44.44% 4	22.22% 2	3.44 9	

A coherent matrix illustrates how simulation experiences are integrated throughout curriculum.

This should already be part of curriculum documentation

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 4
11.11% 1	22.22% 2	0.00% 0	44.44% 4	22.22% 2	3.44 9	

Staff preparation and evaluation

Staff who design scenarios, conduct the simulation scenarios sessions, facilitate debriefing and manage the technology have each undertaken appropriate training.

Is this achievable? Should it be mandatory? Needs careful management. Should we specify what training? CSMEN Faculty development framework reaching at least Tier Two of the Three Tiers?

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 4
11.11%	0.00%	11.11%	66.67%	11.11%	3.67	

1	0	1	6	1	9	

Staff who design simulation scenarios and program manikins are familiar with curriculum and course objectives, have relevant clinical knowledge and understand the technological capabilities of manikins.

Might be IT support/ technical personnel.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 4
11.11% 1	11.11% 1	22.22% 2	55.56% 5	0.00% 0	3.22 9	

Simulation technicians and technologists, whose primary role is to support delivery of Simulation Based Education (SBE), have gained or are working towards professional registration with the Science Council.

Why science council? gold standard? what if don't have technicians? what if been in the job a long time? Nice to have but not necessary.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 3 Mode 3.5
11.11% 1	22.22% 2	33.33% 3	33.33% 3	0.00% 0	2.89 9	

Summative evaluation focuses on measurement of outcomes or achievement of objectives.

Evaluate sessions individually

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 3.5
0.00% 0	0.00% 0	44.44% 4	44.44% 4	11.11% 1	3.67 9	

The facilitator is responsible for the evaluation of all aspects of the simulation experience.

Might not evaluate every session

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 3.5
0.00% 0	33.33% 3	11.11% 1	22.22% 2	33.33% 3	3.56 9	

Training is provided to all faculty to engage with Simulated Patients, where there is an active Simulated Patient programme.

Depends on training content/some courses have already inbuilt (SBE education)

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 3 Mode 3
11.11% 1	0.00% 0	44.44% 4	33.33% 3	11.11% 1	3.33 9	

Teacher demographics are considered.

Ambiguity around this statement.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 3 Mode 3
11.11% 1	11.11% 1	33.33% 3	22.22% 2	22.22% 2	3.33 9	

Simulation is developed with the level of fidelity needed to meet the desired outcomes.

Not all facilities have access to desired level of fidelity so adapt the learning.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 4
11.11% 1	0.00% 0	22.22% 2	55.56% 5	11.11% 1	3.56 9	

Safety

Establishment of a safe learning environment

Vague

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 4
11.11% 1	0.00% 0	22.22% 2	22.22% 2	44.44% 4	3.89 9	

Professional and ethical behaviours

To preserve the integrity of simulation scenarios and provide an equitable experience for each participant, confidentiality is essential.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 4
0.00% 0	0.00% 0	22.22% 2	44.44% 4	33.33% 3	4.11 9	

The simulation learning, assessment and evaluation environments will be areas where mutual respect among participants and facilitator(s) is expected and supported and as such, it is essential to provide clear expectations for the attitudes and behaviours of simulation participants.

Same behaviour expected as in clinical practice but also, we need to see how they might behave.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 4
11.11% 1	0.00% 0	22.22% 2	44.44% 4	22.22% 2	3.67 9	

Learning outcomes, fidelity and resources

Facilitator designs the simulation-based learning experience at the appropriate level for the participant

should be appropriate to level/stage not each participant

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 4
0.00% 0	11.11% 1	11.11% 1	44.44% 4	33.33% 3	4.00 9	

Identify facilitation methods that support simulation objectives

Ambiguous

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 3 Mode 3.5
11.11% 1	11.11% 1	33.33% 3	33.33% 3	11.11% 1	3.22 9	

Outcomes should be appropriate to the level of the participant and the programme

Objectives changed to outcomes Added: and the programme

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 5 Mode 5

0.00% 0	11.11% 1	11.11% 1	22.22% 2	55.56% 5	4.22 9	

Participant objectives should incorporate holistic care

This will depend as not all simulations will be holistic as may break into segments

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 3
11.11% 1	33.33% 3	0.00% 0	33.33% 3	22.22% 2	3.22	

Identify facilitation methods that enable participants' achievement of expected outcomes.

Ambiguous

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 4
0.00% 0	22.22% 2	22.22% 2	33.33% 3	22.22% 2	3.56 9	

The facilitator communicates the objectives and expected outcomes prior to the simulation-based experience. The level of detail revealed to participants will depend on the objectives.

You may not want to reveal all objectives of session

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 4
0.00% 0	25.00% 2	12.50% 1	37.50% 3	25.00% 2	3.63 8	

Completion of participant objectives should be achievable within the designated timeframe (i.e., minutes to hours).

May need period of reflection or be part of a series.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 4
0.00% 0	22.22% 2	11.11% 1	55.56% 5	11.11% 1	3.56 9	

Outcomes are measured: these include learning outcomes (knowledge) skill performance, learner satisfaction, critical thinking and self-confidence.

These won't all be measured after every session.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 3
0.00% 0	33.33% 3	11.11% 1	33.33% 3	22.22% 2	3.44 9	

Participant objectives should include the domains of learning.

Domains of learning ambiguous as nursing students have NMC domains as well.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 3
11.11% 1	33.33% 3	0.00% 0	33.33% 3	22.22% 2	3.22 9	

All simulation-based learning experiences begin with development of clearly written participant objectives, which are available prior to the experience.

May not want all objectives known some time

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 4
22.22% 2	11.11% 1	11.11% 1	44.44% 4	11.11% 1	3.11 9	

A variety of simulation modalities, including Simulated Patients, is incorporated into simulation programmes to create appropriate realism of the learning environment and achieve the objectives of the session being taught.

Requires risk assessment so no harm to simulated patients.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 4
0.00% 0	11.11% 1	11.11% 1	44.44% 4	33.33% 3	4.00 9	

Assessment and feedback

Because familiarity with participants is a significant source of observer bias, the influence of observer's previous knowledge of participants should be avoided whenever possible.

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 2 Mode 2
0.00% 0	55.56% 5	22.22%§ 2	22.22% 2	0.00% 0	2.67 9	

De-briefing

Feedback are incorporated to promote safe rehearsal and consolidation of skills.

Strongly disagree	Disagree	Neither agree	Agree	Strongly agree	Weighted mean	Median 4 Mode 3.5

		nor disagree				
0.00% 0	0.00% 0	33.33% 3	33.33% 3	33.33% 3	4.00 9	

Identify the facilitator's responsibilities during the debriefing process						
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 4
0.00% 0	11.11% 1	22.22% 2	55.56% 5	11.11% 1	3.67 9	

Focus debriefing on the participant objectives and outcomes						
A recognition that other things may happen that require mentioning or a micro teaching session						
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 4.5
0.00% 0	11.11% 1	22.22% 2	33.33% 3	33.33% 3	3.89	

Participants should receive and provide constructive feedback during simulation and debriefing.						
May not always be appropriate or necessary during						
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 4
0.00% 0	0.00% 0	33.33% 3	55.56% 5	11.11% 1	3.78 9	

Identify the structural elements of debriefing to include the optimal time and duration required to achieve the objectives.						
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 4
11.11% 1	11.11% 1	11.11% 1	44.44% 4	22.22% 2	3.56 9	

Student Preparation

A structured orientation is provided for students prior to the simulation session and, depending on the students' prior exposure to simulation activities, includes introduction to and an opportunity to become familiar with the learning objectives, structure, timing and process of the session; the simulation environment, equipment, manikin, monitoring devices, and information and communication technology to be used.						
May not need every session.						
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted mean	Median 4 Mode 4
11.11% 1	0.00% 0	11.11% 1	66.67% 6	11.11% 1	3.67 9	

Key: First line e.g. 0.00% = percentage; second line e.g. 1 = number of participants

Note: If the mode and median had been used as criteria and set at 5 two statements that had been rejected would have been selected, highlighted with red text.

The expert panel were asked to what extent their respective institutions followed each simulation best-practice statement at the present time; only seven of the 28 statements were felt to be followed by all the institutions. **Table 5.12** displays the results: those statements not met were highlighted in red, the statements that all

the institutions met were highlighted in blue and those met by some but not all institutions were highlighted in buff yellow.

Table 5.12 Academics views on if their institutions currently (at the time of the study) meet the 28 selected simulation best-practice statements.

There is a clear vision and mission statement to demonstrate aims and objectives of the simulation facility.	44%	56%
A designated individual oversees the strategic delivery of simulation-based education programmes and ensures that appropriate maintenance of simulation equipment is undertaken.	50%	50%
Simulation-based education programmes are developed in alignment with formal curriculum mapping or learning/training needs analysis undertaken in clinical or educational practice.	56%	44%
A staff member with expertise in simulation-based education oversees the simulation programme design and ensures that it is regularly peer reviewed, kept up to date and relevant to the organisation goals, clinical needs and curriculum to which it is mapped.	56%	44%
Simulation experiences are aligned with the course and module learning outcomes.	100%	0%
Staff engage in continuing professional development with regular evaluation of performance by both learner and fellow staff.	56%	44%
Staff who facilitate simulation sessions have relevant clinical knowledge, understand course and module learning outcomes, and possess expert clinical teaching skills to enable students to relate theory to practice during debriefing.	89%	11%

Regular evaluation of programmes and staff is undertaken to ensure that content and relevance is maintained.	78%	22%
Staff ensure that a safe learning environment is maintained for learners and encourages self-reflection on learning.	89%	11%
Staff have a responsibility for patient safety and to raise concerns regarding learner performance within educational settings, including simulation-based education interventions.	89%	11%
Professional integrity related to confidentiality of the performances, scenario content, and participant experience is required during and after any simulation. Confidentiality is expected in live, recorded, or virtual simulation experiences.	89%	11%
Facilitators' professional and ethical behaviours are required in the simulated environment.	100%	0%
Participants are expected to demonstrate professional integrity.	100%	0%
Evidence-based practice should be incorporated into simulation scenario development, implementation, and debriefing using appropriate participant learning outcomes.	78%	22%
Participant learning outcomes should be congruent with overall course and module learning outcomes.	89%	11%
The usage of simulation technologies and approaches used are consistent with course and module learning outcomes, resource availability and cost-effectiveness. These include but are not limited to, low, and medium or high-fidelity human patient simulation mannequin or part-task trainers.	89%	11%
Multiple methods of facilitation are available and use of a specific method is dependent on the learning needs of the participant(s) and the expected learning outcomes.	100%	0%

Learning outcomes guide all aspects of simulation design including: student preparation activities, clinical scenario, group size, inclusion of observers or students from other disciplines, selection of mannequin infidelity and other equipment, level of student support during the simulation, and method of debriefing.	78%	22%
Environmental fidelity is developed in line with the learning outcomes of the simulation session.	67%	33%
Contextually appropriate clinical equipment and the availability of hardcopy or electronic patient information and charts are used to enhance the realism of the simulation experience.	89%	11%
Any assessment is based on the intended learning outcomes of the exercise, with clarity regarding the knowledge, skills and attitudes to be evaluated and is appropriately tailored to the professional curricula to be evaluated.	100%	0%
Formative feedback provides information for improving performance and behaviours associated with the three domains of learning: cognitive (knowledge), affective (attitude), and psychomotor (skills).	100%	0%
Staff are competent in the process of debriefing.	67%	33%
Structured debriefing is provided immediately following the simulation.	55%	44%
Staff create a safe environment for participant debriefing.	89%	11%
Feedback and debriefing to simulation participants must be constructive.	100%	0%
Depending on the simulation objectives, opportunities for discussion of students' non-technical skills such as clinical	78%	22%

reasoning, situation awareness, communication, leadership and teamwork are included in debriefing.		
The debriefing facilitates students' reflection on practice, self-evaluation and feedback on their perceptions of the experience.	78%	22%

However, the expert panel indicated they agreed 100% (shown highlighted in green) that these simulation best-practice statements could be: adopted by schools of nursing institutionally; they as individuals and their colleagues would be willing to use them; and that they would be willing to engage in further collaborative research. An area for development was staff training in designing and delivering simulation (highlighted in red) (**table 5.13**).

Table 5.13 Agreement on generated simulation best-practice statements

Please indicate your level of agreement that the above best-practice statements could be adopted by Nursing Schools across Scotland.	100%
How willing would you be to use these best-practice statements for simulation in pre-registration nursing curricula?	100%
How willing do you think your colleagues would be to use these best-practice statement indicators for simulation in pre-registration nursing curricula?	100%
As an institution how willing do you think your School of Nursing would be to use these best-practice statements for simulation in pre-registration nursing curricula?	100%
If your institution is a School of Nursing: Do you follow the CSMEN Three-Tier approach to develop those staff delivering simulation	25% yes 75% no
If your institution is not a School of Nursing: Do you follow the CSMEN Three-Tier approach to develop those staff delivering simulation	100%
How willing would you be to join in multi-site research projects that further explore simulation in pre-registration nursing curricula?	100%

5.9.4 Free-Text Comments Results

The free-text comments provided by the expert panel members were collated from each of the three rounds of the e-Delphi study. The themes that emerged from each of the rounds are presented below in **table 5.14** round one; **table 5.15** round two; and **table 5.16** round three.

Table 5.14 Round one: codes and number of responses from round one free-text comments.

Codes round one	Themes
Unclear statements	Terminology in simulation and statements needs to be clear, consistent and familiar
Terminology used in simulation	
High Expectations – what does this mean	
Learning outcomes	
Staff Training	Staff development is needed for all aspects of simulation including debriefing/evaluation
Evaluation	
Debriefing	
Student Preparation	Curriculum development and delivery How we run things?
Safety	
Patient Perspective important	
Curriculum development	
Importance of Scaffolding	
Evidence- Based Practice	
Assessment	
Age of student and learning outcomes	

Table 5.15 Round two: codes and number of responses from round two free-text comments.

Code	Themes
Align to wider organisation	Curriculum development
Different Assessors	
Evaluation	
Integrity	
Lo (Not Age)	
Prep Work	
Strategy	
Safety	
Spelling USA v UK	Terminology
Teacher demographics?	
Language Standardised	
Staff training	Staff development
Using a model	
Technician register	
Debrief	

Table: 5.16 Round three: codes and number of responses from round 3 free-text comments.

Codes round three	Themes
CSMEN Three-Tier approach Not at the moment but we are moving towards this. My experience and understanding is there is a desire from nursing / AHP schools in Scotland to move to this but there are some barriers including finance, we already have staff who have teaching qualifications and some of the framework is covered by this. There is a national drive to embed this in universities so I believe it will come. I would like our School to follow this model as I believe staff should be formally trained in simulation to maximise student learning experience.	Staff development in simulation
Staff training for simulation I think training in simulation would benefit staff and provide a more robust learning experience for students. I believe staff should be formally trained in simulation to maximise student learning experience.	
Debriefing As debrief is rarely undertaken after simulation (which hopefully will change), (therefore need development) having merely a yes/no answer made it difficult to provide a response Housekeeping: We should use the term learning conversation as debriefing often has a negative connotation that discussing something that has gone wrong	

5.9.5 Interview Results

Twelve participants were interviewed in total, the interviewees consisted of one representative of Clinical Skills Managed Education Network (CSMEN 2017) working in an interprofessional simulation centre and eleven participants who worked at six different Scottish Schools of Nursing who ran pre-registration nursing programmes (out of a potential of eleven across Scotland). Levels of simulation conducted in pre-registration nursing curricula varied greatly amongst these six institutions, both from a resource perspective, and the degree of integration into the curriculum. Four main themes emerged from the interview data: How and why nurse academics learn about simulation; lack of awareness of models and guidelines for simulation (precipice of remembrance); positive desire for development of staff with regards to simulation; strong leadership required to enact change (internal and external).

5.9.6 Codes and Themes

The **table 5.17** below illustrates the codes and how they contributed and were amalgamated into the themes. Each theme is then discussed below.

Table 5.17 Interview codes and themes

Codes	Themes
Simulation not part of teaching qualification endorsed by NMC Learn by role modelling or Training from manufactures of equipment Pedagogy not in teaching qualification Special interest: Do simulation because interested Recognition need more development in simulation Teaching qualification – did not include simulation or Teaching qualification – did not include simulation in curriculum but did something informal whilst on course Barriers – not all staff like simulation or engage in it Lack of time/resources/ direction	How and why nurse academics learn about simulation
CSMEN Three-Tier framework- Not heard about it CSMEN Three-Tier framework- Seen it but not sure about what it is Models – not using them Debrief models – not using them Using own debrief method	Lack of awareness of models and guidelines (precipice of remembrance)
CSMEN Three-Tier framework for simulation educators endorsed Staff development endorsed Include volunteer patients in development of simulation	Positive desire for development of staff with regards to simulation

Encourage standardisation Willing to adopt a model New resources (facility) may encourage spread of simulation Those involved have high personal motivation and are dedicated / have a special interest Students themselves because they like simulation have a wish for more	
CSMEN Three-Tier framework have heard of it and plan to use it – strategic Support from line managers and budget holders essential Drivers – strong leadership Drivers – influence all staff to recognise simulation worth NMC and changes to curriculum CSMEN and SCSN – national approach required Support required for interested staff Need to see simulation as important Need resources (facilities) Standardisation Barriers of Financial restraints /Staff themselves Workload / time need addressing by leaders	Strong leadership required to enact change (internal and external)

5.9.7 Themes

i) How and why nurse academics learn about simulation

At the time of this study, the NMC endorsed teaching qualifications for nurse lecturers; those who successfully achieved an approved course could register with the NMC as a nurse tutor (NT). It became apparent that it was not the norm for simulation to be included in the curricula of these courses:

> *"No because I think that would have been…that would have been 2000-2001 so I can't see…not simulation as we know it. You know I think when we did simulation, when we taught Clinical Skills we were doing it in a classroom that didn't bear any resemblance to a ward environment. So, we might have had a bed and an orange, but you were doing a lot of these skills in a classroom where there was desks rather than a simulated environment. So…so I would probably say no to that"* [**participant A**]

Indeed, only one of the interviewees' institutions offered an NMC approved teaching qualification that included simulation as an official part of the curriculum. Nevertheless, two of the interviewees had covered some aspects of simulation informally as part of their course due to personal interest rather than because it was part of the curriculum.

> *"I wrote about simulation within the PG Cert and the MSc, it wasn't necessarily a requirement, but I used that base to answer the question."* [**participant D**]

Interviewees generally felt unprepared for facilitating simulation and described first attempts as

> *"Flying by the seat of your pants."* [**participant J**]

In addition, the large student numbers caused further stressors

> *"Terrifying! Because although I was used to mannequins (due to previous role) errm its quite different training with X (small amount of staff) staff than with X (larger number of*

students) students. It's a bit like "one man and his dog" whistling them in to the pen!" [**participant I**]

Interviewees described how they first started simulation through personal interest rather than it being required of them. Even in the same institution simulation delivery varies

"…however, whilst I am saying all that that's obviously just a personal interest and there's staff … and the there's variation in how its delivered and there's variation in obviously the knowledge of simulation…And there's variation... a lack of support and direction errm and obviously in relation to development" [**participant E**]

Role modelling was frequently described as a method of learning how to conduct simulation. Either the interviewee themselves had been introduced that way or they were providing role modelling for new colleagues. Another main way of learning about simulation was from training from the manufacturers of equipment such as mannequins. Typically, this training was restricted to how to use the equipment rather than involving any underpinning pedagogy, although it was recognised that further help could be gained, on scenario writing for example, but that this came at a prohibitive cost.

"I mean we ... the companies like X and all them they do write scenarios and things like that. And then they charge you for it. They know if you have the money you will pay to have that provided to you…And they charge you so not many people are able to buy them." [**participant J**]

Simulation and how to design, deliver and debrief are currently not usually part of standard academic staff training. Role-modelling seems to be the main method of learning plus private study due to personal interest. This provokes high anxiety when delivering simulation activities.

ii) Lack of awareness of models and guidelines for simulation (fallen off the precipice of remembrance)

Models for simulation, best-practice statements or quality indicators were not evidently in use and only a couple of interviewees mentioned the use of a model for debriefing

> *"We do a sort of a spiral with them the whole idea of the simulation is errr the main part obviously is the debrief using DASH"* [**participant I**]

The decision not to use models or guidance seems to be attributable to a lack of awareness rather than an informed decision not to use them. Data highlighted a lack of consistency around the usage of models and many had adopted their own approaches. In the case of CSMEN (2017) Three-Tier Framework for simulation educators the picture was much the same with interviewees having either not seen it or just a vague notion of having heard about it but not what it entailed.

> *"I've heard of it being mentioned in one of the skills meetings. That's as much as I know."* [**participant G**]

> *"…it's fallen off the precipice of remembrance but yes I have heard of it."* [**participant J**]

This lack of awareness was attributed by the interviewees to lack of time and pressure of workload to engage in training or see what others were doing. A lack of leadership, direction and support was acknowledged as contributory factors and often resulted in a feeling of isolation

> *"But our main problem now is getting to liaise with other colleagues. And conference and things. We just ... we are quite insular*. [**participant I**]

Only three of the institutions out of the seven represented (which included the interprofessional site) seemed to have a more structured approach to simulation. More staff were involved in the delivery of clinical skills and simulation. Simulation was integrated into the curriculum, and finally simulation leadership and staff development were in place.

iii) Positive desire for development of staff with regards to simulation

The need for further staff development was endorsed by all twelve interviewees.

This was felt to be necessary at a foundation level so that academic staff could make informed choices about whether and when to use simulation. The premise being all staff needed to have an awareness of simulation so they can select or deselect simulation as a teaching method

> *"I ...instinctively ...I think all staff in terms of teaching. Of all the different methods we have available to us so we can select the appropriate method for the type of understanding we are trying to engender so we don't have training in something like this it leads to fear and avoidance and imagine we don't have training in simulation, and we don't really know what we are doing then it leads to fear of getting involved."* [**participant H**]

And to ensure staff have an awareness of simulation models and their equivalents to make informed choices

> *"yes certainly... that's what I was just thinking when you were talking about models. And best practice and quality statements. It made me think... I don't know these things exist and I don't know about them and if they do… I should be finding out about them."* [**participant H**]

It was acknowledged that not all staff would feel comfortable delivering simulation and that they should not be forced to use simulation if they chose not to

> *"…not everyone like it … I know a couple of staff that don't like it so what we tend to do then is not put them in the module."* [**participant L**]

but there was also a recognition that fear played a huge role in preventing lecturers engaging with simulation

"BUT I think there's a huge fear factor FOR skills never mind… never mind simulation". [**participant J**]

This led to the need for all staff development to allay these fears. For those staff engaged in simulation development was felt to be achieved by observing others, sharing practices and fostering a mentorship approach so that those who were more experienced could help others. The attendance of bespoke courses was considered beneficial and necessary

"I would like a post reg type of…qualification on Skills Teaching because I think it's not…not that it's an add on to what we're doing but I think we need to focus on the…underpinning the theory or the pedagogy in how we approach skills teaching and explore that further."
[**participant G**]

"Our training It would be a build on build so that by we are delivering it in stage three or even CPD even modules. We would be delivering along a training pathway and education pathway where complexities increase for us as well. So very similar to what we could do what we would like to do for our students. And having time away to do that and very protected time spoking out of that being able to go out with your own organisation to other organisations to do some observational visits and some involvement visits with it so you could start practicing with it with people who are currently running it at a different level to yourself. Almost to have a mentorship out with your own organization errm … I think …partly that would share ideas across Scotland. But it's almost like having a supervisor And I think that's what it should be." [**participant J**]

Overwhelmingly, a desire to be educated and supported to develop their own and institutional simulation practices ran through all the interviews

"Yeah I would say it's essential. If you want to…for me personally anyway, doing these simulations is a bit of a risk because it can be quite a vulnerable learning experience, it can be quite threatening for students but at the same time its…it's an immensely rich learning experience. So, it's essential that you get it right, that you have the right facilitators, and you have the right amount of support but also at the same time you give them the freedom to make their mistakes, or to do their learning within that supportive environment. So…for me I think being formally educated in simulation it's a no-brainer. We absolutely need to have that to make sure that staff know exactly what they're doing. How to do it and how to get the best out of it. I'm sure there's so much more that we could do within simulation that would give our students a much better learning experience, but we need to be educated on that to make sure that we're doing it in the right way so not to cause any harm." [**participant F**]

iv) Strong leadership required to enact change (internal and external)

To facilitate the development of staff it was felt that strong leadership was required. It was apparent that this leadership was viewed as not only being crucial internally in individual institutions but also an external, national approach was considered by some as potentially beneficial. Drivers were viewed as being actioned by leadership and many of the barriers it was felt could be overcome if strong leadership was present.

"Yes. I think having key people who have a passion or a desire to do this, that have the stamina to push it forward, who have the knowledge base to answer the queries and to I suppose negate the barriers and…push it forward on the agenda. So, I think it's really about having the right people in the right places and the buy in from the people who can then action these things." [**participant F**]

Main external drivers were the NMC and enhancement of clinical skills in pre-registration curricula

> *"(big breath) well I think the new NMC standards coming in and how we have to effect change and obviously it's about making sure clinicians are a lot more ... you know. have a higher skill set. So, for me it's a real driver for simulation."*
> [**participant E**]

And the Clinical Skills Managed Education Network (CSMEN) was considered as having the potential to provide standardisation across Scotland

> *"…I think it would be great to have you know…benchmarks for simulation, I think having those CSMEN outcomes that everyone is using or…and going to be using for staff development. If we had something like that for…you know in and around simulation I think that would be brilliant."*
> [**participant L**]

It was evident that support was thought to be required at every level and more than that the status of simulation needs to change within institutions.

> *"Yeah although I think the School part, the whole School buying into it and seeing the importance of Skills and therefore the need for training…it's not about them supporting staff to go but recognising the importance of simulation in Pre-Reg Education."* [**participant B**]

> *"…but it's also about having the person with the leadership and has the knowledge and the training and the networking to cascade it… erm to other colleagues"* [**participant E**]

> *"so, if the people you need to speak to was on the same wavelength, it's like a political rally you've already converted the people doing simulation ... it's the others!! (laughs)*
> [**participant I**]

"so, I think there needs to be a shift in people's minds about they prepare for skills and how the skills should be…as much preparation and development time as a main lecture a lecturer in a classroom is and that's the bit that perhaps is the only barrier. People can't understand that and see it as an extra effort or yeah, I'll do skills, there's nothing easy about doing skills…. It's not weighted as heavily as what the lecturing or the classroom teaching is. Also, I've just been observing, they always bring new staff and put them in skills but actually that's the hardest bit because there are so many dimensions to managing and teaching and learning because it is facilitation, it's not lecturing. [**participant G**]

The notion that clinical skills and simulation required less expertise and less time and was considered less worthy academically was replicated many times through the interview transcripts.

5.10 Discussion

The discussion section is presented in three sections: consensus on simulation best-practice statements; methodological considerations and simulation in pre-registration nursing.

5.10.1 Consensus on Simulation Best-Practice Statements

The findings from this e-Delphi study show the expert panel reached a high level of consensus on 28 simulation best-practice statements. There were no additional statements proposed by the expert panel themselves which might suggest that the array of statements, taken from all four original authors, were deemed comprehensive covering all aspects of simulation. However, an area not considered by the expert panel, or the previous authors, was the role of the student during simulation; why this omitted is not known. Often, students have passive roles, rather than active ones, largely due to the complexity of ensuring large numbers of students are exposed to simulation. Yet, research around role allocation and learning by simulation is inconclusive. Schoening et al. (2006) found the passive observer role beneficial whilst Lasater (2007) found students were

bored in this role. Jeffries and Rizzolo (2006) found no difference between active and observer roles. The significance of a passive role versus an active role during simulation requires further exploration to inform simulation activity (Thidemann and Söderhamn 2013). Roles, active or passive, adopted by simulation participants should be included in simulation best-practice statements, at the very least, to promote transparency and warrants further research. Another area that could be enhanced was the attention to service users who act as volunteer patients.

In the main, reasons for statements not reaching consensus could either be attributed to repetition of content, as might be expected there was considerable overlap between the sets of statements; or because the statements themselves were ambiguous. However, there were some unexpected findings, for example, student preparation did not reach consensus. This may have been due to the notion, as one of the qualitative comments stated that it was not always needed if students had been exposed to simulation previously. In previous sets of statements by Arthur et al. (2013) the role of student preparation and orientation prior to the simulation experience was highly rated, and was an addition since in Jeffries simulation design characteristics (2005) it was not included. It is regarded that student orientation to a clinical skills facility is beneficial to reduce student anxiety (Cato 2013; Nielson and Harder 2013). Students in pre-registration nursing could receive an initial orientation to the clinical skills centre followed up by equipment or task orientation, when anything new is introduced, such as more advanced mannequins; but environment orientation is arguably not required before each simulation session.

Assessment was considered an important selection to this set of simulation best-practice statements and was an area receiving a level of 100% consensus by the expert panel. In response to a statement that the '*assessor should be unknown to student being assessed*' it was suggested that assessor familiarity can help student performance rather than hinder it or lack objectivity. Yet, in Arthur et al.'s (2013) simulation best-practice statements there is no mention of assessment or summative evaluation. Arthur et al. (2013) suggest this is because its use was not well supported in an Australian nursing education context at that time. To sum up the quality indicator statements presented by Arthur et al. (2013) are very similar

to those developed by INASCL, especially around well-prepared staff, the importance of debriefing and use of a variety of facilitation methods. These were all areas for statement selection for new set of best-practice statements. Arthur et al. (2013) set does not contain student preparation and this criterion was omitted in this set of statements. Arthur et al. (2013) and the e-Delphi set both contain summative evaluation of students by simulation.

5.10.2 Themes from the Free-Text Comments

The discussion on the qualitative free-text comments is presented under headings of the three main themes. Use of terminology - How we say it matters; Curriculum design and delivery - what we do matters; and Staff engaged in simulation need development - we need to do it better.

i) Terminology: *How we say it matters*

The free-text responses were utilised by the expert panel to suggest alterations to the best-practice statements often with regards to terminology. Two types of terminology changes were made: spelling and educational culturally recognisable terms. Firstly, because some of the statements used American spelling, some amendments were made. For example, changing 'program 'to 'programme.' In addition, words more familiar in the American than UK education system were also changed; 'faculty' became 'staff;' 'objectives' became learning outcomes.

Another main change was around the use of 'student age'. The expert panel were clear that student age should not determine learning rather it should be the stage of the student and the associated competencies they would be expected to achieve at that stage. In the UK, these are set by the NMC and are not linked to age, but to proficiencies, now listed under seven platforms of practice with corresponding outcome statements (2018). Associated with the achievement of learning outcomes is the fidelity of the equipment used. The panel observed that the level of fidelity can change depending on the learning outcomes to be achieved and that high fidelity is not always required nor always available, Medium-fidelity mannequins are often more cost effective than high-fidelity versions and notably more useful for some learning situations (Levett-Jones et al. 2011).

Interestingly, the statement about using consistent terminology when discussing simulation did not reach the desired level of consensus. Comments indicated that

it would be difficult to achieve agreement from all the different healthcare professions and some inconsistency around the use of different terms was acceptable.

Terminology used for debriefing prompted debate; debriefing is accepted as being when learning is consolidated and as being a factor that facilitates transfer to practice (Fanning and Gaba 2007). One participant claimed that debriefing should now be termed '*learning conversations*' suggesting that the word 'debrief' often has negative connotations. The importance of learning conversations in an educational and professional capacity are well-documented. Senge describes them as "*'learning-ful'" conversations that balance 'inquiry' and 'advocacy', where people expose their own thinking effectively and make that thinking open to the influence of others*" (1990 p.9). This approach embodies what happens in a useful debrief session post simulation. However, the rest of the expert panel shied away from this term deeming it an unnecessary change of terminology and preferring the familiar term of debriefing to continue.

ii) Curriculum design and delivery: *what we do matters*

Debriefing was often referred to in the qualitative comments and contributed to seven of the 28 agreed statements. This is unsurprising, because debrief is seen as the most important part in simulation and '*where the learning happens*' (INACSL 2016a; Fey et al. 2014; Decker et al. 2013). Arthur et al. (2013) also confirmed the importance of debriefing, reflection and self-evaluation immediately after simulation (Fanning and Gaba 2007). Debriefing increases the depth of learning; challenges understanding and affords students the opportunity to verbalise their reasons for actions taken. Excellent performance can be identified; equally gaps in knowledge or performance can be highlighted (Raemer et al. 2011). Debriefing was highlighted by the expert panel as an area for improvement in their institutions for two reasons (i) due to the infrequency of the occurrence of debrief sessions after each simulation activity and (ii) because they reported that it was often absent or not adequate. The expert panel considered that staff development in debriefing was essential.

iii) Staff engaged in simulation need development: we need to do it better

Simulation best-practice statements are currently not in use by half of the Scottish pre-registration nursing education providers surveyed. The reason cited was lack of staff awareness of best practice statements or models which would correlate with the lack of staff training available. Staff training was viewed as very important both around use of simulator technology but also around the development of scenarios and debrief. Issues around staffing and training have the potential to lead to future studies to consider staff training. Adequate staff and student training and support for use of technology has been raised in previous studies (Fetter 2009; Jones and Hegge 2008). A few expert panel members expressed the difficulties with providing staff training and that only a few staff engaged in simulation. This was consistent with the findings of Arthur et al. (2013) as lack of adequate staffing was the "*greatest impediment to the effective use of simulation in undergraduate nurse education*" (p.1360).

One solution offered by the expert panel was to adopt the Clinical Skills Managed Education Network (CSMEN) Three-Tier approach to staff training to deliver simulation. Tier-One could be used to introduce a wider range of academic staff to simulation. Introductory theory could be delivered in an on-line format with a day's face to face attendance required to cover some practical elements. The e-Delphi, useful for establishing consensus, did not offer the scope to allow participants to discuss this or other issues; a criticism, of the Delphi technique, proffered by Goodman (1987) and Walker and Selfe (1996). Therefore, telephone interviews were conducted after the e-Delphi study to explore this suggestion in more detail.

5.10.3 Methodological Debate: Validity, Generalisability and Reliability of Results

This part of the discussion will be focussed on the methodological debates around the Delphi technique itself. Issues of validity, generalisability and reliability will be discussed.

i) Validity

Sackman (1974) critiqued the Delphi technique for not being scientific, yet it does not claim to be. Rather it is proposed as a "model of inquiry"; a way of generating knowledge from experts. As Rowe and Wright point out, the Delphi method

> *"is intended for use in judgment and forecasting situations in which pure model-based statistical methods are not practical or possible … and thus where some form of human judgmental input is necessary"* (2001 p.135).

It is acknowledged that the characteristics of this knowledge, and the role of the expert panel and inquiring researcher, may have an impact on this inquiry process and thus the results obtained. When the expert panel made any comments in the free-text boxes about a statement these were summarised by the researcher and presented in the next round alongside the statement they pertained to. Hence, the expert panel may have reacted to the summary of these comments provided by the researcher between rounds and changed their minds about a statement. Nevertheless, anonymity served to protect them and they were free to come to their own decisions without fear of being judged. These steps would hopefully ensure it was each expert's opinion that was been presented and that this was a valid representation.

In this study, the purpose of using a Delphi technique was to ensure a conformity of knowledge that could not otherwise be acquired. This conformity is reliant on the quality and quantity of experts accessed. The belief is that more credible data is produced than that of a single expert and that this knowledge or opinion can guide future actions to be taken. It follows therefore that the selection of the experts to form the expert panel is critical. Firstly, that they have the relevant expertise but also that this can be authenticated. The screening questions were designed to ensure the relevance of the expert's knowledge and background. Secondly, it was important that the experts were willing to engage in the lengthy and time-consuming process of three rounds of questioning. Therefore, the relationship between researcher and expert panel had to be managed carefully to allow transparency in the research process and encourage responses. To assist this encouragement regular updates were sent via Survey Monkey® along with expressions of thanks and gratitude for their support. A final set of the simulation best-practice statements was released to each participant so they could assess if it was a valid representation of their views. No comments were received from the expert panel members apart from thanks at receiving them.

ii) Generalisability (external validity)

A limitation of the Delphi method itself is the question of generalisability of the results because they are based on a small sample size which therefore represent a limited range of opinions. The expert panel composition aimed to have at least one academic from each Scottish school of nursing and representation from three governing bodies, this would have realised a potential total of 25 panel members. This aim was not achieved. The resulting panel membership comprised academics from eight different Higher Education Institutions, plus representatives from SCSN, but not from the NMC or NES - these invitations were declined. In each of the three rounds, nine participants provided complete responses. The individual membership altered slightly in each round yet still represented a 44% response rate. This is higher than the usual expected online questionnaire response rate, which has been reported as being around 30% over the last ten years (for example, 30% by Brtnikova et al. in 2018 and 33% as suggested by Nulty in 2008).

Early adopters of the Delphi technique recommended that as a minimum, 7 to 15 respondents are considered necessary (Linstone 1978; Delbecq et al. 1975). Linstone (1978) proposed that accuracy deteriorates with smaller panel sizes and improves with larger numbers. A larger group may be required for an expert panel that is comprised of a heterogeneous sample, Turoff (1970 p.153) suggests 10-50 participants. However, it may be that a smaller panel is satisfactory for a homogeneous sample (Briedenhann and Butts 2006). Therefore, it can be claimed that for this study an expert panel of nine homogenous respondents was an acceptable number.

Opening a Delphi panel to others, such as student nurses, might support heterogeneity; Sullivan and Byre (1983) invited both academics and student nurses onto their Delphi panel when considering curriculum design. '*Wisdom of Crowd*' theory informs us that it is not always necessary to have 'all experts' to reach satisfactory decisions: In a study by Giuliano and McGregor (2014), three assessors, two of whom were experts and one who was not, reached the same decisions as three experts. Advantages to having less experts on a panel were seen in relation to cost and an expert's precious time. In this vein it would be interesting to see if a heterogeneous panel, comprising of academics and students,

would produce similar results as this e-Delphi study. Although it might be argued that student nurses don't have the theoretical knowledge to contribute to simulation best-practice statements the results affect them directly and they may have a view based more on certain areas, such as debrief or assessment, rather than others such as the strategic areas. This could be an interesting inclusive study that could be conducted as a follow-on to this e-Delphi study.

iii) Reliability

The e-Delphi inquiry process can be divided into three steps; designing the question, managing the interaction, and using the results. Adopting a Delphi technique means that designing a question and managing the results overlap in that the experts themselves initiate future inquiries. How these interactions are interpreted by the researcher adds to or alters the knowledge obtained. Indeed, synthesis of the data obtained from the experts may not represent truth but is "*merely a cognitive map within the mass of experts*." (Marchais-Roubelat and Roubelat 2011 p.1498). Mackway-Jones et al. (1999) suggested that although her Delphi results of a major incident plan for mass child casualties appeared sound there was still a place for local discussion and final approval to be sought prior to implementation. This premise is acknowledged and leads to the recommendation that any simulation best-practice statements adopted for future collaborative work would need to be revisited and confirmed as 'useable' by any relevant parties.

Another way to test reliability is to compare the consensus achieved in each round. Keeney et al. (2011) term this '*stability of responses'* between the results obtained in each round.

In round 1: 32 statements out of 69 received 100%

In round 2: 25 of the 32 statements receiving 100% in round one remained 4.25 (mean) or above in round two

In round 3: there were no changes.

This means 78% of the best-practice statements remained consistent at the chosen level of consensus between round one and three.

In addition, 'post-group consensus' which "*concerns the extent to which individuals – after the Delphi process has been completed – individually agree with the final group aggregate, their own final round estimates, or the estimates of other panellists*" (Rowe and Wright 1999 p.363) was confirmed because 100% of the panel members felt they could use the simulation best-practice statements, thus, validating their selection.

Whilst Delphi studies typically produce counts and percentages and are analysed quantitatively by descriptive statistics then the consideration of validity and reliability pertain to these quantitative studies. However, there can be an element of qualitative data collected, as in this study, and alternate criteria may be looked for in qualitative studies such as "*transferability, creditability, applicability, or confirmability*" (Keeney et al. 2001 p.198). Delphi studies can be recognised as qualitative research methods because when they search for opinions (Habibi et al. 2014), this is achieved mainly by free-text comments.

This e-Delphi study has a mixed-methods approach as it contained a mix of closed questions and free-text responses; because of this the qualitative criteria as per Keeney et al. (2001) can be applied to the study. The use of selection criteria to enrol the expert panel and the protection of anonymity endorses creditability. Feedback between rounds, supports confirmability of the results as does the high level of stability between the rounds. Overall, the high level of consensus attained would suggest the results are applicable and transferable to the context for which they are intended.

A summary evaluation of the Delphi technique is presented in **table 5.18** and the methodological advantages and disadvantages of the Delphi technique are summarised and considered alongside application to this study, as illustrated in **table 5.19**

Table 5.18: Summary Evaluation of the Delphi technique.

Advantages	Application to this study
Easy access and good response rates	The use of on an online survey enabled participants to gain access. Only 1 participant required the web address as the link was blocked by her work computer. Response rate was 44%.
Early overview and conclusions – can produce evidence relatively quickly.	The survey lasted from the 5th March to the 23rd April, therefore, data collection was achieved relatively quickly.
Cost effective	No cost was incurred.
Reach geographically disparate participants	The survey reached institutions all over Scotland without incurring travel or other costs.
Flexible and easy to set up using software useful for e-Delphi	The survey was set up in SurveyMonkey® by the principal researcher with no training
Opportunity to share knowledge from experts	Essential for this study
'Participatory democracy:' Allows freedom of expression.	Hopefully, anonymity encouraged freedom to speak
Maintains anonymity of participant	Maintained through the survey tool
Panel membership can fluctuate without compromising results.	The rounds had slightly different memberships - but it is their level of expertise that is important rather than actual individuals
Disadvantages	
No opportunity to follow up on comments made or new ideas expressed	Follow-up interviews were conducted to explore some issues raised.

Iterative process may be time-consuming and expert panel may lose interest and drop out	Communication with expert panel important to promote continued engagement and their initial interest in the topic was established.
Justification of authority of expert panel	Clear criteria set out
No agreement on size of panel required	Important to be transparent to allow others to evaluate.
Defining consensus	As there is no agreement on definition of consensus or how decided it was important to be transparent in this study what the parameters were

The advantages of adopting the Delphi technique for this study outweighed the disadvantages. Recognised essential features of the Delphi technique were maintained in this study: anonymity between expert panel members, iteration of rounds, controlled feedback to expert panel members by the researcher and finally a statistical presentation of the group response (Heiko 2012).

Methodological criteria, as suggested by Diamond et al. (2014) (after conducting their systematic review of Delphi studies) have also been considered for this e-Delphi study to evaluate it. Diamond et al. (2014) promote the use of their quality indicators to improve transparency for the reader. The six points are provided in **table 5.19** alongside comments regarding this study.

Table 5.19 Methodologic criteria for reporting Delphi studies (Diamond et al. 2014 p.406).

Study objective	This study
Does the Delphi study aim to address consensus? Is the objective of the Delphi study to present results (e.g. a list or statement) reflecting the consensus of the group or does the study aim to merely quantify the level of agreement?	Yes, only to quantify the degree of group consensus on each simulation best-practice statement. The level of agreement is taken as the extent to which participants each agreed with each of the best practice statements. This was discovered in this study. The consensus of the group was also found with a percentage level of agreement set at 85% for each statement.
Participants	
How will participant be selected or excluded?	The participants were selected according to their involvement and interest in nursing simulation by specific set criteria.
Consensus	
How will consensus be defined? If applicable, what threshold value will be required for the Delphi to be stopped based on the achievement of consensus? What criteria will be used to determine when to stop the Delphi in absence of consensus?	Consensus is defined as a percent level of agreement 85%. The Delphi would be stopped after three rounds because absence of consensus is worthy of reporting and reasons why may have emerged.
Delphi Process	

Were items dropped? What criteria will be used to determine which items to drop?	40 statements were dropped because they did not achieve 85% (percent level of agreement).
What criteria will be used to determine to stop the Delphi process or will the Delphi be run for a specific number of rounds only?	The Delphi was only going to run for a set three rounds. Non-consensus would be reported.

5.10.4 Simulation in Scottish HEI's

This e-Delphi study highlighted that a high level of agreement was reached on 28 simulation-best practice statements and the expert panel agreed 100% that these could be used in their institutions. Simulation was being used by the HEI's who took part in the study as a pedagogy rather than to replace clinical placement hours. Simulation is believed to be a pedagogy that can be implemented to adequately prepare students for practice (Parker et al. 2018). Student nurses who are better prepared should feel more comfortable in practice and this in turn might help towards reducing attrition. Individuals who are better prepared are also likely to be safer in practice which would protect patients from harm. For this reason, those delivering simulation must strive to ensure it is of an optimum standard.

When asked to what extent the expert panel participants' own nursing institutions currently met the 28 simulation best-practice statements only seven statements were met by all eight institutions. This demonstrates the variance in the delivery of pre-registration nursing simulation across Scotland. However, the expert panel agreed 100% that these simulation best-practice statements *could* be adopted by schools of nursing institutionally; and that they as individuals and their colleagues would be willing to use them. Furthermore, participants reported that that they would be willing to engage in further collaborative simulation research. Wilford and Doyle (2006) and Sando et al. (2011) purported that academics need guidelines for effective implementation and this e-Delphi study supports this. Nurse academics in this study aspired to engage with best-practice statements all of which is encouraging for the future. Mapping pre-registration simulation against

best-practice statements could identify areas for consideration and improvement to support simulation-based education.

Only 22% of the eight institutions, seven Schools of Nursing and one interprofessional simulation centre, reported that they provided staff simulation training. This is an area for growth, awareness of models and best practice could be enhanced by the development of staff by providing further education and training. What that staff training might look like, and the consideration of barriers and enablers to providing staff development in simulation were considered in the follow-on interviews.

One of the most striking findings, both in the e-Delphi study and the interviews, was the variance in the different stages of simulation development across Scottish Schools of Nursing; there even appeared to be anomalies between simulation activities in different campuses of the same university. This variance can arguably be attributed to availability of resources, suitable facilities, institutional priorities and the interests of the staff themselves.

5.10.5 Results of interviews

There are three main interview themes: the how and why nurse academics learn about simulation; integration of simulation into the curriculum and simulation leadership. Each will be discussed in turn.

i) **The 'how' and 'why' nurse academics learn about simulation**

The 'how' and 'why' nurse academics learn about simulation was consistent across all the interviewees working in Schools of Nursing. The 'why' nurse academics learn about simulation and become involved in the delivery seems to largely depend on personal interest. Evidence from the transcripts shows this stem from a preference for a 'small-group' style of facilitative teaching and from a belief that simulation addresses the theory/ practice gap in a way no other method can so successfully achieve.

"How" the nurse academics learn about simulation is largely described as through role modelling. This is a recognised and useful teaching method

> "We must acknowledge . . . that the most important, indeed the only, thing we have to offer our students is ourselves. Everything else they can read in a book." (Tosteson 1979 p.690).

Being a role model in clinical practice relies on three main characteristics: clinical competence, teaching skills and personal qualities (Cruess et al. 2008). Whilst accepting that role modelling is a powerful tool for teaching its effect can often be negative and role models must analyse their own performance and remember to "*make the implicit explicit*" (Cruess et al. 2008 p.721). For simulation educators being role models, leaving aside clinical competence and personal qualities, still leaves us with a complex 'teaching skills' scenario. Simulation educators may have already absorbed many of the teaching skills required in simulation, such as encouraging reflection (Schon 1987). They may have received training on how to use various technologies, mannequins, cameras and clinical equipment or have clinical skills technicians to help with parts of the technology. Yet, this does encompass all the skills they will require to conduct a simulation. McGaghie et al. (2010), discussing medical simulation-based education, asserted that effective simulation is neither 'easy' or 'intuitive' and reports that clinical experience does not equate to good simulation educator effectiveness.

The Clinical Skills Managed Education Network devised the Scottish simulation-based-education quality assurance framework to encompass the three stages of simulation, as they define them: brief, immersion and debrief. The framework has three tiers or levels; which were intended to identify improvement outcomes for simulation-based educators (SBE): Tier One - practitioner educators SBE, Tier Two - leaders of SBE and Tier Three - researchers of SBE.

CSMEN (2017) suggest simulation-based educators should aim for the criteria using their simulation-based educator's quality assurance framework. Both the simulation best-practice statements produced in the e-Delphi and the Three-Tier framework aim to enhance simulation. The latter is approaching this mainly through the role of the educator, but in Tier Three mentions the researcher and manager role. Not everyone who is a simulation facilitator would need to adopt these roles to enhance their simulation practices. In **table 5.20** Tiers One to Three and their descriptors have been taken verbatim from the CSMEN Simulation-based

educators Quality Assurance Framework (2017). These have then been mapped to the 28 simulation best-practice statements produced in the e-Delphi study. There is some overlap between the Tiers and the best-practice statements but also some differences. The difference is mainly because the two documents are looking at simulation from a different approach, one from the view of educators development and the best-practice statements from a more holistic stance. Out of 25 descriptors in the Three-Tier framework there are nine which maps albeit not exactly. Overall, there are enough differences to warrant using both tools to enhance simulation and simulation educators.

Table 5.20 Tier One to Three mapped to 28 simulation best-practice statements

Tier One	Tier Two	Tier Three
Describe range of appropriate learning activities that can use simulation (*e.g. procedural skills, communication skills, drills etc.)*	Identify appropriate learning outcomes for simulation-based learning event (*e.g. use of SMART, Blooms taxonomy*) Links to statement 15 and learning outcomes mapped to module and course	Design, deliver and evaluate inter professional SBL event
Recognise the spectrum of simulation modalities (*e.g. VR, part task simulators, manikins, and simulated patients*)	Demonstrate the appropriate underpinning educational theory (*e.g. behaviourism, experiential learning reflective practice, social cognitive theory, activity theory*)	Evaluate role as SBL educator (*e.g. for portfolio evidence, appraisal*) Links to statement 6 and partly to statement 8: both are concerned with evaluation
Recognise impact simulation-based learning (SBL) can have on learner, team and system (*e.g. knowledge, skills, drills and performance)*	Design an SBL event taking account stage and expertise of learner *(e.g. Dreyfus and Dreyfus, Benner Challenge point framework, Perry*)	Demonstrate use of simulation for assessment (*e.g. constructive alignment, immersion and assessment; use of Millar's triangle; Tools such as OSCE and OSCE*

		variants, OSATS, Behavioural marker systems, Ward Simulation Exercise tool) Links to statement 21: which is around simulation assessment
Identify the range of opportunities for faculty development in simulation-based learning (*e.g. range of courses, programmes masterclasses, degrees*)	Design an SBL event utilising principles of deliberate practice and prevention of skill decay *(e.g. Ericsson, paced education)*	Demonstrate skills with video debrief of SBL event (*e.g. book-marking, learning aligned selection, signposting, use of teaching moments)*
Recognise SBL in context of curriculum outcomes (*e.g. Tomorrows Doctors, Foundation and specialty competency-based curricula, NMC*)	Design an SBL event using principles of constructive alignment (*e.g. Biggs*)	Identify and contribute research opportunities for simulation-based education (*e.g. Multicentre trials, publications,*)
Demonstrate awareness of mapping where simulation can enhance curriculum delivery (*e.g. Blueprint vs curriculum*) Link to statement 3 and curriculum mapping although this is just an awareness of	Delivery of SBL Activity (e*.g. Immersion using STEPS or 4 stage, reflective immersion, use of faculty confederate Simulated patients and or simulators)*	Develop integrated curricular programme for SBL (*e.g. integrated, progressive development of knowledge, skills, drills and performance*) Link to statement 3: simulation should be aligned to curriculum

	Debrief and reflect on the SBL event (*use of relevant models, e.g. agenda led-outcomes based, description-analysis-application, learning conversation*) Links to statement 23 staff are competent in debrief	Participate in learning from meta-debriefing (*e.g. DASH, OSAD, peer review debriefing)*
	Establish a safe learning environment for the SBL event *(e.g. Confidentiality, consent, ground rules, time out)* Link to statement 9: staff ensure a safe learning environment	Provide leadership for SBE educators (*e.g. organisations such as universities NHS organisations, societies and associations*)
	Evaluate SBL event using appropriate framework(*e.g. Realistic evaluation, Kirkpatrick levels, DASH Student version*) Links slightly to statement 8: which talks about evaluation of programme and staff rather than an individual event.	Recognise need to link to statutory and regulatory bodies (*e.g. GMC, NMC, HCPC)*

		Manage resources effectively and efficiently (*e.g. use of simplest possible simulator, procurement of consumables, development of patient banks)* Links to statement 2: this refer to maintenance of equipment only rather than procurement and includes a strategic overview

Key: SBL simulation-based learning; SMART (specific, measurable, achievable, realistic, timely). VR virtual reality; OSCE objective structured clinical examination; OSAT onsite assessment and training; WSE ward simulation exercise; DASH debriefing assessment for simulation in health care ; OSAD objective structured assessment of debriefing; GMC General Medical Council; NMC Nursing and Midwifery Council; HCPC Health and Care Professions Council

Abridged from CSMEN Simulation-based educators Quality Assurance Framework (2017) Available online: http://www.csmen.scot.nhs.uk/quality-assurance/development-of-sbe-qa-system/

Acknowledging the views of the interviewees that all educators need an introduction to simulation, Tier One seems to be suitable for all nurse lecturers involved in teaching nursing students. CSMEN (2017) plan to provide Tier One in an online format with a day's face-to-face attendance at a course centre. The learning outcomes are mostly around describing and identifying; equivalent to Bloom's taxonomy level one and two of remembering and understanding. Tier Two could be adopted for simulation facilitators or those wishing to use simulation in their modules and module leaders. Tier Two outcomes link to Bloom's levels three to six of applying, analysing, evaluating and creating (Biggs and Tang 2011). Tier Three could also be applicable to module leaders and those in senior roles; however, it incorporates many factors so all the outcomes might not be applicable to all roles. There is ambiguity in that Tier Three covers research roles as well as management of resources including procurement, which often do not sit together in Schools of Nursing. Some of the aspects could be achieved by module leaders; evaluation and student assessment and meta-debriefing would fit well with a skills module leader in pre-registration nursing. Nonetheless some of the criteria may never be met by some; interprofessional simulation may not be included in all modules, the use of video debrief may not always be needed or available, and curricular responsibilities may fall to senior staff who may or may not endorse simulation.

The CSMEN (2017) SBE framework may offer some guidance on criteria for those delivering simulation to aim for and it may identify what skills they might be role-modelling. It seems to be useful as a mapping tool for institutions to claim what tier their staff align to and it identifies layers of simulation educator activities. When it is available the online learning, relevant to Tier One, may prove a useful learning tool that is more accessible and cost-effective. It may be only those aspiring to Tier Two will need to attend the study day. All this is unknown at the present time. However, what it does not do is address all the needs identified by the respondents in this study. The 'how' one might achieve Tier Two and Three are less clear, rather, they appear to be a self-assessment exercise.

In the USA, Hayden et al. (2014), asserts that nurse education simulation requires staff that receive formal education on theory-based simulation methods. The National League of Nurses (NLN) USA, recognised that simulation educators need

expertise and development in simulation. A national team worked together to analyse Benner's (1984) novice to expert model and mapped this progression to the development of simulation educators (Wilson and Wittmann-Price 2015; Waxman and Telles 2009). An online tool-kit was also developed to be used by simulation educators to self-assess in nine key simulation areas: technology, scenario design, debriefing, teaching/learning strategies, curriculum integration, evaluation, realism, standardised patients, and simulation management.

Thus, NLN distinguish simulation as a 'speciality', simulation educators might use the same educational theories to support learning as other educators but how best to employ these theories in simulation comes with experience and reflection.

> "*An educator can be an expert in one method of teaching while a novice in another. For example, an expert clinical educator could be a novice when it comes to applying educational principles in the simulation laboratory".* (Thomas et al. 2015 p.341).

In addition, The Society for Simulation in Healthcare (SSH) have defined two levels of competency for simulation educators: Certified Healthcare Simulation Educator (CHSE) and Certified Healthcare Simulation Educator–Advanced (CHSE-A). McNeill et al. (2012) recognised that staff development is required for nurse educators to use simulation effectively. Their case study with four schools of nursing demonstrated how a two-pronged approach to staff development: a short course for novice educators and continued education programme for experienced staff who were new to simulation enhanced effective application of simulation pedagogy. McNeill et al. (2012) recommend the use of online resources were possible and a flexible approach as not all staff have the same needs. Additional education for staff not only on simulation pedagogy but on the clinical skills themselves may also help address the theory practice gap as in an integrative review Moradian et al. (2019) suggests one strategy is to improve the clinical skills of academic staff.

ii) **Integration of simulation into the curriculum**

In this study, only one institution's staff teaching course contained simulation in the curricula. It is proposed that this needs to change. By incorporating simulation pedagogy design and delivery into the preparation of staff engaged to prepare health-care nurses for the clinical environment, standards may be improved and staff may feel more prepared to deliver simulation activities.

An element of this preparedness is knowing what is available to guide and structure simulation and then deciding what would be a good fit and what would help in simulation delivery. Checklists, such as the one developed for using simulators by Guimond et al. (2011) are a useful aid to educators. However, none of the interviewees mentioned the use of tools or checklists and none of the institutions in this study had adopted a model, best practice statements or quality indicators to guide simulation overall and nine did not use a model to facilitate debriefing. The inter-professional simulation centre was the only institution to use the CSMEN (2017) Three-Tier framework for simulation educators, although one School of Nursing had plans to adopt it.

Nevertheless, the use of best-practice statements (or equivalent) can guide those who design and deliver simulation to plan and evaluate their simulation practices. It is not suggested that these should be rigid rules or that any guidelines are superior to others. Choice depends on many factors, on need, on context, on culture, even on available resources. The crucial purpose of all these types of 'guides' is that they act as a springboard for highlighting areas for development and improvements and that these are then evaluated.

A model is defined by the Oxford English Dictionary (2019) as "*A thing used as an example to follow or imitate.*" Tuulikki's (2011) longitudinal study, developing a model for use in virtual reality and simulation-based learning environments, asserts that although lecturers were moving towards student-centred approaches they either chose features from one model or no model at all. The simulation educators in Tuulikki's first study all identified the development of pedagogical knowledge as essential. Like previous studies by Postareff et al. (2007), Bruce, and Gerber (1995) who claimed pedagogical training was necessary to change and

improve teaching practice. Just as important as the technological training required to run the simulation equipment (Tuulikki 2011). Pedagogical models provide both theoretical underpinning for simulation activity as well as tools to plan and evaluate teaching. A factor endorsed by medical educationalists who propose emphasis on the use of simulation pedagogy should be highlighted (Issenberg et al. 2005) specially to counter the rise of simulation technology (Kneebone 2003).

Quality indicators or best-practice statements have a similar role as models to play in enhancing simulation; educators need guidelines for effective implementation of simulation. This has been recognised by the Nursing and Midwifery Council of Great Britain (Wilford and Doyle 2006) as well as the International Nursing Association for Clinical Simulation and Learning (INACSL) (Sando et al. 2011) and Australian Learning and Teaching Council (ALTC) (Arthur et al. 2011). Arthur et al. (2011) assert that the quality indicator statements resulting from their Delphi study

> "*will be of benefit to academics with an interest in the design, implementation and integration of simulation. They provide synthesis of research findings and expert opinion about clinical simulation and factors that should be considered for curriculum integration. The quality indicator statements can be used to guide the implementation of simulation within nursing curricula, or to evaluate the extent to which quality implementation has been achieved*." (p.1361).

Lack of specific education about simulation could be considered responsible for the lack of awareness around available models and literature to support simulation. Of those involved in simulation, most are doing so because of personal interest and because they believe simulation to be a good vehicle for learning that the students could benefit from. Learning that they can more easily transfer to practice.

In this study staff education about simulation relied chiefly on role modelling, equipment training from manufacturers and personal, private study. Only one institution's teaching qualification contained simulation as part of the set

curriculum. How then can we raise awareness of the pedagogy of simulation, of models, quality indicators and best-practice guidelines; improve and even justify simulation-based education?

iii) **Simulation leadership**

The respondents in this study considered that leadership, internally in their own institutions and externally, from national organisations was crucial to facilitate change. Simulation leadership is recognised by the National League of Nurses in America to be essential. The NLN 'Leadership Development for simulation educators' is a year-long programme. One of the criteria involves working on a group project that can be hosted on their online platform as a resource for others. The toolkit mentioned earlier, designed by Thomas et al. (2015), was one such resource, it outlined level of expertise for simulation educators.

Conrad et al. (2011) provide a case study of how simulation went from one person's vision in 2002 to a fully equipped simulation centre servicing 500 students in 2010 – all through transformational leadership. A major contributory factor of that transformation was staff training and enhancing simulation pedagogy.

In a qualitative study, nurse educators asked why they did not use high-fidelity simulators, they cited lack of time, support, and education as major barriers (King et al. 2008). Jones and Hegge (2008) reported that educators did not have time to learn the technology to use high-fidelity simulators. Plus, the need for a support from others, such as simulation technicians, to program and operate the high-fidelity simulators is essential to academic staff. (Griffin-Sobel 2009; Jones and Hegge 2008). These points were all raised by interviewees in this study. Evidently, to action all these factors support is required from managers and budget holders; coupled with determined positive leadership to gain this support. Furthermore, employees involved in the leadership process can initiate change (Hussain et al. 2018).

5.10.6 Methods Discussion

Structured interviews are when participants are asked the same question in the same way and in the same order. A pre-planned interview guide provides a rigorous structure (Ryan et al. 2009; McKenna et al. 2006) to conduct the

interviews. This method is useful for collecting demographic data (Holloway and Wheeler 2010) and its strengths lie in time efficiency, the limitations of researcher subjectivity and bias, and the production of data that is easier to analyse (Holloway and Wheeler 2010). However, what was required in this part of the study was the expansion of opinions generated in the e-Delphi study because the Delphi technique does not lend itself to collecting qualitative data because it doesn't facilitate any exploration of ideas or seek any explanations (Berg 2009) therefore, a less structured approach was required.

The unstructured interview allows the participant's thoughts, feelings and interests to be explored in depth. Although an unstructured interview often begins with a general, open question relating to the focus of research, subsequent questions are dependent on how the participant responds (Holloway and Wheeler 2010). The interview may be flexible but an interview guide, appropriate to the question, is still prepared, however, it comprises of themes rather than specific questions. The rationale for conducting an unstructured interview would be when a participant's experiences and thoughts require in-depth exploration (Ryan et al 2009, Holloway and Wheeler 2010). The unstructured interview can be difficult for a novice researcher who may be prone to bias and ask irrelevant or leading questions. Analysing the rich data can also be difficult as well as time-consuming (Doody and Noonan 2013). This level of detail or indeed analysis were not required for this study, the researcher's interpretations were to code and present themes rather than to put their own interpretations on the data therefore a semi-structured interview approach was adopted.

The lead researcher facilitated all the interviews for consistency and to commence familiarisation with the data. The lead researcher interviewed six of the participants from their host institution, it is acknowledged that pre-existing relationships can create advantages and disadvantages when interviewing (Mansell et al. 2004). Where good relationships exist, this may facilitate interviewees to engage more readily and openly (McDermid et al. 2014). Conversely, this may increase interviewee's vulnerability and may result in them feeling judged (Karnieli-Miller et al. 2009). It is important therefore to address any perceived power imbalance and ensure the motivations for the study are clear to the participants (McConnell-Henry et al. 2010). Although it is suggested that

self-disclosure is one way that power imbalance can be mitigated (Dickson-Swift et al. 2006), this viewpoint appears to be in the minority. Furthermore, McConnell-Henry et al. (2010) suggest that disclosure by the researcher themselves may leave them vulnerable because participants are not so obligated to maintain confidentiality. There is not an established rule evident about the relationship between researcher and participant (Karnieli-Miller et al. 2009). The stance taken in this study was that the researcher curtailed relaying their own viewpoint during the interview to avoid influencing the responses given by the participants (Mercer 2007).

The use of the telephone instead of face-to-face interviews for qualitative interviews has often been discouraged because it is considered that the same quality of data cannot be generated (Gillham 2005; Legard et al. 2003). Essentially, the potential deficit in the richness of the data is attributed to the assertion that rapport and the conversational, natural tone of the interview is adversely affected (Shuy 2003). Alternatively, advantages of a telephone interview are largely practical around savings in time and travel costs but it is also suggested that the layer of anonymity might assist some interviewees to relax when the topic is a sensitive one (Sturges and Hanrahan 2004; Chapple 1999).

Irvine et al. (2013) compared telephone versus face-to-face interviews and summarised the differences reported in the literature. Firstly, rapport and naturalness, this argument centres on visual cues that would be lost in a telephone interview. To compensate for this Fielding and Thomas (2008) propose the interviewer makes up for the loss of visual cues by being an effective communicator; ensuring the interviewee stays on topic by keeping an eye on the interview guide. The second difference is meaning and comprehension, Hermanovicz (2002 p.497) claims that in telephone interviews 'breakdowns in communication' happen because those communicating are apart. Thirdly, the ability to monitor responses and emotions, interest and attention is lessened in a telephone interview as visual cues are lost. Novick (2008 p.395) purports the types of data loss or data distortion that may occur when the researcher cannot see the person they are interviewing: "body language and facial expressions; contextual data such as the interviewee's physical characteristics" and it may be difficult to notice some verbal data too. Stephens (2007 p.211) observes that, in

face-to-face interviews, the non-verbal cues guide and shape the interview. However, vocal responses, paralinguistics, can show interest and encouragement and can be used to replace the non-verbal nods and facial expressions (Chapple 1999; Dicker and Gilbert 1988). Lastly, the duration of the interview is likely to be shorter in a telephone interview. Gillham 2005, Shuy 2003, Tausig and Freeman 1998, all assert telephone interviews are more demanding and tiring because the interviewer and respondent are relying solely on verbal communication, thus, more concentration is required than a face-to-face interview. Consequently, Gillham (2005) recommends that telephone interviews should last no more than half-an-hour.

Technology has offered up other mediums for interviewing, which can be accessed remotely, and includes audio as well as visual clues: Skype, face-time or video-conferencing. These methods require the same ethical approval, process and guidelines as face-to-face; in addition, Skype can offer the same visual 'authenticity' as face-to face (Janghorban et al. 2014) However, these audio-visual synchronous tools have drawbacks. Skype requires access to high-speed broadband and for the user's familiarity with online communication and a degree of digital literacy (Deakin and Wakefield 2014; Hamilton and Bowers 2006). Sullivan (2012) adds the complexity of ethical approval for Skype may be complicated as it is provided by a third party. Moreover, video-conferencing requires the booking of specialist equipment and dedicated rooms, which would place an extra burden on the interviewee because this could not be enabled by the researcher. Consequently, telephone interviewing was adopted because this was a reliable and easily accessible option.

To counteract the negative factors of telephone interviewing the researcher adopted several strategies to try to overcome them. Concerning rapport and naturalness the researcher knew some of the interviewees and considered she had a good professional relationship with them. With the cautions McConnell-Henry et al. (2010) outline it was essential interviewees were reassured about the purpose of the study and that they felt comfortable to offer their honest opinions. A dialogue was started before the audio recording commenced to ensure the interviewee was relaxed, in a quiet area and had the opportunity to get a drink if they required one. The researcher worked very hard to be non-judgemental and

not to give their opinion. On one occasion, the researcher felt this had not been adhered to when they may have given their opinion with a comment that was made. Meaning and communication was enhanced by the researcher using the non-verbal skills of summarising and paraphrasing to check understanding and clarify points made. Listening to the interviewer the questions appeared to be asked more slowly then was the usual researcher's voice speed. Communication was sometimes hampered by the telephone line becoming affected. In these instances, interviewees were asked to repeat dialogue and apologies were proffered.

Overall, the audio recordings were clear and easy to transcribe; however, different accents did impede the speed at which some transcription occurred. Concerning noticing emotion and monitoring the interviewee responses this was not, necessary in this study as perhaps might be required when collecting qualitative data about sensitive issues such as bereavement. The interviewer adopted an extensive use of paralinguistics to demonstrate listening and interest, these took the form of "*ahe*", "*mm*" that were interspersed in the dialogue as the interviewee spoke. None of the interviews was over thirty minutes in duration in accordance with Gillham's (2005) suggestion. The telephone interviews were, in the main, scheduled on different days. When interviewee availability meant they were on the same day they were well spaced out. The interviewer did find that a high level of concentration was required during the interview and that this was quite demanding. The advantages and disadvantages of telephone interviewing as applied to this study are summarised in **table 5.21.** Overall, the method of telephone interviewing worked well for this study concurring with Glogowska et al. (2011) that the advantages outweighed the disadvantages. Furthermore, the qualitative telephone interviews felt participant-centred; agreeing with Trier-Bieniek's (2012) contention that honest data emerged.

Table 5.21: Summary of advantages/disadvantages of telephone interviews.

Advantages	Aligned to this study
Time	No traveling time incurred
Cost	Limited cost other than the charge for the call
Access to interviewees	Enabled access to geographically dispersed interviewees across Scotland.
Enhanced anonymity might be useful for sensitive topics	Although not sensitive topics discussed - institutional views might not be represented by, the interviewee so not being face-to-face may have helped here.
Potential disadvantages	
Rapport not established as well	Rapport seemed to be established well. Introductory question about simulation in pre-registration nursing in general/ appropriate use of humour/ used consent question and interview guide/ non-judgemental approach
Non-verbal cues missing	Use of paralinguistics
Meaning and comprehension diminished	Use of summarising/paraphrasing/ clarification questions/ taking interviewee back to comments interviewees made to seek expansion
Tiring	Calls limited to under half-an-hour

5.11 Strengths and Limitations

As well as the debates around the limitations of an e-Delphi with regards to validity, generalisability and reliability there were also practical limitations in the study. The project data collection stage was planned to take place in the universities' semester two before the summer holiday period and exam diets to hopefully encourage participation. The first round, which involved recruitment of the panel, took longer than expected and this combined with Easter school-holidays influenced response rates. All of which caused delays to the proposed time-scale; however, the expert panel members appeared to appreciate the causes for delay and fortuitously did not disengage, rather the extra time allocated to completing the round afforded them the opportunity to respond and became a way of dealing with non-response (Hsu and Sandford 2007).

The geographic location of participants may have affected the results because all were from Scotland, UK. (Skulmoski et al. 2007). This was designed for a specific reason, as the aim was to inform practice in Scotland and initiate research with the long-term aim being to conduct a large-scale simulation study in Scotland. The use of national and international statements to frame the initial simulation best-practice statements may have mitigated against the single geographic location.

The limitations of this study might be the small sample size although data saturation appeared to have been met because no new issues were emerging (Fusch and Ness 2015). Nevertheless, it would have been preferred if all the Schools of Nursing in Scotland, who deliver pre-registration nursing programmes, had been represented: five were not and six were included. Another limitation was that all the participants were from Scottish institutions and results may not be considered generalisable to the rest of the UK or internationally. Although developing simulation practice in nurse education is not an unfamiliar journey; and others may reasonably be expected to mirror these results depending on how far they have thus travelled.

The strengths of this study are the high level of consensus reached by the expert panel on simulation best-practice statements and their willingness and drive to adopt them and be involved in further research. This adds to the growing evidence

base around simulation. The reasons offered for the non-adoption of best-practice statements to date are cited as lack of awareness and time and cost restraints of engaging in education around simulation. The contemporary information about staff views on their development in simulation offers novel insights and can help form future advances in simulation practice for pre-registration nurse education.

5.12 Conclusion and Recommendations

This study has shown that a high level of consensus can be reached on simulation best-practice statements and that there is impetus in Scotland to improve simulation in pre-registration schools of nursing, to adopt these statements and furthermore a willingness to be involved in further research. The expert panel recognised more emphasis on staff development in simulation is required.

Therefore, it is recommended that the simulation best-practice statements, resulting from this e-Delphi study, are adopted and adapted by those interested in the development and delivery of simulation to guide simulation practices. In educational practice these simulation best-practice statements may be of benefit to nurse educationalists who will be able to quality assure the use of resource intensive simulation, students will be better prepared for practice and hopefully patient care will subsequently be enhanced. Used as a benchmark they can provide transparency to others around pre and post simulation activities as well as the actual simulation event. These results have significance for research as well as education practice. By several institutions, adopting these statements multi-site research studies with larger sample sizes may be carried out to explore the transfer of clinical skills to clinical practice.

The results of this e-Delphi study indicate that there is certainly a willingness towards adopting simulation best-practice statements and in engaging in multi-site research, which is very promising for future research. Staff training in simulation has been identified as an area for development, further discussion is required, and interviews with staff were conducted to facilitate this.

Take-home messages from this study are clear. Best-practice statements or their equivalents are currently infrequently adopted by Scottish nurse academics

involved in simulation. However, the perceptions of the expert panel are that they would be extremely beneficial to guide and evaluate simulation practices. It can be suggested that lack of use can be attributed to lack of staff awareness and staff development in simulation.

The need for leadership around simulation and the development of all staff around simulation but those who design and deliver simulation was convincing. CSMEN (2017) Three-Tier framework for simulation educators might provide a useful benchmark for simulation educators to aspire to and would encourage standardisation across Scotland. The profile of simulation might then be raised amongst academic colleagues. Hopefully by raising the profile simulation can be fully integrated into the curriculum, staff can be developed to understand the theories underpinning simulation. In addition, institutional standardisation would facilitate new graduates to transfer to different health boards with commensurate skills having been achieved.

5.13 Implementation

Whilst it is recognised that the e-Delphi study results can be considered as the opinions of a group of people at a given time and open to amendment it is considered that they can still be of use to guide simulation activity and future simulation research in Scotland. This view is supported by some of the comments made in the free-text by nurse academics forming the expert panel. The first step towards implementation will be to seek approval for their adoption at my own institution. To this end, a proposal will be presented in Chapter Seven. The Scottish Clinical Skills Network (SCSN) will be approached to ascertain if they would be willing to endorse or advertise the planned research before a multi-site research study is planned. The SCSN has a sub-group based on simulation research and this notion has already been proposed at the last conference at the sub-group meeting held in June 2018. It is hoped that this study's simulation best-practice statements will be a useful starting point for those institutions participating in the multi-site study to adapt and adopt them.

Chapter Five Summary

This chapter has outlined an e–Delphi study conducted to establish current best practice in pre-registration nursing simulation. The e-Delphi study has generated a high level of consensus for 28 simulation best-practice statements; which could be used by nurse academics to enhance current simulation practice and progress future collaborative research between Scottish schools of nursing. Staff development in simulation has been raised as a topic requiring further exploration.

This chapter presented the themes that transpired around staff development for simulation resulting from telephone interviews with academic staff involved in simulation. These led to some important proposals that will be discussed in Chapter Seven and Chapter Eight, recommendations and conclusion. The next chapter will present a feasibility study exploring the parameters of conducting transfer of learning to clinical practice research.

Two surprises from this piece of research, one that there was such a high degree of consensus around simulation best-practice statements and second, the 100% willingness of academics to engage with them and be involved in future research. This was encouraging as a novice researcher and the next step seemed to be to see how feasible it would be to engage in a transfer of learning study. Comments from participants off-line made me aware of the research responsibility as comments were made about how this research, collaboration and leadership was needed in nurse education. Powerful motivators for the future.

CHAPTER SIX – FEASIBILITY STUDY

Overview of Chapter Six

After the evidence from the integrative review and e-Delphi study it was determined a feasibility study would be undertaken to explore how best to design a study that evaluates transfer of learning from simulation to clinical practice. This chapter outlines this feasibility study designed to test the proposed methods for conducting a study examining how effectively learning by simulation is transferred to clinical practice by healthcare students.

Due to the aim of conducting a study with student nurses it was critical not to contaminate the population I wished to study but imperative to use participants with similar educational and practice experiences. Hence, the decision to focus on physiotherapy students for whose involvement I am eternally grateful.

6.0 Introduction

To recap, preceding this study, an integrative review (Chapter Four) was carried out to synthesise the findings from studies on the effect of simulation on the behaviours and performance in clinical practice of pre-registration student nurses. Kirkpatrick's (2006) levels for evaluating training were used to identify studies that explored student nurses' behaviour in clinical areas after simulated learning. The integrative review found that to answer the question of whether simulation changes practice and to establish whether learning can be transferred from a clinical skills' centre to a clinical area, multi-site, large sample, longitudinal studies are required. To accomplish this collaboration would be required from a selection of HEIs.

The integrative review also highlighted common limitations in research on transfer of learning from simulation to practice. Not least because it is far easier to carry out research around reaction to and learning from simulation rather than to assess if behaviour has changed in practice. The latter is far more complex because there are more extraneous variables to consider. It is also difficult to compare teaching methods with different student groups in the same cohort due to a perceived need

for equity in educational provision. One of the methodological limitations discovered in the integrative review was the lack of information presented about the intervention itself - simulation-based educational activities. It also became apparent from the review that it was difficult to appraise the simulation that had been delivered before the effects of it were then assessed. Whilst some studies provided details of the simulation and perhaps followed simulation best-practice statements, others did not provide such a comprehensive view, although it is acknowledged that this may be due to word-limits imposed by academic journals. To answer the question of whether simulation changes practice in a positive and appropriate way one must first be assured of the standard of the simulation that precedes it. Therefore, simulation best practice statements developed in the e-Delphi study (Chapter Five) will be used to map against the simulation used in this feasibility study to inform the design of future simulations and to ensure compliance with best practice.

Data from both the integrative review and e-Delphi study and interviews highlighted the need for further robust studies investigating simulation and skills transfer. Given the complex and challenging nature of conducting research in clinical areas and coupled with the issues with having students as participants a feasibility study was conducted to inform any future research process. This research was not intended as a pilot study: The terms of 'pilot study' and 'feasibility study' are ambiguous in the literature and are often used to mean the same thing (Whitehead et al. 2014). In a review of medical studies Arain et al. (2010) found that there was no clear distinction between the terms of 'pilot' and 'feasibility'.

Consequently, the research community in general are keen to seek clearer definitions. The National Institute for Health Research (NIHR) define a pilot study as a smaller study that takes place before a larger study; it is "*run in miniature*" (2017 p.2). A pilot is used predominately to test out if all the parts of the main study work together before the larger study takes place.

Conversely, a feasibility study asks the question "*can it be done*"? What are the potential barriers and pitfalls? By listing uncertain parameters and looking at how they may be improved, the aim is to promote the success of the main study. Feasibility studies do not evaluate the outcomes that will be set for the main study

(NIHR 2017). All preliminary work or pilot studies can be described as feasibility studies but not all feasibility studies are pilot studies because a pilot study should contain the design features of the future study/or part thereof but on a smaller scale (Eldridge et al. 2016).

The convergent mixed-methods study design was adopted for this study so that quantitative data from questionnaires and qualitative data from interviews could be integrated.

6.1 Aim

To conduct a feasibility study to explore the parameters of evaluating the transfer of learning respiratory assessment skills from simulation to clinical practice for physiotherapy students.

Although the focus of this thesis is mainly on pre-registration student nurses, to avoid the contamination of future samples of nursing students (because they will be the focus for any multi-site post-doctoral study) physiotherapy students were the participants in this feasibility study (Van Teijlingen and Hundley 2001). The proposed use of physiotherapy students was also a pragmatic choice because this group of students were available on campus to meet the study deadlines. Although the integrative review focused on pre-registration nurses, there are enough similarities between teaching and learning practice to warrant using physiotherapy students in this feasibility study. A cohort of physiotherapy students undertook theory and simulation activities at University in April 2018 as part of their normal planned curriculum.

6.2 Method

A mixed-methods feasibility study was conducted (Chapter Three discusses the format and rationale for a feasibility study). A feasibility study involves listing parameters that are unknown and sets out ways of improving them; this is so that a future main study is more robust and has an increased chance of success (NIHR 2017). An example of a feasibility study is provided by Rehn et al. (2010) who

tested, by simulation, a triage model for ambulance services to use at serious incidents.

For this feasibility study, the unknown parameters were established as:

1. Availability of exposure to relevant clinical placements and opportunities to practice chest auscultation.
    a. Time needed to collect and analyse data.
    b. Whether students perceive transfer of learning has occurred?
2. What will be required to fulfil outcome measure of transfer of learning from simulation to clinical practice?
    a. Appropriateness of theory and simulation activities (by asking the students and simulation facilitator and mapping the simulation activity to simulation best-practice statements).
    b. Suitability of questionnaire and interview questions.
3. Willingness of students to participate.
    a. Recruitment and retention of students, and response rates to interviews and questionnaires.
4. Ethical implications of students as participants.

These parameters led to the development of the following objectives.

6.3 Objectives

The objectives of this mixed-methods feasibility study were to:

1. Establish availability of and time taken to complete relevant placements.
2. Identify whether students perceive that transfer of learning has occurred.

3. Explore whether simulation activities, interview questions and questionnaires are fit for purpose.

4. Establish recruitment and retention rates to a study of transfer of learning from simulation to practice and how to protect students as respondents.

All the lessons learned from exploring these parameters can feed-forward into a future study on transfer of learning to enhance the robustness and validity of the research.

6.4 Study Design

The study design of a feasibility study attempts to neither mirror the main study nor meet its outcomes; instead, it is established to address certain parameters. The study design adopted was a mixed-methods approach that Creswell (2013) describes as *'convergent mixed-methods'* (p.41). This is where both qualitative and quantitative data are collected around the same time and then the information is integrated. In this mixed-methods study, two questionnaires were used and qualitative interviews conducted in-between. This method differs from the 'explanatory sequential mixed-methods' where quantitative data is collected and analysed before qualitative data is collected to help explain the quantitative data. It is also different to the 'exploratory sequential mixed-methods' where qualitative data explores participant's views which then informs the collection of quantitative data, perhaps informing which quantitative tool would be appropriate to use. A convergent methodology was appropriate as the study relied on both qualitative and quantitative data to inform the outcomes but they were not reliant on the results of each other.

6.4.1 Ethical Approval

Ethical approval was obtained from the RGU School of Health Sciences Research Review Group [SHS18/04]. Anonymity of student participants was protected during data processing and analysis by the allocation of a number for each participant and all data was treated as confidential. Any data that was considered could be used to identify either person or place was removed for any publications or presentations (NMC 2018). After ethical approval had been granted an

introductory email (**appendix 16**) was sent to the students substantiated by a participant information sheet (**appendix 17**). The students were given two days between receiving the information by email and the researcher's attendance in class and completion of the consent form (**appendix 18**) and pre-placement questionnaire (**appendix 19**) by those students who wished to participate. When the researcher visited the students in class it was to explain the study face-to-face, to explain the informed consent process and the right to withdraw at any time, to provide reassurances about engagement or non-engagement and to give students the opportunity to ask any questions.

6.4.2 Description of Simulation with Volunteer Patients (the intervention)

The description of the simulation session and activities undertaken by the physiotherapy students has kindly been provided by the lead simulation facilitator (**Figure 6.1**). In addition, the educational materials used for the class are to be found in (**appendix 20**).

Figure 6.1 Simulation Lesson Plan

"Prior to the class students had access to audio lectures on the core assessment techniques and videos which talked them through performing each technique. In first-year, they had undertaken their first practical class, which introduced them to observation, auscultation and palpation. They had also been introduced to the basics of subjective questioning but had not undertaken this practically for a cardiorespiratory patient.

Aim for the session was:

1. To review the basis of cardiorespiratory assessment and its application to the medical respiratory patient

Learning outcomes

Practice basic cardiorespiratory assessment skills (subjective questioning, palpation, auscultation, observation)

Reflect on their own performance and identify areas that require development

During the two-hour practical class students worked in pairs with a volunteer patient.

First hour – Students had the opportunity to practice observation of respiratory pattern, palpation and auscultation. They were to treat the VPs as patients providing appropriate instructions to the patients, appropriate consideration of patient modesty and handling.

During this time, the VPs were not taking on the role of any specific patient but could be themselves. Feedback on how students had communicated etc. was provided. The tutor's role was to provide feedback on skill

performance. Students were also able to provide feedback to their peers using the attached sheets.

Second hour

One student undertook the role of physiotherapist while the other was an observer (using the attached sheets for feedback). VPs were given one of the attached case studies and undertook this role. They were briefed 30 mins before the class:

To take on the role of the patient.

To respond in either a very verbose way or a taciturn way so that students had to work to get the subjective information from the patient.

If they did not understand a question or instruction then to react as a normal patient, either do what they thought or ask what was meant.

Each 'physio' then had to undertake a patient assessment with a VP. Their peer would give them feedback on the attached sheets. The VP would also provide feedback around their communication skills, empathy, caring, and handling. For the second of the pair the students all moved one patient round so that the students worked with a different patient."

6.4.3 Developing the Questionnaires

Questionnaires have many purposes; they were used in this study to measure attitudes (McLafferty 2007) towards the simulation/ simulation best practice statements. The questionnaires were also used to measure intention and behaviour (Conner and Sparks 1995 in Creswell and Creswell 2016) on the transference of clinical skills. The lead researcher developed the questionnaires because they were very specific to this feasibility study and therefore, it was not possible to use previously validated tools. They were designed to be brief and simple to encourage participation. The student questionnaires were purposed to ascertain student perception of the simulation and whether they would, and in their opinion did, transfer the skills to clinical practice. The simulation facilitator questionnaire's aim was to investigate their views on the simulation best-practice statements and to map the simulation that was conducted in this study to the simulation best-practice statements.

The questionnaires were piloted, during the feasibility study, to contribute towards face validity (Gerrish and Lacey 2010). Care was taken to phrase the questions so they did not lead the respondent to answer in a certain way but so that the aims were met. Likert-scales on a five-point scale where utilised for some of the questions as well as free-text responses and simple yes/no choices. A limitation of the questionnaires is that reliability and validity had not been established fully prior to use (Gerrish and Lacey 2010). Face validity was improved after this study because some slight amendments were made to the questionnaires.

6.4.4 Population and Setting

The population of interest was thirty-eight 2nd year BSc (Hons) Physiotherapy students because this group of healthcare students were being taught chest auscultation by simulation as part of their standard curriculum and then they would be proceeding to placement where some of them would have the opportunity to practice the skill on real patients. The setting was a School of Health Sciences in one Scottish HEI.

6.4.5 Sampling

A purposive sampling approach was undertaken (Palys 2008) to target this group of thirty-eight students. It was recognised that not all of them would be attending placements where chest auscultation was likely to be occurring. However, all

students were approached by an introductory email, participant information leaflet and an overview of the research in class when they were also provided with a consent form and the first questionnaire. This was for two reasons. Firstly, because the students did not know where they were going on placement at the time of recruitment to the study, and secondly, because although respiratory, neurological, and community placements may be likely places students would encounter relevant patients - they were not the only areas where students may meet patients requiring chest auscultation.

When the students progressed to placement all the students were emailed to ascertain if they would be prepared to be interviewed (**appendix 21**). They were told that the interview would last approximately ten-minutes and would be conducted at a mutually convenient time. Willing participants indicated by email they would like to be involved and then a time for the interview was scheduled. Informed consent was obtained verbally and all interviews were audio- recorded. An interview schedule was used to guide the interview (**appendix 22**). When all the students returned from placement they were given the post-placement questionnaire (**appendix 23**).

6.4.6 Data Collection

Simulation using volunteer patients was used to rehearse the skill of chest auscultation and facilitate practice in a safe environment. Students completed a questionnaire pre- and post-placement. The simulation facilitator completed a questionnaire post- simulation and mapped what took place with the simulation best-practice statements (Chapter Five). When students progressed to placement at the start of year three they were asked if they would be interviewed about their experiences of conducting chest auscultation in clinical practice. **Table 6.2** illustrates the study timetable.

Table 6.2 Feasibility study timetable.

11th April 2018	All participants receive learning material on chest auscultation.
12th and 30th April 2018	Simulation with volunteer patients on chest auscultation.
30th April 2018	Collect simulation facilitators' and student questionnaires.
29th October – 14 December 2018	All participants proceed to placement.
November - December 2018	Interviews with students.
29th January 2019	Physiotherapy students return to University
5th February 2019	Post-placement questionnaires collected from students

6.5 Data Analysis

Descriptive statistics were calculated to evaluate data from the questionnaires. The quantitative results were mostly displayed as percentages. For the student interviews the data was thematically analysed using the steps recommended by Braun and Clark (2014): familiarisation with the data, (achieved by re-listening to the recorded interviews, before transcribing) then generating initial codes (conducted using NVivo11), searching for themes, reviewing themes, defining and naming themes (a manual process using pen and paper) and producing the report. Since qualitative research should be judged by its trustworthiness (Lincoln and Guba 1985), credibility, transferability, dependability and confirmability are considered in the discussion section of this chapter (Gerrish and Lacey 2010). To enhance rigour, the principal supervisor reviewed both the coding and naming of the themes. There was good agreement between the researcher and supervisor, which enhanced the reliability of the methods and data analysis (Guest et al. 2012).

6.6 Results

The results from the pre- and post-placement questionnaires and the simulation facilitator questionnaires are reported in the form of tables and narrative summaries. The data from the student interviews are presented as themes with illustrative extracts from the interviews.

6.6.1 Questionnaires

Response rates: No demographic data was collected because this was not deemed necessary to evaluate the parameters of this feasibility study. Seventeen out of a possible thirty-eight students completed the pre-placement questionnaires, therefore the response rate was 45%. One pre-placement questionnaire was removed from the study because a corresponding consent form could not be located. This left sixteen in the study, which are reported below. Eleven questionnaires were collected during the class, and six were handed-in at the end of the class. Students reported the questionnaire took on average five minutes to complete.

Thirty-one out of a possible of thirty-eight students completed the post-placement questionnaires; therefore, the response rate was 82%. Three questionnaires were removed from the study, as the corresponding consent form could not be located. Therefore, the results are presented for 28 students. On this occasion the researcher waited in class and collected all the questionnaires that were completed. On average, completion of the post-placement questionnaire took three-minutes, which may mean the students did not give the questionnaire much consideration although they were intended to be completed quickly.

The simulation facilitator questionnaire was completed by one academic who designed and led the volunteer patient chest auscultation simulation; completion time was approximately one hour.

i) **Pre-placement questionnaire results**

The quantitative data and the free-text comments from the pre-placement questionnaire are displayed in **table 6.3** below. All the physiotherapy students found the simulation session with volunteer patients either helpful or very helpful.

An area they felt could be improved was the opportunity to hear different breath sounds; because the volunteer patients do not necessarily have chest conditions this could not be practiced in this session. Not having specific knowledge or experience of a respiratory illness may have affected the feedback the volunteer patient gave to the student. The students highlighted that the best aspect about having the volunteer patients involved in the simulation was that it afforded them the opportunity to put everything they had learned together: communication, consent and instructions to the patient, together with the practicalities of dealing with clothing and positioning the patient. All the students felt that the session was useful and would be applicable to practice. There was high confidence and low anxiety levels reported by the students.

Table 6.3 Pre-placement student questionnaire (n=16).

Question 1: How helpful was the simulation session on chest auscultation?

Response	5 very helpful	4	3	2	1 not very helpful
Number of Respondents	9	7	0	0	0
	56%	44%			

Question 2: What was the least helpful aspect about learning this skill by simulation?

Comments	Number of similar responses	Percentage
Unable to hear abnormal chest sounds	8	50%
No direct feedback from lecturers	1	6%
Inconsistency in feedback on positioning stethoscope from lecturers	1	6%
Volunteer patient not giving correct medical feedback or following the case study	3	19%
Not real life	1	6%
Pressure of volunteer patients on first day of module without warning	1	6%
Blank	1	6%

Question 3: What did you learn from the simulated practice opportunity?

Comments	Number of similar responses	Percentage
What knowledge from previous modules to practice / revise	2	12%
How to be professional with 'real' patients	1	6%
Hearing different breath sounds	1	6%
Practicalities – clothing, consent, communicating explanations so assessment holistic	12	75%

Question 4: Do you think this learning will be transferrable to practice?

Response	5 very likely	4	3	2	1 extremely unlikely
Number of Respondents	12	4	0	0	0
Percentage	75%	25%			

Question 4 comments:

Comments	Number of similar Responses	
Practical aspects of chest auscultation (rather than knowledge)	3	18%
Has transferred already to practice	1	6%
Depends on type of placement	11	69%
Blank	1	6%

Question 5: How confident do you feel about performing chest auscultation on real patients in clinical practice?

Likert scale	5 very confident	4 confident	3 unsure	2 slightly confident	1 not very confident
Number of Respondents	0	12	3	1	0
Percentages	0	75%	19%	6%	0

Question 6: How anxious do you feel about performing chest auscultation on real patients in clinical practice?

Likert scale	5 Extremely anxious	4 anxious	3 unsure	2 slightly	1 not at all anxious
Number of Respondents			2	13	1
Percentages			13%	81%	6%

Question 6 comments

Comments	Number of similar responses	Percentage
Anxious personality	1	6%
Anxious about identifying breath sounds	4	25%
Worried about other equipment interfering e.g. central lines	1	6%
Worried about less able ill patients	1	6%
Blank	9	56%

Time taken to complete questionnaire Mean average time taken to complete questionnaire = 5.1 minutes (n=15)

Approximate individual times	Number of responses
10 minutes	2
5 minutes	6
Less than 5 minutes	6
Did not answer	2

ii) **Post-placement questionnaire results**

Table 6.4 Post-placement student questionnaires (n=28) [only ten students used auscultation in clinical practice on this placement].

Question 1: What do you think, now you have attended placement, was the most helpful aspect about learning this skill by simulation?

Grouped Comments	Number of comments	
Helped with confidence	3	11%
Chance to practice/ get experience/ application /placing of stethoscope	7	25%
Opportunity to hear breath sounds	7	25%
Realism	5	18%
Areas to auscultate	4	14%
Practice communication	3	11%

Grouped Comments	Number of respondents
Not real sounds	10
Not like a real patient (mobility, uncooperative etc.)	5
Volunteer patients feedback not like a real patient	3
Educators weren't specific with markings	1
Communication / interaction not same as with a real patient	2

Question 3: Do you think the simulation you had prior to placement could be improved in any way?

	Yes	No
Number of respondents	8 (29%)	20 (71%)

Question 3: Comments - Please provide any details of any improvements

Comments
Six students provided comments in relation to question three. One student stated that the session was very detailed with all the key aspects taught. The other five students made the following suggestions: listening to the sounds first instead of working in groups and assuming what they are; more practice

on listening to exact breath sounds; More in-depth subjective assessment prior to auscultations; More time spent auscultating

Question 4: Where was your placement?

Stroke rehabilitation
Paediatrics
Community hospital
Women's health
Spinal unit

N.B. Other five comments were actual names of wards/departments/hospitals and so were therefore removed to protect confidentiality of place.

If you performed a chest auscultation.

Did you apply in practice what you learned in simulation?

Yes	No
10 (100%)	0

Question 4: Comments - Please provide any details of application:

Comments	
Correct communication/placement/ able to understand variation of sounds	1
I used the knowledge I gained to auscultate patients on placement. As I used it to clearly identify lung markings	1

Practices to monitor chest to clear any lung problems	1
Part of chest backed up by qualified professional	1
Technique is OK just clarifying pathology and sounds	1
In high dependency ward checking chest was abnormal sounds needed for suctions	1
2x application during placement to post-op patients	1
Not applicable or no comments	21

Question 5: Did you have any issues performing chest auscultation on placement?

	Yes	No
Number of respondents	2 (20%)	8 (80%)

Question 5: Comments - Please provide any information, which would have helped with any issues you had?

Comments	
Difficulty distinguishing breath sounds	1
Identifying correct sounds and relating to pathophysiology and practice	1

Time taken to complete questionnaire

Time taken to complete questionnaire around three minutes (n=29)

Approximate individual times

5 minutes	5		2-2.5 minutes	14
3 – 5 minutes	1		Less than 2 minutes	2
3 minutes	5		Did not answer	1

iii) **Simulation facilitator questionnaire**

The lead simulation facilitator for the volunteer patient chest auscultation simulation was sent an introductory email (**appendix 24**); participant information sheet (**appendix 25**); consent form (**appendix 26**) and subsequently, they were sent and they completed the questionnaire (**appendix 27**) as well as mapping the volunteer patient simulation with physiotherapy students to the simulation best-practice statements produced by the e-Delphi study outlined in Chapter Five. The lead simulation facilitator has a senior role within the School of Health Sciences and is an experienced simulation educator and researcher. The lead simulation facilitator for this study considered that the best-practice statements were very useful, that they could be used to identify areas for improvement in simulation activity as an audit tool and to guide staff development. Debrief was an area that staff may require additional support albeit it was thought that not all sessions needed an end debrief. On a school level, the statements were considered as being useful but there was a caveat that not all simulation sessions would need to be mapped against all the statements. It was suggested grouping them to individual simulation type of activities would be a worthwhile exercise. Potential barriers were staff 'buy-in', therefore senior team discussion and institutional wide leadership were considered essential to endorse their use. The simulation facilitator suggested that enablers to encourage using the statements would be to group the statements for certain simulation activities and making a tick checklist for quicker use. This suggestion resulted in the researcher developing a checklist version (**appendix 28**) that could be completed more quickly by staff.

iv) **Mapping of simulation best-practice statements to volunteer patient chest auscultation simulation**

The mapping exercise completed by the lead simulation facilitator mapped the best-practice statements produced in the e-Delphi study (Chapter Five) against the simulation that took place in April 2018 and they made comments. The complete results can be viewed in **appendix 29**.

A summary of the mapping feedback, completed by the simulation facilitator, shows that the best practice statements were considered useful for auditing simulation and providing the impetus for change. The simulation provided met many of the best-practice statements. Areas for improvement were staff training and evaluation. This includes staff development for the role of debriefer. Leadership, including the stronger implementation of a simulation strategy, are needing growth and as factors that would enhance simulation and its evaluation. Interestingly, these findings match the e-Delphi and interview results outlined in Chapter Five.

It is acknowledged that both types of checklist, the comments version or the met/not met/not applicable version, would require piloting with more staff as the view of only one individual was collected in this feasibility study. Early indications of its value are positive however, and mirror the expert panel staff responses in Chapter Five that endorse the best-practice statements as a useful tool to guide simulation.

6.6.2 Results Student Interviews

Of the total cohort of 38 students, four were scheduled to attend respiratory placements and five neurological placements, where it would be reasonable to expect chest auscultations might take place. This explains the lower response rate because 29 students attended placements where they were less likely to perform chest auscultation. However, in the questionnaire data ten students indicated that they had performed a chest auscultation whilst on practice. Just four students volunteered to be interviewed; of these only two had performed chest auscultation in practice and the remaining two had not. Of the two who had completed a chest

auscultation one of them was on a neurological placement and the other was in an acute area.

6.6.3 Themes from Interviews

Three key themes emerged during data analysis: (i) the importance of pre-learning/ scaffolding before simulation, (ii) that the volunteer patient simulation activity is beneficial or even essential as a further stepping stone to clinical practice and preparation, and (iii) simulation is not a replacement for clinical but an essential preparation. **Table 6.5** illustrates how the codes were grouped into themes, coupled with some exemplars of student comments from the transcripts.

Table 6.5 Codes and related themes from the student interviews with comments.

Code	Exemplars of comments from student transcript	Theme
Being observed by academics in the simulation session helped prepare for clinical placement	*(being observed) …that definitely affected how I performed on placement, particularly with people…if you're getting watched by your educator or a couple of educators, having that environment in uni with the six bedded ward and with your lecturer looking over you and watching while you're doing it, or getting recorded. I think that kind of leads you up for that pressure as well doing it while someone is watching you and being confident in what you're doing.*	The importance of pre-learning/ Scaffolding before simulation
Being videoed and receiving feedback from academics helped	*…and we watched it back and we got feedback from it so we did quite a lot of voluntary and patient sessions for the acute care module which is quite good*	
Pre- learning occurred	*yeah, we had the previous year's slides that we looked over and had pictures of where we should be aiming for anatomically in relation to the different bone structures and landmarks and we had done it in previous years as well on classmates and stuff, so we'd had some previous experience and practice of that.*	

Information was retained	*…but yeah overall it was a good clear session and the actual practical of where to place all the different points for the stethoscope and everything like that were fine and that information has been retained so that's not a problem there.*	
Students felt prepared and had skills to revise material when needed	*I would feel prepared enough to carry out the chest auscultation and know that I had all the…I would obviously just recap quickly before I did it. So, in my preparation for placement I would go over the different auscultation points and maybe some kind of different breath sounds but I would feel confident enough to be able to complete and assessment …*	
Peer practice not enough	*…and then we then got to practice on each other which is always much easier obviously because we're all healthy and well and we all move really easily for each other. We're all very accommodating, but it's obviously that's what you want to start off with when you're learning is you have that ability to kind of find your landmarks on someone that is not difficult to move, or…more challenging in that way.*	that the volunteer patient simulation activity is beneficial even essential as a further stepping stone to clinical practice and preparation
Using volunteer patients is beneficial	*It was useful because they were a bit more like real patient because when we practice on each other we know what to do….and with a volunteer you have to*	

	be clear with instructions and tell them what you're going to do...	
More training for volunteer patients: i.e. restricted movement	*obviously, the volunteers aren't going to all have something wrong with them, but I think even if some of them were like oh sorry I can't move that way, or…*	
Communication better with volunteer patients	*understanding, so I think that was quite valuable in terms of your explanation and getting that down, because once you explain it in a way that most people understand you… kinda...*	
Simulation beneficial	*don't think so. I think everything that can be replicated was done. There's obviously a limitation in uni that can't really be avoided but I think everything that we did was helpful and was useful. Yeah. I wouldn't say there was anything that really could be improved to be honest.*	
What happened in simulation	*But yeah no it was good, and you were sort of consolidating that and then we then got to go on with some volunteer patients and practice as well and yeah that was a bit more challenging. You had to think about your language, how you explained it….*	
Educator confirmed learning and practice	*…looking at that everything he witnessed consistently, and I checked everything off, the only thing that w mentioned was when assessing [] too*	Simulation not a replacement for clinical but an

	central, although I was still over the lungs, he said that I could move slightly more lateral –	essential preparation
Transfer of learning occurred	*I was able to auscultate all the points and there was no issues or things flagged up with that chest assessment.*	
Breath sounds are difficult, and practice is required	*…the clinical would be something that I still struggle with slight I think just because the breath sounds and everything until you hear them on a real patient I think it would be difficult to distinguish between them so obviously you would look to your clinical educator for guidance there.*	
Peers and volunteer patients breathe normally	*Obviously, the whole class had normal breath sounds so that wasn't really of much relevance*	
Real patients with chest conditions required in simulation	*But when we're in uni we don't get to hear that really.*	
Not confident with breath sounds but OK with process	*slightly I think just because the breath sounds and everything until you hear them on a real patient I think it would be difficult to distinguish between them so obviously you would look to your clinical educator for guidance there. But as far as actually doing a chest auscultation I would feel confident".*	

Need more practice with breath sounds	*we need to kind of get more practice and emphasis of understanding what each sound is like and then putting that forward to clinical* practice
Opportunities to practice on placement are limited	*Depending on where we go on placement.*
Simulation not to replace clinical placement.	*But then since being on placement, patients don't always present like that obviously, some of them are not conscious or are unable to move their limbs, they're all different shapes and sizes. So that kind of came [pause] a few barriers which are not necessarily being able to be replicated in class in a simulation.*
Differences in practice with patients cannot be truly replicated	*…it will be a more challenging assessment because they will be awake obviously but also their physical limitations aren't static necessarily so it will be trying to deal with…dystonia, and actually trying to work out handling with that at the same time as obviously trying to do the auscultation*

6.6.4 Narrative summary of themes

Each of the three themes will now be presented in turn.

i) Theme 1: Scaffolding

It was highlighted that before the simulation with volunteer patients and then eventual transfer to practice could take place certain learning had to be achieved. Pre-learning took the form of self-study, PowerPoint Presentations, pictures, hearing recordings of breath sounds, practicing on peers and then on volunteer patients.

> *"So, we covered it first of all sort of in class, sort of the theory side of it, we had to go and do some self-reading"* [**participant 3**]

This learning specific to chest auscultation commenced in year two of the degree programme.

> *"Okay so second year we kind of briefly went over it in a session kind of what we should know, where we should be placing our auscultation points and understanding - placing our stethoscope and then kind of getting a real in-depth …understanding different ways of auscultation, a patient and looking to kind of do it."* [**participant 4**]

This pre-learning coupled with observation by academics, being videoed and receiving feedback enabled students to feel prepared and confident to carry out a chest auscultation in clinical practice on a real patient. The one caveat is that breath sounds still require more practice and repetition on patients who have respiratory disorders.

> *"I still struggle with slightly I think just because the breath sounds and everything until you hear them on a real patient I think it would be difficult to distinguish between them so obviously you would look to your clinical educator for guidance there. But as far as actually doing a chest auscultation I would feel confident' [***participant 1**]

Having the underpinning theory and study materials available meant that students felt reassured that they could revisit and revise key principles before undertaking a chest auscultation on a real patient in practice and revise material so they could refresh their knowledge before placement.

> *"I'll go back through my notes just to remind myself of the key sort of landmarks and key places I'm going to go to just because I haven't done since being sort of…doing it within the course. I'm aware of it in the back of my head, I think I know what I need to do but I would definitely be revisiting my notes on it prior to going out"* [**participant 3**]

ii) Theme 2: Simulation on volunteer patients beneficial

Simulated patients offered the students the chance to practice the skill of chest auscultation more holistically. During the simulation session with volunteer patients the students reported that they were able to put all their knowledge and skills together to practice on the volunteer patient. This included correct placement of the stethoscope, communication with the patient, factors such as obtaining consent and maintaining dignity.

> *"Yes we did practice on volunteer patients so that was more beneficial because although the volunteer patients obviously they are meant to be healthy enough to be able to go through a full assessment and mobilise etcetera, some of them did actually have breath sounds just of previous conditions that were like underlying but didn't need treated by us obviously because it was a volunteer patient session but some of them did have breath sounds but again that depended on which volunteer patient you got and what you were listening for and everything."* [**participant 1**]

Practicing on volunteer patients was preferred to practice on peers because it enabled the students to focus more as if it were a real patient. They could practice relaying the correct procedure to the patient and gaining informed consent and the practicalities of maintaining dignity whilst undertaking the procedure.

"…because once you explain it in a way that most people understand you kind of go with that every single time. The assessment runs a bit more smoothly and I think also in terms of things like maintaining dignity with clothing, particularly for women, manoeuvring around bras and tops and whatever, I think that was quite valuable as well because again if you're doing it on classmates you're maybe not as focused on that because you're doing it on each other..." [**participant 2**]

The students reported that the volunteer patients were not as 'real' as some actual patients would be, there was a recognition that the volunteers didn't have anything wrong with them and so students did not get to hear different chest sounds but also that they did not get to practice on a patient who had mobility difficulties or comprehension issues.

*"I think like we did the best we could with what was there and being able to kind of…obviously the volunteers aren't going to all have something wrong with them but I think even if some of them were like oh sorry I can't move that way, or…I know it was like right at the start of our acute care module, but we should still be able to kind of reposition a patient I would say. So even them being like oh I can't move that way, or…just…thinking a bit more kind of outside the box maybe because everyone was just like yeah okay I'm fine, I'll take my top off, and that's fine. "[***participant 4***]

In addition, those paediatric patients were not represented in the volunteer group and that they as a patient group presented additional problems to manage

"...but also, their physical limitations aren't static necessarily so it will be trying to deal with…dystonia, and actually trying to work out handling with that at the same time as obviously trying to do the auscultation." [**participant 3**]

Overall, students were very clear that without the simulation on volunteer patients they would not feel as prepared or confident to practice chest auscultation in practice.

> "...*Probably a nervous wreck doing it on placement. Even kind of…because we had to do that for our clinical assessments as well. If I hadn't of had that practice…. you get that nerves out and you're like okay I know what I need to do, and I know where I need to place this. So, it just makes it a lot easier, but I don't think it would have gone very well if we hadn't done that simulation."* [**participant 4**]

The students recognised the value of simulation with volunteer patients but also, because of the limitations, it is seen as a stepping-stone to completing the same skill on a real patient.

iii) Theme 3: Simulation not a replacement for clinical but an essential preparation

On placement a new set of difficulties emerge. Due to patients' existing conditions, lack of mobility, body shape (high Body Mass Index (BMI)) the skill becomes more demanding to perform. It is worth making clear that this was no different to the clinical educator's experience, and that they had the same challenges with handling the patient. This was especially true for a paediatric placement

> *'so, it will be trying to deal with…dystonia, and actually trying to work out handling with that at the same time as obviously trying to do the auscultation."* [**participant 3**]

It is recognised that breath sounds require practice before competence will develop.

> "*Very similar but slightly different and I think if I'd come across that I think I would have needed a bit of assistance in distinguishing, but I think that comes with practice and once I start…once I have a respiratory placement and I'm doing it on a day to day basis I think that will definitely come."*
> [**participant 2**]

"As far as listening to the breath sounds they did have a machine set up to listen to the different breath sounds. But I think until you're out in practice doing it, it will be hard to recognise them because I couldn't remember right now back to then exactly which breath sounds correlate to which condition." [**participant 1**]

It is also difficult to plan for patient contact and opportunities to practice may just arise unexpectedly:

"I've not had a respiratory placement. [Just by chance] this patient had suddenly got a bit unwell, so they said do you want to go and have a listen to his chest? I said yeah that would be really good. So, I just managed to have [a practice]." [**participant 4**]

Evidence from the interview participants' transcripts substantiated this:

"no, I haven't used…so really I haven't used chest auscultations at all yet on any placements, but I haven't had a specific respiratory placement. So…that could be why. Yeah, I believe it's still one of the…you're required to do a respiratory placement either in third or fourth years. So, I will probably have a respiratory placement to complete in fourth year. Most likely in an acute hospital so that's where my chest auscultations will be required, mostly likely on a daily basis I imagine" [**participant 1**]

Therefore, simulation is not seen as a substitute for clinical practice but an essential preparation. The usefulness of the volunteer simulation was recognised

"I would say that the volunteer patients were definitely key because doing stuff on each other which generally most of the class are quite slim, quite kind of healthy, able bodied people, and the volunteer patients although they're still able bodied and that, obviously able to come into the uni(versity)

they're not kind of…They're all different shapes and sizes so that helped." [**participant 1**]

but also, with the acknowledgement that realistically there is only so much that can be achieved by simulation.

"…I think everything that can be replicated was done". [**participant 2**]

Indeed, patients are far more complex to manage in real-life

"Yeah so, I saw someone in the High Dependency Unit, and when I first saw them they were…they had a very low Glasgow Coma Scale score. They were…only responding to open their eyes to repetitive verbal and touch stimulus and it was very variable throughout the day. So, I think was more alert in the morning, like first thing, when they were getting washed and dressed than later on. So was very much less responsive, particularly when we saw the patient after they'd been washed and dressed and things like that. So, in terms of that they weren't able to specifically move limbs at that time to get around to the posterior aspect of their lungs so we could get the auscultation. So that was quite challenging in that aspect because with the simulation the volunteer that we practiced on was alert. They were able to move their arms across their chest to allow you to get into get easier handling. And then the patient on placement was larger, had quite a high BMI, so in terms of me being able to manoeuvre around and get into those slightly more difficult auscultation points that was quite challenging." [**participant 2**]

Furthermore, there is a lot of repetition required to become proficient in hearing and diagnosing breath sounds:

"… get more practice and emphasis of understanding what each sound is like and then putting that forward to clinical practice, and I know it's really difficult for like uni to go we

can get somebody with this, and this, but…like that's a fine skill that we need to then really brush up on when we go on placement basically." [**participant 4**]

By integrating the data from the questionnaires and the interviews, a vivid picture forms of the benefits of the chest auscultation simulation with volunteer patients. The students valued the opportunity to put all their skills together to practice the skill in a holistic manner, incorporating communication skills and practical aspects of the skill. This made them feel better prepared, more confident and less anxious about placement. Once on placement, although the sample is small, the evidence supports that all the preparation, the pre-learning and simulation, had enabled students to perceive that they would be able to transfer the learning from simulation to clinical practice or indeed that they had. Simulation is seen as a valid and essential preparation for practice but not a replacement.

6.7 Discussion

The discussion will be presented under the headings of questionnaires, interviews and researcher reflections. As the purpose of this feasibility study was to inform a main study key messages that could inform this will be highlighted throughout.

The objectives of the feasibility study were fully met, and a summary of the findings is presented below.

i. Establish availability of, and time taken, to complete relevant placements.

The feasibility study informed the researcher how long would be required for all the students to have attended a cardio-respiratory placement. For this cohort of students this would be two years.

ii. Discover if students do perceive transfer of learning has occurred.

Students considered that they would be able to transfer learning and those that had performed a chest auscultation in clinical practice deemed that they had transferred the skills they developed during simulation. This is encouraging and would support a study examining the transfer of learning to support the student perceptions.

iii. Determine if simulation activities, interview questions and questionnaires are fit for purpose.

The simulation activity was fit for purpose, nevertheless a few improvements could be made. For future simulation the addition of debrief would enhance the opportunities for learning (Ryoo and Ha 2015). The absence of debrief could be viewed as a deficit in this study. The interview questions worked well and students responded openly. A few amendments to the questionnaire were highlighted (questions 4) that would be important to change before a further study. The simulation best-practice statements were deemed fit for purpose and useful.

iv. Establish recruitment and retention rates to a study of transfer of learning from simulation to practice and how to protect students as respondents.

Recruitment to the questionnaire part of the study was satisfactory but could be improved, perhaps by using an online questionnaire. Volunteers for the interviews were less forthcoming, perhaps the students would have been more comfortable talking to someone they knew, potential reasons will be suggested below.

6.7.1 Questionnaires

Some of the questions in the student questionnaire require attention to avoid misinterpretation in the future. In the pre-placement questionnaire, question four requires re-wording. Participants took the question to mean would the placement offer them the opportunity to practice chest auscultation, which of course, many of the placements do not. Instead of

Q.4 Do you think this learning will be transferrable to practice? To which 11 respondents said, "*it depends on the placement*"

Question 4 will now read:

Q.4. If you get the opportunity to practice chest auscultation in clinical areas do you think this learning will transfer to your practice?

In the post-placement questionnaire further clarity needs offering to the students around question four, which asked where they went on placement, responses included place names and hospitals rather than type of placement. Not naming

specific wards or departments is essential to protect confidentiality of the clinical areas.

Instead of question four reading:

Q4. Where was your placement?

Question four will now read:

Q4. What type of placement have you just attended? Please circle the appropriate choice or if 'other' please state the type of placement.

Neurological Respiratory Paediatric or Other…….

The next part of the question should read 1) did you perform chest auscultation on placement and 2) did you apply in practice what you learned in simulation

Key message

Amend questionnaire so students understand questions. Bartram (2019) advocates the importance of piloting a questionnaire and this has proved a very useful pursuit in this study. The questionnaires seem to be of the right length to elicit required information without encumbering the student unduly. Online questionnaires sent to the student's email address may provide a higher response rate, although staying to collect them in class did yield a greater return; however, this may have been coercive researcher behaviour. In addition, students often have online surveys to complete for the university so an on-line questionnaire may be lost or forgotten about. However, for future studies using both methods might prove useful to promote accessibility and choice (Patten (2016) provides a worthwhile guide).

6.7.2 Simulation Facilitator Responses

The simulation facilitator considered that the simulation best-practice statements were useful to highlight areas for improvement and could be used to conduct audits on simulation, which would guide staff development. Debriefing was considered one area that could be focussed on because there was a perceived lack of staff training in this area. A debrief was not included in the initial simulation. Stronger simulation leadership was viewed to achieving this. It was raised that not all simulation statements are relevant to every simulation activity but that in

general they provide a useful framework that could easily be adopted; perhaps in the form of a checklist. Staff resistance was a potential barrier to implementation; conceivably, this might be overcome with sensitive change management (Dasborough et al. 2015) and strong leadership (McCaffery 2018).

Key message

The intervention of volunteer patient simulation was of a high standard and met many of the simulation best-practice statements. This should be replicated in the main study. Improvements could be made about the provision of debrief at the end of the simulation. It should be remembered that this was the view of only one simulation facilitator and can therefore, only be accepted with caution. Multi-site studies would gain access to a wider sample of simulation facilitators.

6.7.3 Interview Themes

Clear themes emerged from the student interviews: the necessity of pre-learning in preparation for simulation activities and clinical practice; the value of practicing on volunteer patients and lastly, the added challenges with real patients meaning that simulation should not replace clinical practice even though the opportunities to practice with real patients are variable.

i) **Theme 1: Pre-learning/scaffolding is essential to support simulation**

When conducting any future study, it will be important to keep the pre-learning and preparation for the simulated practice and then clinical placement as comprehensive as it was for this feasibility study. The use of scaffolding learning is supported by Kelly et al. (2016) and includes pre-learning material, simulation activities that are videoed followed by feedback and debrief. This approach is substantiated by Cant and Cooper's review of simulation literature. They found that a '*3-step simulation process*' (2010 p.12) was required for simulation to be effective: pre-briefing, simulation, de-briefing (Kneebone 2005). In a recent systematic review of healthcare literature by Tyerman et al. (2019), it was concluded that both pre-simulation preparation and pre-briefing activities have an effect at Kirkpatrick training evaluation levels one and two: learner satisfaction; knowledge and skill performance. Evidence showed that '*tailoring*' (p.23) these activities to the level of the learner and relating them to clinical and simulation experiences was beneficial; student anxiety was reduced, and students were

supported in their ability to meet learning outcomes (Gantt 2013; Nielson and Harder 2013; Elfrink et al. 2010). In this feasibility study the students wanted more opportunities to practice determining different breath sounds.

Key message

The structuring of the pre-learning and simulation worked well for the students and should be replicated in future studies and educational practice. Students would appreciate repetition with practicing breath sounds, a suggestion might be to make these recordings available on the virtual learning environment and/or ad-hoc access to the breath-sounds machine. The introduction of formal debrief could make the most of the learning opportunity.

ii) **Theme 2: Simulation on volunteer patients is beneficial**

Simulated patients offered the students the chance to practice in a more holistic way. Students put together what they learned about patient positioning and correct placement of the stethoscope along with communicating to the patient what they intended to do, obtaining consent and maintaining dignity. Whilst practicing on each other the partner playing the patient can move easily and can pre-empt instructions, so this makes it easier to perform the chest auscultation but less realistic. Pritchard et al. (2016) endorses the use of simulated (volunteer) patients; their systematic review and meta-analysis demonstrated that the effect of using simulated patients was *"comparable to that of alternative educational strategies on development of physical therapy clinical practice competencies and serve a valuable role in entry-level physical therapy education"* (p.1342). There is a cautionary note however, that confidence cannot be claimed for these findings due to lack of rigour in the studies. Reviews of nursing and medical literature suggest that the use of simulated patients improves knowledge acquisition (Norman 2012); psychomotor skills (Norman 2012; May et al. 2009) and communication skills (May et al. 2009). Oh et al. (2015) conducted a meta-analysis on the effectiveness of simulated patients and found a positive impact on self-efficacy, learning motivation, knowledge and skill acquisition. This body of literature supports the opinions of the students in this feasibility study. Therefore, it would be critical to retain this element of student preparation before they proceed to placement and perform chest auscultation on a real patient.

Being observed by academics and being videoed mimics the pressure the student will encounter in placement when the clinical educator is assessing them. By achieving in the simulated environment, the student becomes more confident and prepared to perform the skill in placement (Grant et al. 2010).

Key message

The sessions with volunteer patients should run as before. This is viewed as a critical step to aid transition of learning from university to clinical placements and real patients. More input on hearing breath sounds could be incorporated to enhance the session by providing 'breath sounds' on the virtual learning environment or giving students unsupervised access to the 'breath sounds machine' in addition to scheduled class time.

iii) **Theme 3: Simulation not a substitute for clinical practice with real patients**

It is recognised that to evaluate an isolated skill such as chest auscultation a substantial length of time is required. For all students to have had the opportunity to perform naturally occurring chest auscultation on real patients they have to be exposed to the appropriate placements where they are more likely but not exclusively exposed to patients requiring chest auscultation. These are usually respiratory or neurological and sometimes community placements. Physiotherapy students on a four-year degree programme would be afforded this opportunity in a placement in either year three or four because this is when they have been allocated these types of placement by the placement officer.

Any study looking at this skill would need to cover a three-year period. The students would receive taught content and simulation in year two and then a relevant placement in year three or four. This has implications for results because students will have different lengths of time between receiving simulation and practicing the skill on placement. Jiang et al. (2011) acknowledged this; their simulation study lasted over two years and the average time between the retest and the clinical thoracentesis was six months but the range was 3-16 months. This long duration could have influenced the results because some students would have practiced the skill closer to the simulation than others would and skill decay may have occurred (Oermann et al. 2011).

Key message

For data collection alone, a two-year period will be required. Additional time would be required to fulfil the pre-learning and simulation experience with volunteer patients and obtain governance permissions.

Despite the time-scales needed to furnish students with the opportunity to practice chest auscultation, simulation is viewed as a preparation for practice not a replacement. As Jiang et al. (2011) clarifies in their study using a thoracentesis simulator there were elements that it did could not provide; for instance, how to communicate with the patient and how to observe patient reaction. The purpose of simulation is for the student to become familiar with procedure before proceeding to clinical practice. "*Thus, simulation-based training cannot be used as a substitute for clinical practice"* (Jiang et al. 2011, p.6). The simulated patients are extremely useful because they offer the opportunity to practice on different body shapes but do not, and cannot ever; replicate engaging with a real patient and the complexities that arise. On placement a new set of difficulties, emerge. Due to patient's existing conditions, lack of mobility, and body shape (e.g. High Body Mass Index (BMI)) the skill becomes more difficult to perform. These challenges the student experiences are no different to the clinical educator's experience and some simply cannot be overcome. Crucially, it is recognised that breath sounds require practice before competence will ensue. Students were very clear that without the simulation on volunteer patients they would not feel as prepared or confident to practice chest auscultation.

It can be concluded that simulation is not a replacement for clinical practice but essential to adequately prepare students to perform the skill on a real patient. Thus, ensuring less time is needed with the patient who is unwell, and perhaps in pain.

Key message

The chest auscultation simulation involving volunteers (simulated patients) is an extremely useful and necessary part of learning but it does not replicate exactly the challenges faced in practice when dealing with actual patients. Transfer of learning was perceived by the students and this is encouraging for a larger scale

study that tests the outcome of transfer at Kirkpatrick's level three (Kirkpatrick 2006). For transfer to be evaluated an assessment tool will need to be developed and validated. A draft version of a global evaluation tool is provided in **appendix 30**. In addition, access to clinical areas will need ethical approval from NHS governance bodies.

6.7.4 Researcher reflections

Part of conducting a feasibility study is the opportunity for the researcher(s) to reflect on the study results and how this may influence the main study (Gerrish and Lacey 2010). The ethical dilemma of students as participants was of interest as was research governance.

i) Ethical and practical dilemma of involving students and patients in research

The main ethical consideration in this study is that students were the participants. As Butler (2003) recognises, there is often an unequal power balance between participant and researcher; evident when the participant is a patient, or in this case a student, and the researcher is responsible for their care, or in this case education, as the lecturer is also the researcher. To address this, students were reassured that non-engagement or engagement in the study would not affect their studies in any way. Moreover, it could be argued, as Daly (2015) purports, that the power is in fact equal. This is because in educational research, the student has been given a voice and there will be improvements made to their educational experience with this collaborative approach.

Key message

Conceivably, stressing the co-development of education might increase student participation in the main study. For instance, if changes were made to pre-learning, such as more exposure to breath sounds, this would be concrete evidence of change after student feedback and may encourage greater participation for future study. When students are research participants, using a framework for ethical practice would strengthen future studies (Bradbury-Jones et al. 2010) (see **appendix 31** for the framework and suggestions of ways to address the framework questions).

ii) Research Governance

All research or service evaluation that takes place in clinical environments and involves staff or patients requires permission from health board governance groups. These governance groups provide full ethical review for research as well as advice on projects deemed to be *'clinical audit, service development/ evaluation, surveillance and usual practice'*. (NHS Research Scotland 2019).

In this feasibility study in one sense patients are involved as they are the subjects on which the students need to perform chest auscultation, but in another they are not as their involvement is specifically limited to their patient role. Being a patient and giving permission for students to perform interventions on you is recognised as part of normal healthcare practice. Patients do have to be made aware of the status of the healthcare professional providing care so, in normal clinical practice it is necessary that students make clear their role and seek verbal informed consent from the patient before they continue with providing any element of care. Professional bodies such as the NMC and HCPC stipulate these requirements; as do local NHS and Higher Education Institution 'partners in practice' agreements (NMC 2018; HCPC 2016). In this feasibility study, neither the patient's views, feedback nor personal details were required. However, potentially there may be a requirement to provide a patient information leaflet and consent form to ensure transparency and supplement the integrity of further study. Especially if an evaluation tool is implemented and used by the practice educators to assess their students' transfer of knowledge whilst on placement. The challenges of involving patients are also evident in medical educational research. Jiang et al. (2011) found it difficult to obtain permission from patients and their relatives for a thoracentesis to be performed by a resident or medical student in their study even though all thoracenteses were supervised by a clinical physician.

Permissions would also be required from individual health boards. In this feasibility study's time-frame only nine students were attending placements likely to be afforded the opportunity to perform chest auscultation. However, when these were investigated these placements covered three different NHS boards and four different hospital sites and therefore three separate health board governance group permissions would be required. In addition, four separate gatekeepers (clinical educators/managers) would need to provide access to patients. Post-

placement it was identified that ten students had performed chest auscultation; therefore, these ten placement areas would have needed to be approached for consent. Because there was no accurate prediction of where students may encounter a patient who required chest auscultation all placement areas would need to be approached to maximise prospective participants.

Key message

The difficulties with obtaining access to relevant placements, patients and approvals from governance groups to conduct studies is well established. For a future study that involves students being assessed in practice performing chest auscultation adequate time would need to be allocated to determine governance conditions.

6.7.5 Methodological Discussion

Qualitative research can be evaluated by four key aspects: credibility, transferability, dependability and confirmability (Lincoln and Guba 1985 cited in Gerrish and Lacey 2010, p.139). How these were addressed are considered for this feasibility study interview phase.

Credibility is described as the "*fit between the participants' view and the researcher's representation of them"* (Gerrish and Lacey 2010, p.139). Creswell outlines that it is not the case of two people theming a passage independently but agreeing that they would have coded in the same way (Creswell 2016 p.278). However, for this study the data was coded and themed independently by two researchers and any disagreements discussed. This process was conducted in this study to ensure the views of the participants were being represented accurately and so, we can be confident that results were credible (believable by the community the research involved) (Creswell 2015 p.129). The verbatim quotes from the interviewees help this process. An additional strategy would be to return the transcripts to the interviewees so they could confirm their meaning was clear and understood.

Transferability "*relates to the adequacy of the description to judge similarity to other situations so findings might be transferred*" (Gerrish and Lacey 2010, p.139). To judge transferability there must be enough information presented so others can see if there is similarity to their situations and consider that findings

might be transferred. The use of a table and narrative summary of the themes with a wide range of verbatim quotes was considered adequate to facilitate this. The setting, participants and results have the potential to be transferred to other Scottish, even UK-wide HEI's and health boards.

Dependability "*relates to the transparency of the research process and decision trial*" Gerrish and Lacey 2010, p.139. It was deemed that the research process and decisions made were clear with a rationale provided. Two researchers coded the data independently enhancing dependability of the results.

Confirmability is defined as "*establishing that data, findings and interpretation are clearly linked*" (Gerrish and Lacey 2010, p.139). Thematic analysis is the researcher's manipulation of the data. The researcher should ensure that the links between the data findings and the researcher's interpretation are sound. Two researchers examining the data led credence to this aspect as they independently coded and themed the data.

6.8 Strengths and Limitations

The limitations of the feasibility study are firstly the small sample of students that were interviewed. Out of the four students that were interviewed only two had performed chest auscultation in clinical practice on real patients.

The questionnaires will require some adjustments for the main study and their ability to collect relevant data was therefore compromised to some extent in this study. However, one of the purposes of the study was to test data collection methods so this was a successful component of the study.

Another limitation was that although the simulation activity itself and scaffolding leading up to the simulation were thorough the students did not have an opportunity to debrief. In a future study this would be important to include.

The strengths are that the unknown parameters have been explored in some detail and will inform future studies. The simulation best-practice statements were deemed useful to highlight areas for improving simulation albeit by one participant; evidence of how they might be effectively applied to evaluate

simulation was demonstrated. These contributions will help prepare a study to measure transfer of student learning to clinical practice.

6.9 Key Outcomes

Contributions from this feasibility study are the key messages that will guide the preparation of a large-scale study examining the transfer of skills from the simulation centre to clinical practice. By synthesising and converging the data from the mixed-methods approach the parameters, outlined at the start of this chapter, can be revisited to see if they have been addressed:

i) Establish availability of and time taken to complete relevant placements

A longitudinal study is required over at least two years. This will allow for the time needed to maximise exposure to relevant clinical placements, with the opportunity for the students to practice chest auscultation on real patients.

ii) Identify if students perceive that transfer of learning has occurred.

Students did perceive the transfer of learning had occurred and an objective measure of the transfer of learning using a validated tool could provide robust evidence if used in the future. Simulation was an essential preparation for placement but not a replacement for clinical practice and real patients.

iii) Explore whether simulation activities, interview questions and questionnaires are fit for purpose.

To fulfil the main study outcome measure of establishing if transfer of learning has occurred from simulation to clinical practice:

a. The theory and simulation activities are deemed appropriate by the students. To improve slightly activities involving breath-sounds could be made available on the virtual learning environment and practiced more frequently.

b. The simulation that was provided fully met 18 of the 27 simulation best-practice statements; two were not relevant as they were about assessment and five were partially met. The partially met statements were either concerned with strategy, leadership and evaluation rather than the actual

simulation activity. Debrief was not included in the session so was deemed not relevant for that simulation activity. Two statements that were not met were those concerning staff development and peer review. These areas could be improved for a future study.

c. Adjustments are required to one question on the pre-placement questionnaire and one on the post-placement questionnaire.

iv) **Establish recruitment and retention rates to a study of transfer of learning from simulation to practice and how to protect students as respondents**.

Ten students out of a cohort of 38 performed a chest auscultation in practice on one placement episode and only two of those ten volunteered to be interviewed therefore any future sample size needs to be significantly larger to allow for non-engagement, drop-out and exposure to chest auscultation. A multi-site study would facilitate provision of a larger sample. A sample size calculation would ensure the sample size was enough to extrapolate the results. Students were willing to participate however; a research team could consider ways to increase participation, such as student collaboration by involving the students in the research and development of educational activities and online questionnaires. The ethical considerations of students as participants has been fully considered and would need to be replicated in the main study.

6.10 Conclusion

This feasibility study has enabled some of the parameters for a future larger scale study to be conducted and it proved to be a worthwhile exercise. The longitudinal nature that would be required of such a study is illustrated. Student views on the pre-learning and the simulation activities with volunteer patients provided evidence that these interventions would meet the requirements of a future study. There are enough similarities between the physiotherapy and nursing students programme of study to highlight areas for consideration, such as length of study required. The application of the best-practice simulation statements was a useful precursor to a wider scale use and their validation.

Chapter Six Summary

This chapter has outlined the process and results of a feasibility study exploring some of the parameters required for a main study evaluating the transfer of learning of chest auscultation from simulation to clinical practice for physiotherapy students.

CHAPTER SEVEN – DISCUSSION

Overview of Chapter Seven

This chapter will discuss the main points raised throughout the thesis and emphasise the key unique findings from each of the three studies: the integrative review; e-Delphi study with the explanatory interviews; and finally, the feasibility study.

My motivation for working as a nurse academic and undertaking this doctorate stems from a desire to ensure that students are prepared to manage and care for patients safely whilst adopting an optimum standard of holistic care. Bloomfield's warning is ever valid, for

> *"there are some patients whom we cannot help: there are none that we cannot harm". (Arthur L. Bloomfield MD 1888-1962 cited in Strauss 1968).*

However, it is not only about <u>not</u> harming the patient it is also about protecting the student as they learn; and protecting the clinical staff who are supporting the students in clinical practice, from doing harm to patients. Educators are tasked with ensuring students have the best preparation possible so they can fully engage in patient care using clinical skills in clinical practice as effectively, confidently and safely as possible

7.0 Introduction

In this discussion chapter, the motivation and aim of the thesis will be revisited followed by a summary of the key findings from each of the three studies. After this some key discussion points will illustrate the novel findings of this thesis before the associated eighth chapter, 'conclusions' is presented.

To recap, the overall aim of this thesis was to extend the knowledge base about the transfer of clinical skills to clinical practice after simulation in pre-registration

nurse education and to explore what evidence of transfer exists and how it can be evaluated. This chapter will sum up the results of the three studies in this thesis that contribute towards this exploration. As a reminder simulation is defined by the Nursing and Midwifery Council (NMC) as

> *" an artificial representation of a real-world practice scenario that supports student development and assessment through experiential learning with the opportunity for repetition, feedback, evaluation and reflection".* (NMC 2018 p.14).

Simulation we can see from the NMC's most recent definition is a complex phenomenon, it is seen as important to develop student nurses' ability to care for patients and as such, demands exploration to ensure it is effective. Simulation can also be viewed as a way of addressing the perceived theory-practice gap.

7.1 Integrative Review

The novel approach of this integrative review is that it solely selected research that looked at the effects of simulation and transfer of learning clinical skills to clinical practice – at Kirkpatrick's (2006) level three of behaviour change. Other research reviews, such as Cant et al. (2018), usually incorporate all levels of Kirkpatrick's training evaluation (2006). Alternatively, are focussed on uni-professional groups such as medics (Cox et al. 2015; Cook et al. 2015). The key broad message from both the first review, which was then confirmed, by the integrative review is that there is evidence of transfer but that results are affected by the need for more robust studies exploring simulation and transfer of learning to clinical practice. The larger samples that are required could be achieved by multi-site studies; this would enhance the generalisability of the results. However, increasing the number of sites would mean that more confounding factors were introduced which would require mitigation? Inconsistencies would include different educators providing the simulation; different settings, placement providers and programme requirements. To manage these variations as much standardisation as possible would be required. Simulation best-practice statements would assist in managing the simulation intervention in a multi-site study.

Longitudinal studies are needed that can evaluate the effect of simulation over time. Frequent areas for improvement are the need for masked allocation (blinding) of the assessors, which will reduce the potential for bias. It is accepted that randomised controlled trials may not be possible in educational research and suggestions are that quasi-experimental trials are often more suited to educational settings. Conceivably, a pre-/post-test design or use of a control group versus an intervention group could be used to evaluate if learning occurred and whether it was transferred to practice. To ensure equity of educational experience if a control group is used then this group could receive simulation after the estimate of transfer of learning to ensure parity between how each group is treated.

In addition, the integrative review highlighted specific issues with academics being the researchers. Suggestions were that data collection or analysis may be achieved by colleagues who are not involved in teaching the students may claim to be less biased. Albeit that this is not always feasible, however, what is important is that the participant/researcher relationships are fully considered and mitigated against, disclosed and discussed in any manuscripts. This is true also for the role of student as participant and researchers need to explain how the power imbalance was addressed.

A lack of homogeneity between simulations makes it difficult to compare results. To overcome this, it is proposed the use of best-practice statements be used to guide the research intervention on simulation. Sites involved in any multi-site study would need to deliver a standardised simulation session using the same scenarios and resources. The simulation facilitators would need to be trained in the same way and deliver the simulation activity and debrief in the same manner.

Lastly, the evaluation tools used were often open to criticism leading to a lack of confidence in the results. To ease this situation different sites might collaborate to develop tools that could be used universally and be validated for use to promote confidence in the results they produce.

It is recognised in these studies that conducting research in this sphere is not easy to accomplish. There are many extraneous variables to consider, such as previous experience of the students. It is difficult to achieve control and intervention groups when curricula are set and student equality of experience must be respected. For

student nurses the option of altering patient case notes or reporting tools are not an option, as they do not have the autonomy to change patient care plans or to reporting systems. Direct observation using a validated tool appears to be the most valid option to generate robust evidence, which then means gaining access to clinical areas which can be time-consuming and requires a researcher with the knowledge and skills to navigate the relevant permissions process.

The integrative review highlighted that what happens in simulation is critical to the transfer of learning. More attention is required around aspects of the intervention, which is of course simulation. Authors need to ensure there is a full description of the simulation so others can replicate it and/or appraise the simulation activity.

Therefore, the intervention of simulation needs to follow best practice and be transparent about any adaptations or nuances so readers are fully informed. For instance, did students have active or passive roles? Was there a debrief session?

Once on placement the student needs to be able to recognise similar situations so they can apply their new skills and have the confidence to do so. Lastly, the support from clinical colleagues was essential to enable students to access opportunities to practice the skill. There was no evidence in the studies reviewed that simulation should replace clinical hours.

7.2 e-Delphi Study and Explanatory Interviews

The innovation in this study was determining a high level of consensus on a final set of 28 simulation best-practice statements for use by nurse academics in Scotland. It was established that nurse academics involved in simulation in Scotland would be 100% willing to adopt the 28 simulation best-practice statements in their own institutions. Given the diverse range of institutions involved, this was perhaps surprising. Themes that arose from the e-Delphi study free-text comments were that the terminology used in simulation and the best-practice statements needed to be clear, consistent and familiar; staff development is required for all aspects of simulation including debriefing and evaluation; and

finally, it is important to integrate simulation into the curriculum rather than adopting an ad hoc approach.

To the best of the researcher's knowledge, this is the first study to explore simulation facilitator's views on simulation development in pre-registration nursing in Scotland. Themes from the explanatory interviews contribute to a new understanding of how and why nurse academics use simulation and how they learn about it. A lack of staff awareness about models and guidelines was uncovered but accompanying this a positive desire for development of staff about simulation and a belief that strong leadership was required to enact change. The views expressed by the nine participants in the e-Delphi and the twelve interviewees were strikingly consistent around the need for staff development in the theory and practice of simulation; and leadership to raise the status and legitimacy of simulation. Also seen as crucial was the integration of simulation into the curriculum and the use of best-practice statements.

7.3 Feasibility Study

Given the recognised difficulties with conducting research, examining transfer of learning to clinical practice a feasibility study was conducted to explore some of the parameters involved. These were *to establish availability of and time taken to complete relevant placements*: A longitudinal study is required over at least two years. This will allow for the time needed to maximise exposure to relevant clinical placements, with the opportunity for the students to practice chest auscultation on real patients. Secondly, *to identify if students perceive that transfer of learning has occurred*: Students did perceive the transfer of learning had occurred and an objective measure of the transfer of learning using a validated tool could provide robust evidence if used in the future. Simulation was an essential preparation for placement but not a replacement for clinical practice and real patients. Thirdly, to *explore whether simulation activities, interview questions and questionnaires are fit for purpose:* The theory and simulation activities are deemed appropriate by the students. The simulation that was provided fully met 18 of the 28-simulation best-practice statements and proved a useful tool. Adjustments are required to one question on the pre-placement questionnaire and one on the post-placement

questionnaire. Fourthly, to *establish recruitment and retention rates to a study of transfer of learning from simulation to practice and how to protect students as respondents:* Close attention to future sample size would be required to allow for non-engagement, dropout and exposure to chest auscultation. A sample size calculation would ensure the sample size was enough to extrapolate the results. Students were willing to participate however; a research team could consider ways to increase participation, such as student collaboration by involving the students in the research and development of educational activities and online questionnaires. The ethical considerations of students as participants has been fully considered and would need to be replicated in the main study. The interviews with the two students tested methods that will be utilised for a full transfer study to be conducted and provided evidence that students did perceive transfer of learning had occurred.

Having considered the three main studies and identified their own unique originalities, it is now useful to look at the thesis and discuss some key themes.

7.4 Simulation is a Pedagogy

In this thesis, an argument has been presented that simulation is a pedagogy – a method of teaching and learning. As a pedagogy used for teaching, learning, and assessment, it can take many forms and make use of many different types of simulation, simulator and level of fidelity. Simulation as a teaching method relies on a plethora of learning theories. These theories should underpin what transpires in simulation and guide the facilitator to provide the right environment and conditions for the student to learn. Knowledge of the different learning theories can allow the educator to develop appropriate activities underpinned by the relevant theory – hopefully resulting in the student achieving the desired learning outcomes.

Chapter One outlined several learning theories and demonstrated how they underpinned simulation. Whilst the purpose of this thesis was not to discover 'how' simulation works, the endeavours of theorists to describe this are valuable. Bland et al. (2011) undertook a concept analysis of simulation as a learning strategy in the education of undergraduate student nurses. Bland et al.'s (2011) rationale for

completing the work was the rapid rise in the use of simulation and a concern that most of the literature is uncritical. The definition of concept analysis Bland et al. (2011) adopt is "*a process of dissecting an idea or phenomenon to understand better and optimise its use*" (Holcomb et al. 2002 p.379). Analysis of the articles was achieved by using Walker and Avant's (2005) eight-step systematic process. Bland et al.'s (2011) analysis concludes there are five critical attributes to simulation when it is used for learning:

1. *"Creating a hypothetical opportunity*
2. *Authentic representation*
3. *Active participation*
4. *Integration*
5. *Repetition, evaluation and reflection".*
   (Bland et al. 2011 p.666).

These critical attributes are represented in the 28 best-practice statements apart from 'active participation'. None of the best-practice statements used to populate the e-Delphi study refers to active roles. Neither did any of the expert panel during the e-Delphi rounds add a statement about roles during simulation. It can be argued that the passive role is not effective for learning a psychomotor clinical skill. By applying Peyton's four stage model (1998) observation is useful in the first stages of demonstration, deconstruction, comprehension but the last stage of performance is critical when learning a psychomotor skill. For instance, when equipment must be manipulated and the outcomes can be harmful if procedures, such as cannulation, are not carried out correctly.

In addition, Bland et al. (2011) identified that there are antecedents that must occur before simulation can function:

1. *"The need to provide a simulated learning opportunity as the necessary healthcare experience is not immediately available.*
2. *Educators delivering simulation must develop and provide realistic learning opportunities that enable the student to suspend belief.*
3. *There must be an open and interactive learning environment created where self and peer evaluation can occur.*

4. *The quality of the simulated learning experience must be of a standard that acts as a motivating factor for students to actively engage and learn."* (Bland et al. 2011 p 667)

These antecedents are represented in the 28 simulation best-practice statements apart from antecedent number one. With respect to the need to provide simulated learning because the healthcare experience is not available this statement's scope could be widened to include preparation for a healthcare experience. This would then more accurately reflect pre-registration simulation, which is not just about unavailability of placements.

It is proposed that these attributes and antecedents proposed by Bland et al. (2011) need to be considered as a benchmark to appraise simulation. They are all represented in the simulation best-practice statements selected in the e-Delphi study except for the active participation and availability of experiences.

Another theorist, Walton et al. (2011), exercised grounded theory to ask 'how' students learn in simulation. The sample included twenty-six students in total, sixteen of whom participated in simulation across two semesters. The students then completed in-depth interviews that were audiotaped. Ten senior students who participated in two focus groups (five participants in each group) validated the findings. As well as validating findings, the senior students also identified teaching styles and helpful interventions. The core category was negotiating the role of the professional nurse, and five phases that the students negotiated were identified. Phase one: was when the student felt uncomfortable, requiring a lot of guidance, often using humour to cover up inadequacies. Phase two: students start to try things out, repeating actions, still feeling out of their comfort zone and joking around. Phase three: the students start to take things seriously and get into role more. Phase four: students grow more confident in the nurses' role; this stage is called 'transference'. Phase five: full integration as a team member in the nurses' role, even acting as the patient's advocate.

Walton et al. (2011) believe this conceptual model will assist simulation educators to understand the pedagogy of simulation and develop teaching and learning strategies. A limitation of the research, which the authors point out, is that the participants were mainly female, Caucasian, and from middle class rural areas; it

would have been useful to have a larger and more representative sample. Despite this the research does offer us some insight into how students learn through simulation and why 'getting it right' in simulation is so important. The evidence from Walton's work, describing how students traverse through the stages resulting in them adopting a professional role, and evidence from this thesis would seem to support constructivist theories underpinning simulation.

7.5 Simulation is Preparation for Practice

The evidence cited in this thesis did not suggest that simulation should be used as replacement for clinical practice; more that it should help prepare the student for placement. Hence, simulation can be adopted so that the first time a student performs a skill it is not on an actual patient and so they can practice rarely occurring events or events that it is difficult for a student to access.

Yet, according to the most recently published NMC standards, (NMC Standards of Proficiency for registered nurses 2019) simulation can form part of the teaching methods for nurse education in either university or clinical settings. Each Higher Education Institution can decide on how much simulation to use and when to use it. This is a departure from the previous guidelines, which stipulated no more than 300 hours out of the required 2,700 (approximately 11%) could be replaced by simulation.

Replacement of clinical hours with simulation was cited as the rationale for conducting some of the studies included in the integrative review (Meyer et al. 2011 and Harris 2011). A wider search of the literature showed that more and more frequently simulation is being considered as an actual substitution for clinical practice hours (Bogossian et al. 2018). This phenomenon is largely due to lack of placement and learning opportunities for students and simulation is seen as the panacea to address this. In Canada and USA as well as the UK, the lack of placement opportunity for students is well documented and simulation has been considered as a viable alternative (NMC 2018; INASCL 2017; Canadian Association of Schools of Nursing 2015).

Hayden et al. (2014) undertook a longitudinal randomised control trial in the USA comparing nursing student simulation to clinical practice. Perceived benefits of simulation when used to replace clinical hours varied. In certain clinical areas, medical-surgical and community health areas, there were benefits to clinical competency but in other areas, perinatal, paediatric and mental health areas, there were disadvantages. From a student point of view, simulation was perceived to have benefitted self-confidence. Hayden conducted the research on behalf of INASCL and is employed by them; a fact which is not discussed in the article and which might indicate the presence of bias.

A systematic review undertaken by Larue (2015) seems to support Hayden's hypothesis, which was that the same skills, knowledge and critical thinking could be developed in simulation as in clinical practice. All the studies were positive about using simulation, in their case, high or intermediate fidelity of simulation, to educate students in preparation for clinical placement. Yet, there is a cautionary note; methodological scrutiny of the studies included in the review revealed that validated assessment tools were not used to measure effects. Often the evidence relied on perception of improvement or even levels of satisfaction and concluded that evaluation tools still need to be developed (Larue et al. 2015).

Larue et al.'s (2015) work supports this thesis' review findings: Rutherford-Hemming et al.'s (2016) research, outlined in Chapter Two, concluded there is not enough robust evidence to warrant replacing student advance practitioner clinical hours with simulation. It seems to be that we are basing decisions on whether simulation can replace clinical hours on limited, potentially erroneous information. Firstly, we need to consider the motivation driving the switch of learning context-is lack of placement opportunities enough justification for replacement of clinical hours with simulation. Secondly, as the integrative review and others such as McGaghie et al. (2006), Garden (2008) and Cook (2015) have discovered there are methodological weaknesses in the studies. Lastly, the evidence is weak; even in Hayden et al.'s (2014) study there are mixed messages and the results of Larue et al.'s (2015) systematic review are inconclusive. Too little robust evidence exists to support replacing clinical hours to any degree with simulation at this present time. This thesis found no suggestions that simulation should replace clinical practice. As the feasibility study showed, simulation was an essential preparation

in chest auscultation but the real test was in performing the skill on a real patient with complex needs in an authentic clinical setting. This illustrates the importance of the Vygotsian notion of scaffolding as each step taken in university prepared the physiotherapist student for the real learning to happen in practice (Smagorinsky 2011).

7.6 Integration of Simulation into the Curriculum

Nonetheless, there is another way of considering the use of simulation within pre-registration nursing curricula. Larue et al. (2015) suggest it might be better to ruminate which environment is best suited to which method of teaching– to take advantage of the strengths of both. Interestingly, Larue et al. (2015) articulate that research needs to consider clinical practice and investigate how that learning environment can be improved; they propose post-clinical debriefing may be an asset in clinical just as it is in simulation. This would involve a more integrated and complex approach to nursing curriculum development than we currently seem to have in Scotland overall.

Consider a medical placement of eight weeks, the first week could be dedicated to simulation in the clinical skills centre and in-situ at the clinical setting (as in Harris 2011). In these simulations, students could be orientated to some of the types of scenario they may come across and ones they may be excluded from. Liaw et al. (2012) suggest that instead of constructing scenarios around a condition, asthma, for example, care of the breathless patient would be the scenario and that this broad learning is easier to apply when in practice. Although it might be accepted that pre-clinical placement simulation, closer to the learning experience in clinical practice, is more valuable it is also logistically more challenging to accommodate. However, perhaps best practice should be considered a priority and striven for? The evidence in this thesis suggests that simulation needs to be integrated into the curriculum, so it is visible and meaningful before this step should be taken. Notwithstanding, the resources needed to accommodate periods of simulation in pre-registration would be considerable. The financial implications would not only be on the physical space and personnel required but also the consumables that would be essential.

Zendejas et al. (2013b) point out that cost is rarely evaluated in simulation-based education.

For simulation to be an effective pedagogy, it is considered that it should be fully integrated into the curriculum. However, the staff interviews revealed a more ad hoc approach to simulation in many Scottish institutions. Curriculum integration will naturally guide educators 'when' to use simulation. However, what type of simulation activities, what level of fidelity and so forth are all complex decisions to make and rely on the knowledge and expertise of educators to make reasoned, evidence-based decisions. Evaluation of the actual simulation activity is required both at a local operational and strategic level as well as engaging in evaluative research into the effectiveness of simulation.

7.7 Evaluation is Critical

If simulation is integrated into the curriculum, and with it being such a critical method in the student journey, it is imperative that we evaluate its effectiveness. Kirkpatrick (2006) provides levels of evaluation that educators can consider against any training programme. Level three, transfer to clinical practice, is the aim but one that is most challenging to evaluate. The first step in this research journey was to find out what evidence of transfer already existed both generally for healthcare professionals and then more specifically for pre-registration student nurses. The first notable fact was the limited robust evaluative research available to date.

7.8 Limited Availability of Robust Evidence

The results from both the broad literature review and the integrative review found limited evidence on transfer of learning skills to clinical practice. In addition, it was considered that the available evidence often lacked rigour, affecting the ability to confidently accept the findings. Improvements could be made both to study design and methodology. On a positive note, a review of simulation research conducted in 2018 by Cant et al. showed a high degree of quality in simulation research at level one and two of Kirkpatrick's levels (2006) or transfer in simulated

environments. However, it is acknowledged that transfer to clinical practice research is more demanding to achieve.

Recommendations were made consistently, in the conclusions of the selected studies discussed in this thesis; identifying a need for larger sample, multi-site, longitudinal studies. That the methods of evaluation lack rigour are continually acknowledged and the need for the use of validated assessment tools are inferred by researchers. Much of the evidence educators are relying on to make decisions at present is dependent on self-reports and perceptions when the use of a validated tool, observations and a mixture of qualitative and quantitative data is indicated.

It is acknowledged that undertaking research in education and following students to practice is challenging. This was demonstrated by the feasibility study that explored some of the parameters when evaluating the transfer of learning of chest auscultation from simulation to clinical practice for physiotherapy students. The longitudinal nature that would be required of such a study is illustrated and the difficulties this poses. Moreover, ethical considerations are complex when students are participants and practice on patients is required. The need for supported opportunities to practice with exposure to certain patients and scenarios is critical. For the skill of chest auscultation, it was quite clear that after being well prepared by simulation - practice on real patients was necessary because of the nuances and challenges a real patient poses.

Explicit to the focus of this thesis is that research concerning simulation and transfer of skills needs to be more transparent about the 'intervention' of simulation. Descriptions in reviewed studies of what transpired before, during and after simulation were often minimal and therefore could not be replicated. It was proposed that it was difficult to compare one study against another or evaluate if lack of transfer was due to a factor in the simulation rather than simulation as an entity being culpable. Moreover, multi-site studies were repeatedly advocated in the research examined. This would be challenging to achieve unless several sites (institutions) carried out simulation using a consistent approach.

It was proposed that addressing the quality and consistency of simulation activities could be abetted by the adoption of guidelines or standards: simulation best-practice statements.

7.9 Production of Simulation Best-Practice Statements

There are examples of national and international statements that are used to guide simulation. However, which statements would be suitable for and acceptable to nurse educators in Scotland was important to determine. The e-Delphi study is the first study that explores nurse educator's views on simulation best-practice statements in Scotland. As an outcome 28 best-practice statements emerged that the expert panel agreed would be useful to their practice and that they and their institutions would be willing to adopt. It is proposed that the resulting 28 statements are not static but can be added to or altered depending on need. However, the premise that agreement was established is an important step towards organising a large multi-site study. An unexpected element that arose during the e-Delphi was the independent volunteering of views and high level of agreement about the need for staff development in the pedagogy of simulation. The USA seems to be ahead of the game in the use of best-practice statements. This has largely been promoted by INASCL. It appears Scottish nursing schools, from the evidence in this thesis, seem to be at the start of the journey - yet very keen to evolve. A strong sense that this is partly due to lack of education and development for academic staff who are involved in nursing simulation in Scotland was visible in both the e-Delphi study and the explanatory staff interviews.

Take-home messages from this thesis and implications for practice are clear. Currently, in Scottish pre-registration nurse education there is very little use of models or other guidelines for the design and delivery of simulation. However, this study found that nurse academics in Scotland unanimously agreed that using them would be beneficial.

7.10 Staff Development in the Pedagogy of Simulation

A very strong theme from the staff interviews highlighted that simulation educators desire more development in simulation. This sentiment is substantiated by Dieckmann et al.'s (2018) study. Simulation educators who ran Advanced Life Support (ALS) and Crisis Resource Management (CRM) recognised that they not only had to be clinically competent but also, they needed to be prepared to use simulation. Merely placing new academics in clinical skills/simulation roles because they have the most recent clinical experience is inadequate.

The e-Delphi (Chapter Five) also highlighted a current lack of staff awareness about the use of models to structure debrief or to structure the whole simulation activity. Nor were staff aware of available best-practice statements or their equivalent to guide the design and delivery of simulation. Lack of awareness was attributed to lack of staff education and the need for specific staff development was reinforced in the staff interviews. Staff passion and enthusiasm for simulation was very apparent and numerous examples were recounted of innovative and justifiable simulation activities. What was lacking was robust evaluation and support for simulation educators to develop and sustain their roles. Evidence from the staff interviews suggested that often finances had been spent on resources and equipment but staff had not received the same investment. To facilitate the development of simulation in nurse education and to strengthen the justification for both its use and expenditure on resources staff development is indicated. The e-Delphi study generated a high level of consensus for 28 simulation best-practice statements; these could be used by nurse academics to enhance current simulation practice and progress future collaborative research between Scottish schools of nursing since the will for change clearly exists.

Inconsistent use of any model or best-practice statements was attributed to a lack of awareness and staff development around simulation. The need for leadership around simulation and the development of all staff around simulation but those who design and deliver simulation was convincing. In Scotland, the CSMEN (2017) Three-Tier framework for simulation educators might provide a useful benchmark for simulation educators to aspire to and would encourage standardisation across Scotland. There are other self-assessment models to help simulation educators appraise their skills as a simulation educator; the National League for Nurses in

the USA, adapted Benner's model (1984), to reflect the skills required as a simulation educator (Thomas et al. 2015). Simulation educators are then directed to resources that will aid them attain the next level.

A strong message from this thesis is the need for staff education in simulation, a definite thirst for knowledge. Although it wasn't about simulation per se, Postaroff et al.'s (2007) qualitative study demonstrated that the more pedagogical education academics received the greater conceptual change occurred, that they used a more student-focussed approach and self-efficacy beliefs improved – moreover all the comments from academics about pedagogical education were positive.

Bognossian et al. (2018) surveyed the use of simulation in Australian and New Zealand pre-registration nursing education. 51.6% of institutions responded, the results showed there was variation in how much of the nursing programme was allocated to clinical or simulation hours. On a positive note, simulation was integrated into the curriculum and simulation environments were adequate. On a negative note, '*staff time, training and resource development were seen as barriers to increasing the quality, amount and range of simulation experiences*' (p.327). In addition, quality assurance and robust evaluation were inadequate. These negative factors tally with the findings of this thesis in Scotland suggestive that the results of this thesis could also be useful internationally.

7.11 Leadership for Simulation

To secure education and investment in academic staff, students and patients the evidence from the e-Delphi and explanatory interviews with staff pointed to a need for strong leadership. The profile of simulation might then be raised, nurse academics recounted in the post-Delphi interviews it is often belittled in academia. Many of the comments from the staff interviews alluded to this and described how this made them feel undervalued. To raise the profile of simulation it needs to be recognised as a legitimate pedagogy used to help safeguard both patients and students by better preparing students. Organisations concerned with simulation: INASCL, CSMEN, ASPiH all recognise the importance of leadership concerning simulation.

7.12 Key Findings

So, what does all this tell us? Firstly, that there is evidence to suggest that learning skills by simulation does transfer to practice. There is a caveat however, that the available research could be improved. If the aim is to raise the profile and worth of simulation then the evidence needs to be robust enough to persuade the individuals with the financial responsibilities and curriculum leadership to invest in staff to deliver. One of the pivotal aspects to achieve is assuring the quality of simulation itself, both for educational and research purposes. It is asserted that the use of best-practice statements would be a major step forward to achieve this goal. This thesis has made advances to this goal by determining a high level of consensus on 28 simulation best-practice statements that nurse academics agree on and would adopt. The arena of research in clinical practice is accepted as being challenging and this thesis has identified areas to consider for future research. This cannot occur to satisfaction unless collaborations are made between HEI's and individuals.

Chapter Seven Summary

This chapter has discussed the main points raised throughout the thesis and emphasised the key and unique findings from each of the three studies: the integrative review; e-Delphi study with explanatory interviews; and finally, the feasibility study. The last chapter, conclusions, will condense the originalities, implications, recommendations, strengths and limitations and finally propose further ideas for research.

CHAPTER EIGHT: CONCLUSIONS

8.0 Introduction

This final chapter will sum up the originality of the studies within the thesis, highlight implications, strengths and limitations and make recommendations for future simulation research exploring transfer to practice and simulation pedagogy in nurse education and consider future research opportunities.

8.1 Originality

This thesis makes several original contributions, to the best of the researcher's knowledge

1. The integrative review is the first to focus on simulation and transfer of learning (at Kirkpatrick's level three (2006)) for pre-registration nursing students;
2. The e-Delphi study and explanatory interviews is the first study to ascertain the thoughts and beliefs of Scottish nurse academics involved in simulation on the selection and use of simulation best-practice statements and staff development in simulation;
3. The feasibility study is the first to explore chest auscultation and healthcare students transfer of clinical skills to clinical practice.
4. The three studies have used mixed-methodology which might be considered a novel approach to studying transfer of learning to find out what evidence exists, what is important about the intervention of simulation and explores the parameters of a transfer study.

8.2 Implications of key findings

A summary of the implications of key findings from the three studies in this thesis are outlined below in relation to research, and educational practice involving students and staff facilitating simulation.

i) Simulation and staff

- Simulation should be integrated into the curriculum.
- There is currently a lack of awareness on simulation guidance and the use of best practice statements.
- There is a positive desire for development of staff with regards to simulation.
- Consensus on simulation best-practice statements and adoption into educational practice has been demonstrated.
- Strong leadership to drive simulation is essential.
- Shared resources and collaboration to validate tools and conduct multi-site studies is indicated.

ii) Simulation and students

- Simulation matters: what happens in simulation is critical to the transfer of learning.
- There is currently no evidence that simulation should replace clinical practice.
- It is important to recognise when to apply learning in practice: it is important that students can recognise similar situations in which to apply their new skills.
- Holistic preparation for practice: Feeling prepared gives students confidence to transfer skills they had learned.
- There is a need for supported opportunities to practise clinical skills and learning by simulation in clinical practice.

iii) When conducting simulation research

- Larger samples are required that reach an adequate effect size.
- There is a need for longitudinal studies.
- Multi-site studies are required.
- More robust studies, including a greater control to reduce bias are required, for example: allocation concealment, and blinding of the personnel analysing the results or conducting the assessments.

- There is a need for randomised controlled trials OR quasi-experimental trials which may be more suitable for educational settings.
- Consideration should be given to a pre-/post-test design or the use of a control group versus an intervention group to evaluate if change or learning has occurred.
- There is a need to consider bias when academics are researchers.
- Researchers should be particularly mindful of protecting students as participants.
- Heterogeneity between simulations makes it difficult to evaluate effectiveness.
- Attention to the evaluation tool, and the use of validated tools where possible, is indicated.

8.3 Strengths and Limitations of the Thesis

The main limitation of the thesis is the single context of Scotland; indeed, it would be interesting to see if the findings from the three studies in this thesis would be replicated elsewhere in the UK or internationally. The strengths of the thesis are the practical contributions it can offer to simulation and healthcare educational practice in Scotland. Furthermore, the elements of this thesis will inform and support a proposal (**appendix 32**) to conduct a national simulation research project to investigate transfer of learning to clinical practice after simulation. This was the original intention at the very start of this doctoral journey but it quickly became apparent that other steps needed to be achieved first to promote the successful outcome of such a venture.

8.4 Recommendations for Research and Educational Practice

i) Research practice recommendations

1. Higher education institutions should collaborate to perform multi-site, longitudinal studies with large samples, using a quasi-experimental research design to avoid methodological weaknesses of previous studies evaluating simulation and transfer of learning to practice.

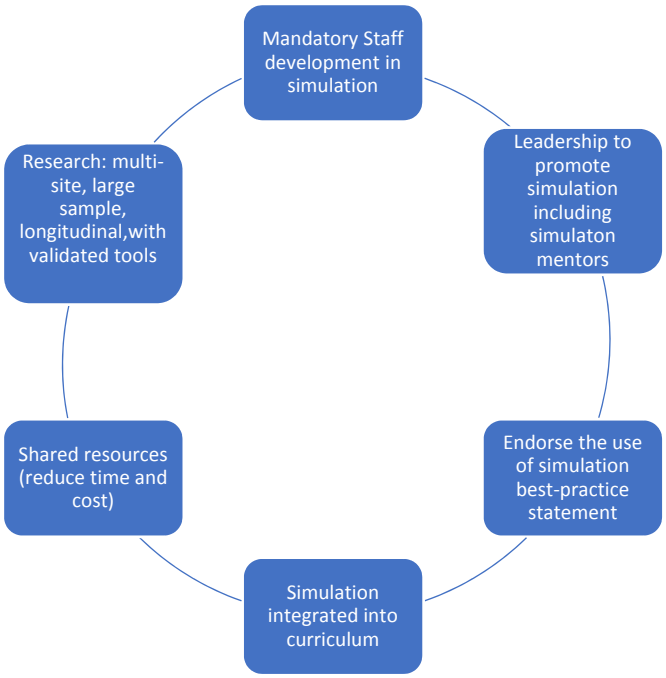
2. Higher education institutions should collaborate to develop and then use validated tools to evaluate transfer of learning from simulation to clinical practice.
3. The intervention of simulation might be strengthened using best-practice statements. Using best-practice statements will help to ensure consistency when conducting multi-site studies as a framework for simulation educators and the sharing resources, validated tools to evaluate simulation transfer of learning to practice.

ii) Educational practice recommendations

1. Leadership for simulation should be a priority by nurse educators to raise the profile of simulation.
2. Staff development in simulation pedagogy should be implemented for healthcare educators.
3. Use of simulation best-practice statements and a framework for simulation educators to standardise, make transparent, evaluate and improve simulation activities.
4. Use of simulation champions nationally to mentor, guide and support simulation educators.
5. Sharing of resources nationally, including simulation scenarios and a validated evaluation tool to promote efficiency and effectiveness (CSMEN endorse this approach).
6. Scottish Schools of Nursing are currently not able to consider simulation as a replacement for more than the occasional clinical hours.

These recommendations can be visualised as a six-step model to enhance simulation in pre-registration nurse education (**Figure 8.1**)

Figure 8.1: Model for simulation-based education development.



8.5 Future Research Ideas

It is evident that further research is required around simulation and transfer of learning to clinical practice. This thesis has started the process to prepare the way to complete a national collaborative study. This would involve inviting the Schools of Nursing in Scotland who utilise simulation to collaborate and conduct a national research project examining the transfer of learning to clinical practice. This would be a multi-site study involving Higher Education Institutions that deliver pre-registration nursing. The study could replicate the feasibility study with the addition of evaluating transfer to clinical practice by direct observation. It would need to be longitudinal to allow students the opportunity to attend a placement where chest auscultation was required. Nursing students have not routinely been taught chest auscultation in the past so this would mean a transferable clinical skill could be isolated and followed through to practice. An assessment tool would need to be validated before use and would be more credible the more institutions that could be involved.

Another area of interest is exploring the differences between active and passive roles in simulation. This would require a control and intervention group. The intervention group would participate in simulation with an active role; chest auscultation might be the skill. The control group would have a passive role,

observing only. The transfer to practice could then be evaluated to determine whether the role adopted influences, the extent to which learning can be transferred to practice. To ensure equity, after being assessed in practice the students could swap roles during simulation allowing those initially allocated to the control group to experience an active role during simulation.

8.6 Overall Conclusions

There was no suggestion in the e-Delphi and staff interviews that any simulation activity has been sub-standard. Conversely, numerous examples of seemingly innovative practice have been recounted by staff. What is of importance is that an audit trail of evaluation exists and a cycle of improvement transpires - that we constantly improve. Whether simulation might be a substitute for clinical hours is still for a topic for debate but the evidence from this thesis would suggest that nurse education in Scotland is not ready to support replacing clinical practice with simulation. Academic staff who design and deliver simulation need further development. Simulation needs to be standardised and when it is the intervention in research, reporting and transparency are paramount.

Finally, the future of simulation in pre-registration nursing and healthcare professions is dependent on the passion and professionalism of the simulation facilitators and students, akin to those that gave their time to be involved in this doctoral study. At the heart of their motivation is the patients they seek to care for and protect. My intention has been that the contributions of this thesis are of value to this endeavour and that this is just the start…

REFERENCES

ABDULGHANI, H.M., SHAIK, S.A., KHAMIS, N., AL-DREES, A.A., ISHRAD, M. KHALIL, M.S. ALHAQWI, A.I. and ISNANI, A. 2014. Research methodology workshops evaluation using the Kirkpatrick's model: Translating theory into practice. *Medical Teacher;* Supplement, 36(Sup1), pp. S24-S29.

ADLER, M. and ZIGLIO, E., (Eds), 1996. *Gazing into the Oracle: the Delphi Method and its application to social policy and public health*. London: Jessica Kingsley Publishers.

AEBERSOLD, M. and TSCHANNEN, D. 2013. Simulation in nursing practice: The impact on patient care. *OJIN: The Online Journal of Issues in Nursing*, 18(2) pp. 1-6.

AHMAD, R. ALHASHMI, G., AJLAN, A. and ELDEEKET, B., 2015. Impact of high-fidelity transvaginal ultrasound simulation for radiology on residents' performance and satisfaction. *Academic Radiology*, 22(2), pp. 234-239.

AKHTAR-DANESH, N., BAXTER, P., VALAITIS, R. K., STANYON, W. S and PROUL, S. 2009. Nurse faculty perceptions of simulation use in nursing education. *Western Journal of Nursing Research*, 31(3), pp. 312-329.

ALEXANDER, M. DURHAM, C. F., HOOPER, J. I., JEFFRIES, P. R., GOLDMAN, N., KARDONG-EDGREN, S., KESTEN, K. S., SPECTOR, N., TAGLIARENI, E., RADTKE, B., and TILLMAN, C., 2015. NCSBN simulation guidelines for prelicensure nursing programs. *Journal of Nursing Regulation*, 6(3) pp.39-42.

ALINIER, G., HUNT, W.B. and GORDON, R. 2004. Determining the value of simulation in nurse education: Study design and initial results. *Nurse Education in Practice*, 4(3), pp. 200-207.

ALLIGER, G. M., TANNENBAUM, S. I., BENNETT, W., JR., TRAVER, H. and SHOTLAND, A. 1997. A meta-analysis of relations among training criteria. *Personnel Psychology*, 50(2), pp. 341–358.

ARAIN M, CAMPBELL MJ, COOPER C.L and LANCASTER GA. 2010. What is a pilot or feasibility study? A review of current practice and editorial policy. *BMC Medical Research Methodology*, 10(1), p. 67.

ARCHER, B.H., 1980. Forecasting demand: quantitative and intuitive techniques. *International Journal of Tourism Management*, 1(1), pp. 5-12.

ARTHUR J.R., W., BENNETT JR, W., STANUSH, P.L. and MCNELLY, T.L., 1998. Factors that influence skill decay and retention: A quantitative review and analysis. *Human Performance*, 11(1), pp. 57-101.

ARTHUR J.R., W., BENNETT JR, W., EDENS, P.S. and BELL, S.T., 2003. Effectiveness of training in organizations: a meta-analysis of design and evaluation features. *Journal of Applied Psychology*, 88(2), p. 234.

ARTHUR, C., LEVETT-JONES, T. and KABLE, A., 2013. Quality indicators for the design and implementation of simulation experiences: a Delphi study. *Nurse Education Today,* 33(11) pp. 1357-1361.

ASSOCIATION FOR SIMULATION PRACTICE IN HEALTHCARE (ASPiH) 2017. *The ASPiH standards framework and guidance, ASPiH Standards for simulation-based education*. [online]. Lichfield: ASPiH. Available from: https://aspih.org.uk/standards-framework-for-sbe/ [Accessed 5 September 2018].

AURA, S., JORDAN, S., SAANO, S., TOSSAVAINNEEN, K. and TURUNEN, H., 2016. Transfer of learning: radiographers' perceptions of simulation-based educational intervention. *Radiography*, 22(3) pp. 228-236.

AVELLA, J.R., 2016. Delphi panels: Research design, procedures, advantages, and challenges. *International Journal of Doctoral Studies*, 11(1), pp. 305-321.

AVEYARD, H., 2014. *Doing a literature review in health and social care: a practical guide*. 3rd ed. Maidenhead: McGraw-Hill Education (UK).

AVRAHAM, R., SHOR, V., HURVITZ, N., SHVARTSUR, R. and KIMHI, E. 2018. Transferability of medication administration simulation training to clinical settings. *Teaching and Learning in Nursing,* 13(4), pp. 258–262.

BAKER, J., LOVELL, K. and HARRIS, N., 2006. How expert are the experts? An exploration of the concept of 'expert' within Delphi panel techniques. *Nurse Researcher (through 2013)*, *14*(1), pp. 59-70.

BALDWIN, T. T. and FORD, J. K. 1988. Transfer of training: a review and directions for future research. *Personnel Psychology*, 41 pp.63–105.

BANDURA, A. 1977. *Social learning theory*. London: Prentice-Hall.

BARSUK, J.H., COHEN, E.R., WILLIAMS, M.V., SCHER, J., FEINGLASS, J., MCGAGHIE, W.C., O'HARA, K. and WAYNE, D.B., 2016. The effect of simulation-based mastery learning on thoracentesis referral patterns. *Journal of Hospital Medicine*, 11(11), pp.792-795.

BARTON, A.J., ARMSTRONG, G., PREHEIM, G., GELMON, S.B., FACHE, P.H. and ANDRUS, L.C. 2009. A national Delphi to determine developmental progression of best practice statements and safety competencies in nursing education. *Nursing Outlook*, 57(6), pp. 313-322.

BARTRAM, B., 2019. Using questionnaires. In: M. LAMBERT, ed. *Practical Research Methods in Education: An Early Researcher's Critical Guide.* Abingdon: Routledge. pp.1-11.

BEARD, J.D., JOLLY, B.C., NEWBLE, D.I., THOMAS, W.E.G., DONNELLY, J. and SOUTHGATE, L.J., 2005. Assessing the technical skills of surgical trainees. *British Journal of Surgery*, *92*(6), pp.778-782.

BEARMAN, M., NESTEL, D. and ANDREATTA, P., 2013. Simulation-based medical education. In: K. WALSH, ed. *Oxford Textbook of Medical Education.* Oxford: Oxford University Press. Chapter 16, pp.186-97.

BEE, R., 1994. *Training needs analysis and evaluation*. London: Institute of Personnel Management.

BENNER, P.E., 1984. *From novice to expert: excellence and power in clinical nursing practice.* Menlo Park, CA: Addison-Wesley.

BENNETT, B., COVENTRY, E., GREENWAY, N. and MINCHIN, M. 2014. The NICE process for developing quality standards and indicators. *Zeitschrift für Evidenz, Fortbildung und Qualität im Gesundheitswesen*, 108(8-9), pp.481-6.

BENNETT, S., RODGER, S., FITZGERALD, C. and GIBSON, L., 2017. Simulation in occupational therapy curricula: a literature review. *Australian Occupational Therapy Journal*, 64(4), pp.314-327.

BERG, B.L. 2009. *Qualitative research methods for the social sciences*. 7th ed. Boston MA: Allyn and Bacon.

BERRAGAN, L., 2011. Simulation: an effective pedagogical approach for nursing? *Nurse Education Today*. 31(7), pp. 660-663.

BEWLEY, W.L. and O'NEILL, H.F., 2013. Evaluation of medical simulations. *Military Medicine.* 178(10 suppl), pp.64-73.

BEZEMER, J. 2013. Learning, design and performance: towards a semiotic-ethnographic account of surgical simulation. In: M. BÖCK and N. PACHLER. eds. *Multimodality and social semiotics: communication, meaning-making and learning in the work of Gunther Kress.* New York: Routledge. Ch. 26, pp. 254-262.

BIGGS, J.B. and TANG, C. 2011. *Teaching for quality learning at university: what the student does.* 4th ed. Maidenhead: Society for Research into Higher Education and Open University Press.

BLAND, A.J., TOPPING, A. and WOOD, B., 2011. A concept analysis of simulation as a learning strategy in the education of undergraduate nursing students. *Nurse Education Today,* 31(7), pp.664-670.

BLEAKLEY, A., 2006. Broadening conceptions of learning in medical education: the message from team-working. *Medical Education*, 40(2), pp. 150-157.

BLIGH, J. and BLEAKLEY, A., 2006. Distributing menus to hungry learners: can learning by simulation become simulation of learning? *Medical Teacher*, 28(7) pp.606-613.

BLOOR, M. and WOOD, F., 2006. *Keywords in qualitative methods: a vocabulary of research concepts.* London: SAGE Publications.

BOELL, S.K. and CECEZ-KECMANOVIC, D., 2010. Literature reviews and the hermeneutic circle. *Australian Academic and Research Libraries*, 41(2), pp. 129-144.

BOET, S., BOULD, M., FUNG, L., QOSA, H., PERRIER, L., TAVARES W., REEVES S., and TRICCO A. 2014, Transfer of learning and patient outcome in simulated crisis resource management: a systematic review. *Canadian Journal of Anaesthesia*, 61(6), pp.571-582.

BOGOSSIAN, F., COOPER, S., KELLY, M., LEVETT-JONES, T., MCKENNA, L., SLARK, J. and EATON, P., 2018. Best practice in clinical simulation education—are we there yet? A cross-sectional survey of simulation in Australian and New Zealand pre-registration nursing education. *Collegian*, *25*(3), pp.327-334.

BOONE, H.N. and BOONE, D. 2012. Analysing Likert Data. [online]. *Journal of Extension*, 50(2). Available from: https://www.joe.org/joe/2012april/tt2.php [Accessed 30 August 2019].

BRADBURY-JONES, C. and ALCOCK, J., 2010. Nursing students as research participants: a framework for ethical practice. *Nurse Education Today*, 30(2), pp.192-196.

BRADLEY, P. and POSTLETHWAITE, K., 2003. Simulation in clinical learning. *Medical Education*, *37*(s1), pp. 1-5.

BRAUN, V. and CLARKE, V., 2006. Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3, pp. 77-101.

BRAUN, V. and CLARKE, V., 2014. What can "thematic analysis" offer health and wellbeing researchers? *International Journal of Qualitative Studies on Health and Well-Being*, 9*.*

BRAUN, V., CLARKE, V. and TERRY, G., 2014. Thematic analysis. *Qualitative Research Clinical Health Psychology*, 24, pp. 95-114.

BREMNER, M., ADUDDELL, K., BENETT, F. and VANGEEST, J., 2006. The use of patient simulators: best practice with novice nursing students. *Nurse Educator*, 31(4), pp. 170-174.

BREMNER, M.N. and BRANNAN, J.D., 2000. A computer simulation for the entry level RN: enhancing clinical decision making, *Journal for Nurses in Staff Development*, 16(1), pp. 5-9.

BREWER, J. and HUNTER, A., 1989. *Sage Library of Social Research, vol. 175. Multimethod research: a synthesis of styles.* Thousand Oaks, CA: Sage Publications.

BRIEDENHANN, J. and BUTTS, S., 2006. Application of the Delphi technique to rural tourism project evaluation. *Current Issues in Tourism*, 9(2), pp. 171-190.

BROOME, M.E., 1993. Integrative literature reviews for the development of concepts. In: B.L. RODGERS and K. A. KNAFL, eds. *Concept development in nursing.* Philadelphia, PA: W.B. Saunders Co.

BROOME, M.E. 2000. Integrative literature reviews for the development of concepts. In: B.L. RODGERS and K.A. KNAFL, eds. *Concept development in nursing: foundations, techniques and applications.* 2nd ed. Philadelphia, PA: W.B. Saunders Co. Chapter 13, pp.231-250.

BRTNIKOVA, M., CRANE, L. A., ALLISON, M. A., HURLEY, L. P., BEATY, B. L. and KEMPE, A. 2018. A method for achieving high response rates in national surveys of U.S. primary care physicians. [online]. *PLoS ONE*, *13*(8). Available from: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0202755 [Accessed 30 August 2019].

BRUCE, C. and GERBER, R., 1995, Towards university lecturers' conceptions of student learning. *Higher Education*, 29, pp. 443–458.

BUCKLEY, T. and GORDON, C., 2011. The effectiveness of high-fidelity simulation on medical-surgical registered nurses' ability to recognize and respond to clinical emergencies. *Nurse Education Today*, 31(7), pp. 716−721.

BURNS, N. and GROVES, K., 1997. *Practice of nursing research*. Philadelphia, PA: WB Saunders.

BUTLER, J., 2003. Research in the place where you work – some ethical issues. *Bulletin of Medical Ethics*, 185, 21–23.

CAE Healthcare, 2017. *I Stan*. [online]. Sarasota, FL: CAE Healthcare. Available from: https://caehealthcare.com/patient-simulation/istan. [Accessed 2 September 2019].

CANADIAN ASSOCIATION OF SCHOOLS OF NURSING (CASN). 2015. *Practice domain for baccalaureate nursing education: Guidelines for clinical placements and simulation*. [online]. Ottawa, ON: CASN. Available from: http://www.casn.ca/wp-content/uploads/2015/11/Draft-clinical-sim-2015.pdf [Accessed 2 September 2019].

CANNON, W.D., GARRETT JR, W.E., HUNTER, R.E., SWEENEY, H.J., ECKHOFF, D.G., NICANDRI, G.T., HUTCHINSON, M.R., JOHNSON, D.D., BISSON, L.J., BEDI, A. and HILL, J.A., 2014. Improving residency training in arthroscopic knee surgery with use of a virtual-reality simulator: a randomized blinded study. *JBJS*, *96*(21), pp.1798-1806.

CANT, R.P., LEVETT-JONES, T. and JAMES, A., 2018. Do simulation studies measure up? A simulation study quality review. *Clinical Simulation in Nursing*, *21*, pp.23-39.

CANT, R.P. and COOPER, S.J., 2017. Use of simulation-based learning in undergraduate nurse education: an umbrella systematic review. *Nurse Education Today*, 49, pp.63-71.

CANT, R.P. and COOPER, S.J., 2010. Simulation-based learning in nurse education: systematic review. *Journal of Advanced Nursing*, 66(1), pp.3-15.

CASCIO, W.F. 1987. *Applied psychology in personnel management*. 3rd ed. Englewood Cliffs NJ: Prentice-Hall.

CATO, M.L., 2013. Nursing student anxiety in simulation settings: a mixed methods study. Ed.D. dissertation. [online]. Portland, OR: Portland State University. Available from: https://pdxscholar.library.pdx.edu/open_access_etds/1035/ [Accessed 17 February 2019].

CAYLESS, S. and WENGSTRÖM, Y**.,** 2008. S*coping exercise to review best practice statements: skincare of patients receiving radiotherapy and the management of pain in patients with cancer*. Stirling: Cancer Care Research Centre, University of Stirling.

CHAPPLE, A., 1999. The use of telephone interviewing for qualitative research. *Nurse Researcher*, 6(3), pp.85.

CHEUNG, C.K.A., 2013. *Experiential education and adolescents' personal and spiritual development a mixed-methods study in the secondary school context of Hong Kong*. Wiesbaden: Springer VS.

EBSCO, 2019. *CINAHL: The Cumulative Index to Nursing and Allied Health Literature.* [online]. Barnet: Ebsco. Available from: https://health.ebsco.com/products/the-cinahl-database [Accessed 2 September 2019].

CIOFFI, J., 2001. Clinical simulations: development and validation. *Nurse Education Today,* 21(6), pp. 477-486.

CLAY-WILLIAMS, R. and BRAITHWAITE, J., 2009. Determining of health-care teamwork training competencies: a Delphi study. *International Journal for Best-practice Statements in Health Care*, 21(6), pp. 433–440.

CLINICAL SKILLS MANAGED EDUCATION NETWORK (CSMEN) 2017. The *Scottish Faculty Development Programme for Simulation Based Learning Educators Faculty Development for Simulation: A National Outcomes Framework*. [online]. Dundee: Clinical Skills Managed Education Network. Available from: http://www.csmen.scot.nhs.uk [Accessed 27 February 2019].

COATES, J.F., 1975. In defence of Delphi: a review of Delphi assessment, expert opinion, forecasting, and group process by Sackman, H. *Technological Forecasting and Social Change*, 7(2), pp. 193–194.

COCHRANE, 2019. *Cochrane.* [online]. Oxford: Cochrane. Available from: https://www.cochrane.org/about-us [Accessed 2 September 2019].

COLLINS, A., BROWN, J. S., and NEWMAN, S. E. 1987. *Cognitive apprenticeship: teaching the craft of reading, writing and mathematics. Technical Report No. 403*. Cambridge, MA. BBN Laboratories, Centre for the Study of Reading, University of Illinois.

CONN, V.S., ISARAMALAI, S.A., RATH, S., JANTARAKUPT, P., WADHAWAN, R. and DASH, Y., 2003. Beyond MEDLINE for literature searches. *Journal of Nursing Scholarship*, 35(2), pp. 177-182.

CONRAD, M.A., GUHDE, J., BROWN, D., CHRONISTER, C. and ROSS-ALAOLMOLKI, K., 2011. Transformational leadership: Instituting a nursing simulation program. *Clinical Simulation in Nursing*, 7(5), pp. e189-e195.

COOK, D.A. and HATALA, R., 2015. Got power? A systematic review of sample size adequacy in health professions education research. *Advances in Health Sciences Education*, 20(1), pp. 73-83.

COOK, D. A., HATALA, R., BRYDGES, R., ZENDEJAS, B., SZOSTEK, J. H., WANG, A. T. and HAMSTRA, S. J. 2011. Technology-enhanced simulation for health professions education: a systematic review and meta-analysis. *JAMA*, 306(9), pp. 978-988.

COOPER, H.M., 1984. *The integrative research review: a systematic approach.* Beverley Hills, CA: Sage Publications Inc.

COOPER, J.B. and TAQUETI, V.R., 2004. A brief history of the development of mannequin simulators for clinical education and training. *Quality and Safety in Health Care*. 13 (Suppl. 1), pp. i11-i18.

COOPER, S., CANT, R., PORTER, J., BOGOSSIAN, F., MCKENNA, L., BRADY, S. and FOX-YOUNG, S., 2012. Simulation based learning in midwifery education: a systematic review. *Women and Birth*, 25(2), pp. 64-78.

COWMAN, S., GETHIN, G., CLARKE, E., MOORE, Z., CRAIG, G., JORDAN-O'BRIEN, J. and STRAPP, H., 2012. An international e-Delphi study identifying the research and education priorities in wound management and tissue repair. *Journal of Clinical Nursing*, 21(3-4), pp. 344-353.

COX, T., SEYMOUR, N. and STEFANIDIS, D., 2015. Moving the needle: simulation's impact on patient outcomes. *Surgical Clinics*, 95(4), pp. 827-838.

CRESWELL, J.W., 2009. *Research design: qualitative, quantitative, and mixed methods approaches*. Thousand Oaks, CA: Sage Publications Inc.

CRESWELL, J.W., 2013. *Research design: qualitative, quantitative and mixed methods approaches*. 4th ed. Thousand Oaks, CA: Sage Publications Inc.

CRESWELL, J.W., 2015. *A concise introduction to mixed methods research.* Thousand Oaks, CA: Sage Publications Inc.

CRESWELL, J.W. and CRESWELL, J.D., 2018. *Research design: qualitative, quantitative and mixed-methods approaches*. 5th ed. Thousand Oaks CA: Sage publications Inc.

CRESWELL, J.W. and PLANO CLARK, V.L., 2017. *Designing and conducting mixed methods research.* 3rd ed. London: Sage Publications Inc.

CRONIN, P., RYAN, F. and COUGHLAN, M., 2008. Undertaking a literature review: a step-by-step approach. *British Journal of Nursing*, 17(1), pp. 38-43.

CROTTY, M., 1998. *The foundations of social research: meaning and perspective in the research process*. London: Sage.

CRUESS, S.R., CRUESS, R.L. and STEINERT, Y., 2008. Role modelling: making the most of a powerful teaching strategy. *British Medical Journal, 336*(7646), pp. 718-721.

CUSTER, R.L., SCARCELLA, J.A. and STEWART, B.R., 1999. The Modified Delphi Technique: a rotational modification. *Journal of Vocational and Technical Education*, 15(2), pp. 50-54.

DALKEY, N. and HELMER, O., 1963. Delphi Technique characteristics and sequence model to the use of experts. *Management Science*, 9(3), pp. 458-467.

DALY, A., 2015. Refocusing the lens: educational research in an era of relationships. *Journal of Educational Administration*, 53(1), [online]. Available from: https://doi.org/10.1108/JEA-11-2014-0135 [Accessed 4 September 2019].

DANCEY, C.P., REIDY, J.G. and ROWE, R. 2012. *Statistics for the health sciences.* London: Sage Publications Ltd.

DASBOROUGH, M., LAMB, P. and SUSENO, Y., 2015. Understanding emotions in higher education change management. *Journal of Organizational Change Management*, *28*(4), pp. 579-590.

DAVENPORT, J., 1987. Is there any way out of the andragogy morass? *Lifelong Learning*, 11(3), pp. 17-20.

DE MELO, B.C.P., RODRIGUES FALBO, A, SORENSON, J.L., van MERRIENOER, J.J.G. and van der VLEUTEN, C., 2018. Self-perceived long-term transfer of learning after postpartum haemorrhage simulation training. *International Journal of Gynaecology and Obstetrics*, 141(2), pp. 261-267.

DE SOUZA, M.T., DA SILVA, M.D. and DE CARVALHO, R., 2010. Integrative review: what is it? How to do it? *Einstein*, 8(1), pp. 102-106.

DEAKIN, H. and WAKEFIELD, K., 2014. Skype interviewing: reflections of two PhD researchers. *Qualitative Research*, *14*(5), pp. 603-616.

DEBONO, V.B., ZHANG, S., YE, C., PAUL, J., ARYA, A., HURLBURT, L., MURTHY, Y. and HABANE, L., 2013. A look at the potential association between PICOT framing of a research question and the quality of reporting of analgesia RCTs. *BMC Anaesthesiology*, 13(1), p.44.

DEBOURGH, G.A. and PRION, S., 2011. Using simulation to teach pre-licensure nursing students to minimize patient risk and harm. *Clinical Simulation in Nursing*, 7, pp. e47-e56.

DECARLO, D., COLLINGRIDGE, D.S., GRANT, C. and VENTRE, K.M., 2008. Factors influencing nurses' attitudes toward simulation-based education. *Simulation in Healthcare*, 3(2), pp. 90–96.

DECKER, S., FEY, M., SIDERAS, S., CABALLERO, S., ROCKSTRAW, L(R), BOESE, T., FRANKLIN, A.E., GLOE, D., LIOCE, L., SANDO, C.R., MEAKIM, C. and BORUM, J.C. 2013. Standards of best-practice: simulation standard VI: the debriefing process. *Clinical Simulation in Nursing*, 9(6s). pp. S30–S29.

DECKER, S., UTTERBACK, V. A., THOMAS, M. B., MITCHELL, M. and SPORTSMAN S. 2011. Assessing continued competency through simulation: a call for stringent action. *Nursing Education Perspectives*, 32 (2), pp.120-125.

DELBECQ, A.L., VAN DE VEN, A.H. and GUSTAFSON, D.H., 1975. *Group techniques for program planning: a guide to nominal group and Delphi processes.* Glenview, IL: Scott, Foresman.

DEPARTMENT OF HEALTH. 2007. *Trust, assurance and safety: the regulation of health professionals in the 21st century.* London: The Stationary Office.

DESANTIS, L. and NOEL UGARRIZA, D., 2000. The concept of theme as used in qualitative nursing research. *Western Journal of Nursing Research*, 22, pp.351–372.

DEWEY, J., 2012. *How we think*. New York: Dover Publications.

DIAMOND, I.R., GRANT, R.C., FELDMAN, B.M., PENCHARZ, P.B., LING, S.C., MOORE, A.M. and WALES, P.W., 2014. Defining consensus: a systematic review recommends methodologic criteria for reporting of Delphi studies. *Journal of Clinical Epidemiology*, 67(4), pp. 401-409.

DICKER, R., GILBERT, J., 1988. The role of the telephone in educational research. *British Educational Research Journal*, 14(1), pp. 65-72.

DICKSON-SWIFT, V., JAMES, E.L., KIPPEN, S. and LIAMPUTTONG, P., 2006. Blurring boundaries in qualitative health research on sensitive topics. *Qualitative Health Research*, 16(6), pp. 853-871.

DIECKMANN, P., BIRKVAD RASMUSSEN, M., ISSENBERG, S.B., SØREIDE, E., ØSTERGAARD, D. and RINGSTED, C., 2018. Long-term experiences of being a simulation-educator: A multinational interview study. *Medical Teacher*, 40(7), pp. 713-720.

DOMURACKI, K.J., MOULE, C.J. OWEN, H., KOSTANDOFF, G. and PLUMMER, J.L. 2009. Learning on a simulator does transfer to clinical practice, *Resuscitation*, 80(3), pp. 346-349.

DONALDSON, S.I. and GRANT-VALLONE, E.J. 2002. Understanding self-report bias in organizational behaviour research. *Journal of Business and Psychology*. 17(2), pp. 245-260.

DOODY, O. and NOONAN, M., 2013. Preparing and conducting interviews to collect data. *Nurse Researcher*, 20(5), pp. 28-32.

DOOLEN, J., MARIANI, B., ATZ, T., HORSLEY, T. L., ROURKE, J. O', MCAFEE, K. and CROSS, C. L., 2016. High-fidelity simulation in undergraduate nursing education: A review of simulation reviews. *Clinical Simulation in Nursing*, 12(7), pp. 290-302.

DOUGHERTY, D. and CONWAY, P.H., 2008. The "3T's" road map to transform US health care: the "how" of high-quality care. *JAMA*, 299(19), pp. 2319–2321.

DUFFIELD, C., 1993. The Delphi technique: a comparison of results obtained using two expert panels. *International Journal of Nursing Studies*, 30(3), pp. 230-237.

DUFFY, K. 2003. *Failing students: a qualitative study of factors that influence the decisions regarding assessment of students' competence in practice*. London: Nursing and Midwifery Council.

DUNN, J.C., BELMONT, P.J., LANZI, J., MARTIN, K., BADER, J., OWENS, B. and WATERMAN, B.R., 2015. Arthroscopic shoulder surgical simulation training curriculum: transfer reliability and maintenance of skill over time. *Journal of Surgical Education*, 72(6), pp. 1118-1123.

EBSCO, 2019. *CINAHL: The Cumulative Index to Nursing and Allied Health Literature.* [online]. Barnet: Ebsco. Available from: https://health.ebsco.com/products/the-cinahl-database [Accessed 2 September 2019].

EDWARDS, P., ROBERTS, I., CLARKE, M., DIGUISEPPI, C., PRATAP, S., WENTZ, R. and KWAN, I., 2002. Increasing response rates to postal questionnaires: systematic review. *British Medical Journal*, 324(7347), p. 1183.

ELDRIDGE, S.M., LANCASTER, G.A., CAMPBELL, M.J., THABANE, L., HOPEWELL, S., COLEMAN, C.L. and BOMD, C.M., 2016. Defining feasibility and pilot studies in preparation for randomised controlled trials: development of a conceptual framework. *PLOS One*, 11(3), e0150205.

ELFRINK, V.L., KIRKPATRICK, B., NININGER, J. and SCHUBERT, C., 2010. Using learning outcomes to inform teaching practices in human patient simulation. *Nursing Education Perspectives*, 31(2), pp. 97-100.

ERLAM, G.D., SMYTHE, L. and WRIGHT-ST CLAIR, V. 2017. Simulation Is not a pedagogy. *Open Journal of Nursing*, 7, pp.779-787.

ETIKAN, I., ALKASSIM, R. and ABUBAKAR, S., 2016a. Comparison of snowball sampling and sequential sampling technique. *Biometrics and Biostatistics International Journal*, 3(1), p. 55.

ETIKAN, I., MUSA, S.A. and ALKASSIM, R.S., 2016b. Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics*, 5(1), pp. 1-4.

EUROPEAN COMMISSION, 2019. *EU Data Protection Rules*. [online]. Brussels: European Commission. Available from: https://ec.europa.eu/commission/priorities/justice-and-fundamental-rights/data-protection/2018-reform-eu-data-protection-rules_en [Accessed 6 September 2019].

EVANS, D. and PEARSON, A., 2001. Systematic reviews: gatekeepers of nursing knowledge. *Journal of Clinical Nursing*, 10(5), pp. 593-599.

EWERTSSON, M., ALLVIN, R., HOLMSTRÖM, I.K. and BLOMBERG, K., 2015. Walking the bridge: Nursing students' learning in clinical skill laboratories. *Nurse Education in Practice*, 15(4), pp. 277-283.

EWERTSSON, M., ALLVIN, R., HOLMSTRÖM, I.K. and BLOMBERG, K., 2015. Walking the bridge: nursing students' learning in clinical skill laboratories. *Nurse Education in Practice*, 15(4), pp. 277-283.

FAN, W. and AN, Z., 2010. Factors affecting response rates of the web survey: a systematic review. *Computers in Human Behaviour*, 26(2), pp. 132–139.

FANNING, R.M. and GABA, D.M., 2007. The role of debriefing in simulation-based learning. *Simulation in Healthcare*, 2(2), pp. 115–125.

FEILZER, M. Y. 2010. Doing mixed methods research pragmatically: implications for the rediscovery of pragmatism as a research paradigm. *Journal of Mixed Methods Research*, 4(1), pp. 6-16.

FENWICK, T. and DAHLGREN, M.A., 2015. Towards socio-material approaches in simulation-based education: lessons from complexity theory. *Medical Education*, 49(4), pp. 359-367.

FETTER, M.S., 2009. Curriculum strategies to improve baccalaureate nursing information technology outcomes. *Journal of Nursing Education*, 48(2), pp. 78-85.

FEY, M.K., SCRANDIS, D., DANIELS, A. and HAUT, C., 2014. *Clinical Simulation in Nursing*, 10(5), pp. e249–e256.

FIELDING, N.G. and THOMAS, H., 2008. Qualitative interviewing. In: N. GILBERT, ed. *Researching Social Life*. 3rd ed. London: Sage. pp. 123-144.

FINK, A., 2019. *Conducting research literature reviews: from the internet to paper*. London: Sage Publications.

FINK, A., KOSECOFF, J., CHASSIN, M. and BROOK, R.H., 1984. Consensus methods: characteristics and guidelines for use. *American Journal Health Promotion*, 74(9), pp. 979-983.

FISHER, R.J. and KATZ, J.E., 1999. Social-desirability bias and the validity of self-reported values. *Psychology of Marketing*, 17(2), pp. 105-120.

FLUHARTY, L., HAYES, A., MILGROM, L., MALARNEY, K., SMITH, D., REKLAU, A., JEFFRIES, P. and MCNELIS, A. 2011. A multisite, multi-academic track evaluation of end-of-life simulation for nursing education. *Clinical Simulation in Nursing*, 8(4), pp. e135-e139.

FORD, D.G., SEYBERT, A.L., SMITHBURGER, P.L., KOBULINSKY, L.R., SAMOSKY, J.T. and KANE-GILL, S.L., 2010. Impact of simulation-based learning on medication error rates in critically ill patients. *Intensive Care Medicine*, 36(9), pp.1526-1531.

FORONDA, C., LIU, S. and BAUMAN, B. 2013. Evaluation of simulation in undergraduate nurse education: an integrative review. *Clinical Simulation in Nursing*, 9 (10), pp. e409-e416.

FRASER, K., WRIGHT, B., GIRARD, L., TWOREK, J., PAGET, M., WEILIKOVICH, L., Mc. LAUGHLIN, K., FRASER, K., WRIGHT, B. and GIRARD, L., 2011. Simulation training improves diagnostic performance on a real patient with similar clinical findings. *CHEST*, 139(2), pp. 376-381.

FUSCH, P.I. and NESS, L.R., 2015. Are we there yet? Data saturation in qualitative research. *The Qualitative Report*, 20(9). [online]. Available from: https://nsuworks.nova.edu/tqr/vol20/iss9/3/ [Accessed 12 April 2019].

GABA, D., 2007. The future vision of simulation in healthcare, *Simulation in Healthcare,* 2(2), pp. 126-134.

GANTT, L.T., 2013. The effect of preparation on anxiety and performance in summative simulations. *Clinical Simulation in Nursing*, 9(1), pp. e25-e33.

GARDEN, A., 2008. Research in simulation. In: R.H. RILEY, ed. *Manual of simulation in health care*. Oxford: Oxford University Press. Chapter 18, pp. 227-240.

GBRICH, C., 2007. Qualitative data analysis: an introduction. London: Sage Publications.

GERRISH, K. and LACEY, A., 2010. *The research process in nursing*, 6th ed. Oxford: John Wiley and Sons.

GETENET S.T. and BESWICK K., 2016. Linking Research and Practice. In: S. FAN and J. FIELDING-WELLS, eds. *What is next in educational research*? Rotterdam: Sense Publishers.

GILLHAM, B., 2005. *Research interviewing: the range of techniques. A practical guide*. London: McGraw-Hill Education.

GIULIANO, D.A. and McGREGOR, M. 2014. Assessment of a generalisable methodology to assess learning from manikin-based simulation technology. *Journal of Chiropractic Education,* 30(1), pp. 16-20.

GLOGOWSKA, M., YOUNG, P. and LOCKYER, L., 2011. Propriety, process and purpose: considerations of the use of the telephone interview method in an educational research study. *Higher Education*, 62, pp.17–26.

GOOD, L.M. and GRAVENSTEIN, J.S., 1989. Anaesthesia simulators and training devices. *International Anaesthetic Clinician*, 27, pp.161-166.

GOODMAN, C.M., 1987. The Delphi technique: a critique. *Journal of Advanced Nursing*, 12(6), pp. 729-734.

GOOLSBY, C.A., GOODWIN, T.L. and VEST, R.M., 2014. Hybrid simulation improves medical student procedural confidence during EM clerkship. Military Medicine, 179(11), pp. 1223-1227.

GORDON, C. J. and BUCKLEY, T., 2009. The effect of high-fidelity simulation training on medical-surgical graduate nurses' perceived ability to respond to patient clinical emergencies. *Journal of Continuing Education in Nursing*, 40(11), pp. 491-498.

GRANT, M.J. and BOOTH, A., 2009. A typology of reviews: an analysis of 14 review types and associated methodologies. *Health Information and Libraries Journal*, 26(2), pp. 91-108.

GRANT, J.S., MOSS, J., EPPS, C. and WATTS, P., 2010. Using video-facilitated feedback to improve student performance following high-fidelity simulation. *Clinical Simulation in Nursing*, 6(5), pp. e177-e184.

GREATOREX, J. and DEXTER, T., 2000. An accessible analytical approach for investigating what happens between the rounds of a Delphi study. *Journal of Advanced Nursing*, 32(4), pp.1016-1024.

GRIFFIN-SOBEL, J.P., 2009. The ENTREE model for integrating technologically rich learning strategies in a school of nursing. *Clinical Simulation in Nursing*, 5(2), pp. e73-e78.

GRIFFITHS, C., FOSTER, G., RAMSAY, J., ELDRIDGE, S. and TAYLOR, S., 2007. How effective are expert patient (lay led) education programmes for chronic disease? *British Medical Journal*, 334(7606), pp. 1254-1256.

GUBA, E.G., 1990. *The paradigm dialog*. Newbury Park, CA: Sage Publications, Inc.

GUEST, G., MACQUEEN, K.M. and NAMEY, E.E., 2012. Validity and reliability (credibility and dependability) in qualitative research and data analysis. In: G. GUEST, K.M. MACQUEEN and E.E. NAMEY, eds. *Applied thematic analysis*. Thousand Oaks, CA: Sage Publications, pp.79-106.

GUIMOND, M.E., SOLE, M.L. and SALAS, E., 2011. Getting ready for simulation-based training: a checklist for nurse educators. *Nursing Education Perspectives*, 32(3), pp. 179-185.

GWET, K.L., 2014. *Handbook of inter-rater reliability: the definitive guide to measuring the extent of agreement among raters*. Gathersburg, MD: Advanced Analytics, LLC.

HABIBI, A., SARAFRAZI, A. and IZADYAR, S., 2014. Delphi technique theoretical framework in qualitative research. *International Journal of Engineering and Science*, 3(4), pp. 8-13.

HALLGREN, K.A., 2012. Computing inter-rater reliability for observational data: an overview and tutorial. *Tutorials in Quantitative Methods for Psychology*, 8(1), p. 23.

HALPERN, D.F. and HAKEL, M.D., 2003. Applying the science of learning to the university and beyond: teaching for long-term retention and transfer. *Change*, *35*(4), pp. 36-41.

HAMBLIN, A.C., 1974. Evaluation and Control of Training. *Industrial Training International*, *9*(5), pp. 154-6.

HAMILTON, R.J. and BOWERS, B.J., 2006. Internet recruitment and e-mail interviews in qualitative studies. *Qualitative Health Research*, 16(6), pp.821-835.

HAMMERSLEY, M. 2004. Reflexivity. In *The SAGE encyclopedia of social science research methods*, ed. M. S. LEWIS-BECK, A. BRYMAN, and T. F. LIAO, Vol. 3, pp. 933–935. Thousand Oaks, CA: SAGE Publications.

HANDLEY, R. and DODGE, N., 2013. Can simulated practice learning improve clinical competence? *British Journal of Nursing*, 22(9), pp. 529-535.

HARRIS, M. A., 2011. Simulation-enhanced paediatric clinical orientation. *Journal of Nursing Education*, 50(8), pp. 461-465.

HASSON, F. and KEENEY, S., 2011. Enhancing rigour in the Delphi technique research. *Technological Forecasting and Social Change*, 78(9), pp. 1695-1704.

HASSON, F., KEENEY, S. and MCKENNA, H., 2000. Research guidelines for the Delphi survey technique. *Journal of Advanced Nursing*, 32(4), pp. 1008–1015.

HAYDEN, J., SMILEY, R., ALEXANDER, M., KARDONG-EDGREN, S. and JEFFRIES, P. 2014. The NCSB National Simulation Study: a longitudinal, randomized, controlled study replacing clinical hours with simulation in prelicensure nursing education. *Journal of Nursing Regulation*, 5(2) pp. S43-S64.

HEALTH and CARE PROFESSIONS COUNCIL (HCPC), 2016. *Guidance on conduct and ethics for students.* London: HCPC. Available from: https://www.hcpc-uk.org/globalassets/resources/guidance/guidance-on-conduct-and-ethics-for-students.pdf. [Accessed 9 February 2019].

HEGLAND P.A., AARLIE, H., STRØMME, H. and AMTVEDT, G., 2017. Simulation-based training for nurses: systematic review and meta-analysis. *Nurse Education Today*, 54, pp. 6-20.

HEIKO, A., 2012. Consensus measurement in Delphi studies: Review and implications for future quality assurance. *Technological Forecasting and Social Change*, 79(8), pp. 1525-1536.

HENNEMAN, E.A., ROCHE, J.P., FISHER, D.L., CUNNINGHAM, H., REILLY, C.A., NATHANSON, B.H. and HENNEMAN, P.L., 2010. Error identification and recovery by student nurses using human patient simulation: Opportunity to improve patient safety. *Applied Nursing Research*, 23(1), pp.11-21.

HERMANOWICZ, J.C., 2002. The great interview: 25 strategies for studying people in bed. *Qualitative Sociology*, 25(4), pp. 479-499.

HERRMAN, E.K., 2008. Remembering Mrs Chase before there were smart hospitals and sim men there was Mrs. Chase. *Imprint*, 55(2), pp. 52-55.

HESSE-BIBER, S.N., 2010. *Mixed methods research: merging theory with practice*. New York: Guilford Press.

HOLCOMB, B.R., HOFFART, N. and FOX, M.H., 2002. Defining and measuring nursing productivity: a concept analysis and pilot study. *Journal of Advanced Nursing*, 38(4), pp.378–386.

HOLEY, E.A., FEELEY, J.L., DIXON, J. and WHITTAKER, V.J., 2007. An exploration of the use of simple statistics to measure consensus and stability in Delphi studies. *BMC Medical Research Methodology*, 7(1), p. 52-60.

HOLLOWAY I. and WHEELER S., 2010. Q*ualitative research in nursing and healthcare*. 3rd ed. Oxford: Wiley-Blackwell.

HOLTON III, E.F. 1996. The Flawed Four-Level Evaluation Model. *Human Resource Development Quarterly*, 7(1), pp. 5-21.

HOPE, A., GARSIDE, J. and PRESCOTT, S., 2011. Rethinking theory and practice: pre-registration student nurses experiences of simulation teaching and learning in the acquisition of clinical skills in preparation for practice. *Nurse Education Today*, 31, pp. 711-715.

HOPWOOD, N., 2014. Four Essential Dimensions of Workplace Learning. *Journal of Workplace Learning*, 26(6/7), pp. 349-363.

HSU, C.C. and SANDFORD, B.A., 2007. Minimizing non-response in the Delphi process: How to respond to non-response. *Practical Assessment, Research and Evaluation*, 12(17), pp. 62-78.

HUITT, W. and HUMMEL, J., 2003. Piaget's theory of cognitive development. *Educational Psychology Interactive*, 3(2), pp. 1-5.

HUNT, L.A., MCGEE, P., GUTTERIDGE, R. and HUGHES, M., 2012. Assessment of student nurses in practice: a comparison of theoretical and practical assessment results in England. *Nurse Education Today*, 32(4), pp. 351-355.

HUSSAIN, S.T., LEI, S., AKRAM, T., HAIDER, M.J., HUSSAIN, S.H. and ALI, M., 2018. Kurt Lewin's change model: A critical review of the role of leadership and employee involvement in organizational change. *Journal of Innovation and Knowledge*, 3(3), pp. 123-127.

INTERNATIONAL ASSOCIATION FOR CLINICAL SIMULATION AND LEARNING (INACSL) STANDARDS COMMITTEE, 2016a. INACSL standards of best practice: simulation design. *Clinical Simulation in Nursing*, 12(Suppl), pp. S5-S26.

INTERNATIONAL ASSOCIATION FOR CLINICAL SIMULATION AND LEARNING (INACSL), 2017. *INACSL Standards of Best-practice: Simulation SMINASCL*. 3rd ed. Raleigh, NC: INACSL.

IRONSIDE, P.M., 2001. Creating a research base for nursing education: An interpretive review of conventional, critical, feminist, postmodern, and phenomenologic pedagogies. *Advances in Nursing Science*, 23(3), pp. 72-87.

IRVINE, A., DREW, P. and SAINSBURY, R.D. 2013. 'Am I not answering your questions properly?': clarification, adequacy and responsiveness in semi-structured telephone and face-to-face interviews. *Qualitative Research*, 13(1), pp. 87-106.

ISSENBERG, B.S., MCGAGHIE, W.C., PETRUSA, E.R., LEE GORDON, D. and SCALESE, R.J., 2005. Features and uses of high-fidelity medical simulations that lead to effective learning: a BEME systematic review. *Medical Teacher*, 27(1), pp. 10-28.

IVANKOVA, N.V. and KAWAMURA, Y. 2010. Emerging trends in the utilization of integrated designs in the social, behavioural, and health sciences. In: A. TASHAKKORI and C. TEDDLIE, eds. *SAGE handbook of mixed methods in social & behavioural research.* 2nd ed. Thousand Oaks, CA: SAGE. pp. 581–611.

JAIRATH, N. and WEINSTEIN, J. 1994. The Delphi Methodology (part one): a useful administrative approach. *Canadian Journal of Nursing Administration*, 7(3), pp. 29-40.

JANGHORBAN, R., ROUDSARI, R.L. and TAGHIPOUR, A., 2014. Skype interviewing: the new generation of online synchronous interview in qualitative research. *International Journal of Qualitative Studies on Health and Well-being,* 9(1) p. 24152.

JANIS, I.L., 1972. *Victims of Groupthink: A Psychological Study of Foreign-Policy Decisions and Fiascos*. Boston: Houghton Mifflin.

JANSSON, M., KÄÄRIÄINEN, M. and KYNGÄS, H., 2013. Effectiveness of simulation-based education in critical care nurses' continuing education: a systematic review. *Clinical Simulation in Nursing*, 9(9), pp. e355-e360.

JANSSON, M.M., SYRJÄLÄ, H.P., OHTONEN, P.P., MERILÄINEN, M.H., KYNGÄS, H.A. and ALA-KOKKO, T.I., 2016. Randomized, controlled trial of the effectiveness of simulation education: a 24-month follow-up study in a clinical setting. *America Journal of Infection Control,* 44(4), pp. 387–393.

JASPER, M. and ROSSER, M. 2013. Reflection and reflective practice. In: M. ROSSER, G. P. MOONEY, and M. JASPER, eds. *Professional development, reflection and decision-making in nursing and healthcare* Chichester: Wiley-Blackwell. pp. 41-82.

JEFFRIES, P.R., 2005. A framework for designing, implementing, and evaluating: simulations used as teaching strategies in nursing. *Nursing Education Perspectives*, 26(2), pp. 96-103.

JEFFRIES, P.R., RODGERS, B. and ADAMSON, K., 2015. NLN Jeffries simulation theory: brief narrative description. *Nursing Education Perspectives*, 36(5), pp. 292-293.

JEFFRIES, P.R., 2008. Getting in S.T.E.P. with simulations: simulations take educator preparation. *Nursing Education Perspectives,* 29(2), pp. 70-73.

JEFFRIES, P.R. and RIZZOLO, M.A. 2006. NLN Project Summary Report: d*esigning and implementing models for the innovative use of simulation to teach nursing care of iil Adults and Children: A National Multi-site, Multi-method Study*. Available from: http://www.nln.org/docs/default-source/professional-development-programs/read-the-nln-laerdal-project-summary-report-pdf.pdf?sfvrsn=0 [Accessed 25 July 2018].

JENSEN, U.J., JENSEN, J., OLIVECRONA, G., AHLBERG, G., LAGERQUIST, B. and TORNVALL, P., 2014. The role of a simulator-based course in coronary angiography on performance in real life cath. lab. *BMC Medical Education*, 14, Article 49.

JIANG, G., CHEN, H., WANG, S., ZHOU, Q., LI, X., CHEN, M K. and SUI, X. 2011. Learning curves and long-term outcome of simulation-based thoracentesis for medical students. *BMC Medical Education*, 11, Article 39.

JOANNA BRIGGS INSTITUTE (JBI), 2018. *Critical appraisal tools*. [online]. Adelaide, South Australia. Available from: http://joannabriggs.org/research/critical-appraisal-tools.html [Accessed 5 September 2019].

JOHNSON, L. and PATTERSON, M.D., 2006. Simulation education in emergency medical services for children. *Clinical Paediatric Emergency Medicine*, 7, pp. 121–127.

JOHNSON, R. B., ONWUEGBUZIE, A. J. and TURNER, L. A. 2007. Toward a definition of mixed methods research. *Journal of Mixed Methods Research*, 1(2), pp. 112–133.

JOHNSON, R.B. and ONWUEGBUZIE, A.J., 2004. Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, 33(7), pp. 14-26.

JONES A. and SHEPPARD L. 2011. Use of a human patient simulator to improve physiotherapy cardiorespiratory clinical skills in undergraduate physiotherapy students: A randomised controlled trial. *The Internet Journal of Allied Health Sciences and Practice*, 9, pp. 1-11.

JONES, A.L. and HEGGE, M., 2008. Simulation and faculty time investment. *Clinical Simulation in Nursing*, 4(2), pp. e5–e9.

KARDONG-EDGREN, S., ADAMSON, K.A. and FITZGERALD, C., 2010. A review of currently published evaluation instruments for human patient simulation. *Clinical Simulation in Nursing*, 6(1), pp. e25-e35.

KARDONG-EDGREN, S., LUNGSTROM, N. and BENDEL, R., 2009. VitalSim® versus SimMan®: a comparison of BSN student test scores, knowledge retention, and satisfaction. *Clinical Simulation in Nursing*, *5*(3), pp. e105-e111.

KARNIELI-MILLER, O., STRIER, R. and ESSACH, L., 2009. Power relations in qualitative a thing used as an example to follow or imitate research. *Qualitative Health Research*, *19*(2), pp. 279-289.

KEENEY S, HASSON F. and MCKENNA H., 2006. Consulting the oracle: Ten lessons from using the Delphi technique in nursing research. *Journal of Advanced Nursing*, 53, pp. 205-12.

KEENEY, S., HASSON, F. and MCKENNA, H. 2011. *The Delphi technique in nursing and health research.* Oxford: Wiley-Blackwell.

KEENEY, S., HASSON, F. and MCKENNA, H.P., 2001. A critical review of the Delphi technique as a research methodology for nursing. *International Journal of Nursing Studies*, 38(2), pp. 195-200.

KELLY, M.A., HOPWOOD, N., ROONEY, D. and BOUD, D., 2016. Enhancing students' learning through simulation: Dealing with diverse, large cohorts. *Clinical Simulation in Nursing*, 12(5), pp. 171-176.

KIM, J., PARK, J.H. and SHIN, S., 2016. Effectiveness of simulation-based nursing education depending on fidelity: a meta-analysis. *BMC Medical Education*, *16*(1), p. 152.

KING, C.J., MOSELEY, S., HINDENLANG, B. and KURITZ, P., 2008. Limited use of the human patient simulator by nurse faculty: an intervention program designed to increase use. *International Journal of Nursing Education and Scholarship*, 5(1), pp. 1-17.

KIRKEVOLD, M., 1997. Integrative nursing research: an important strategy to further the development of nursing science and nursing practice. *Journal of Advanced Nursing*, 25(5), pp. 977-984.

KIRKMAN, T., 2013. High-fidelity simulation effectiveness in nursing students' transfer of learning*. International Journal of Nursing Educational Scholarship*, 10(1), pp. 171-176.

KIRKPATRICK, D.L., 1959a. Techniques for evaluating training programs. *Journal of the American Society of Training Directors*, 13, pp. 3–9.

KIRKPATRICK, D.L., 1959b Techniques for evaluating training programs: Part 2 - Learning., *Journal of the American Society of Training Directors* 13, pp. 21–26.

KIRKPATRICK, D.L., 1960a. Techniques for evaluating training programs: Part 3 - Behavior. *Journal of the American Society of Training Directors*, 14, pp. 13–18.

KIRKPATRICK, D.L., 1960b. Techniques for evaluating training programs: Part 4 - Results. *Journal of the American Society of Training Directors*, 14, pp. 28–32.

KIRKPATRICK, D.L., 1985. Effective training and development. Part 2: In-house approaches and techniques. *Personnel*, 62, pp. 52–56.

KIRKPATRICK, D.L., 1976. Evaluation of training. In: R. L. Craig, ed. *Training and development handbook: a guide to human resource development.* 2nd ed. New York: McGraw-Hill. pp. 301–319.

KIRKPATRICK, D.L., 1998. *Evaluating training programs: the four levels.* 2nd ed. San Francisco, CA: Berret-Koehler.

KIRKPATRICK, D. L.,1996. Invited reaction: reaction to Holton article. *Human Resource Quarterly Development*, 7 (1), pp. 23–25.

KIRKPATRICK, D.L. and KIRKPATRICK, J.D., 2006, *Evaluating training programmes: the four levels*. 3rd ed. San Francisco, CA: Berrett-Koehler.

KNEEBONE, R., 2003. Simulation in surgical training: Educational issues and practical applications. *Medical Education,* 37, pp. 267–277.

KNEEBONE, R., 2005. Evaluating clinical simulations for learning procedural skills: a theory-based approach. *Academic Medicine*, 80(6), pp. 549-553.

KNOWLES, M.S., 1968. Andragogy, not pedagogy. *Adult Leadership*, 16(10), pp. 350-352.

KNOWLES, M.S., HOLTON, E.F. and SWANSON, R. A., 2005. *Adult learner.* Burlington, MA: Elsevier.

KOENIG B.A., BACK A.L. and CRAWLEY L.M., 2003 Qualitative methods in end-of-life research: recommendations to enhance the protection of human subjects. *Journal of Pain and Symptom Management,* 25(4), pp. S43–S52.

KOLB, D., 1984. *Experiential learning: experience as a source of learning and development*. New Jersey: Prentice Hall Partners.

KRAIGER, K., FORD, J.K. and SALAS, E., 1993. Application of cognitive, skill-based, and affective theories of learning outcomes to new methods of training evaluation. *Journal of Applied Psychology*, 78(2), pp. 311-328.

KRUEGER, R.A., 2014. *Focus groups: a practical guide for applied research*. London: Sage Publications.

KUHN, T.S., 1962. *The structure of scientific revolutions.* Chicago: University of Chicago Press.

KUMAR, A., WALLACE, E.M., SMITH, C. and NESTEL, D. 2019. Effect of an in-situ simulation workshop on home-birth practice in Australia. *Women and birth*, 32(4), pp. 346-355.

LAERDAL, 2012. *Nursing Anne.* [online]. Orpington: LAERDAL. Available from: https://www.laerdal.com/gb/products/simulation-training/nursing/nursing-anne/

LAMBERT, V.A. and LAMBERT, C.E., 2012. Qualitative descriptive research: an acceptable design. *Pacific Rim International Journal of Nursing Research*, 16(4), pp. 255-256.

LANDY, F. J. and CONTE, J. M., 2007. *Work in the 21st century: an introduction to industrial and organizational psychology.* 2nd ed. Malden: Blackwell.

LAPKIN, S. and LEVETT-JONES, T., 2011. A cost–utility analysis of medium vs. high-fidelity human patient simulation manikins in nursing education. *Journal of Clinical Nursing*, 20(23-24), pp. 3543-3552.

LARUE, C., PEPIN, J. and ALLARD, É., 2015. Simulation in preparation or substitution for clinical placement: a systematic review of the literature. *Journal of Nursing Education and Practice*, 5(9), pp. 132-140.

LASATER, K., 2007. High fidelity simulation and the development of clinical judgement: student's experiences. *Journal of Nursing Education* 46(6), pp. 269–306.

LAVE, J. and WENGER, E., 1990. *Situated Learning: legitimate peripheral participation.* Cambridge: Cambridge University Press.

LAVE, J. and WENGER, E. 1999 Learning and Pedagogy in Communities of Practice. In: J. LEACH and B. MOON. *Learners and Pedagogy.* London: Paul Chapman Publishing Ltd.

LAVELLE, M., ATTOE, C., TRITSCHLER, C. and CROSS, S. 2017. Managing medical emergencies in mental health settings using an interprofessional in-situ simulation training programme: a mixed methods evaluation study. *Nurse Education Today*, 59, pp.103-109.

LEACH, J. and MOON, B., 1999. *Learners and pedagogy*. London: Sage Publications Ltd.

LEE, S., SHIN, J., KIM, D., Kim, E., HWANG, J. and YOON, H.B., 2014. Evaluation of first year outcomes of Lee Jong-Wook Seoul Project using Kirkpatrick's four-level evaluation approach. *Korean Journal of Medical Education,* 26 (1), pp. 41-51.

LEGARD, R., KEEGAN, J. and WARD, K., 2003. In-depth interviews. In: J. RITCHIE and J. LEWIS. *Qualitative research practice: a guide for social science students and researchers.* London: Sage. pp. 138-169.

LEVETT-JONES, T., LAPKIN, S., HOFFMAN, K., ARTHUR, C. and ROCHE, J., 2011. Examining the impact of high and medium fidelity simulation experiences on

nursing students' knowledge acquisition. *Nurse Education in Practice*, 11(6), pp. 380-383.

LIAW, S.Y., CHANA, S.W., SCHERPBIERB, A., RETHANSB, J. and PUAC, G.G. 2012. Recognizing, responding to and reporting patient deterioration: transferring simulation learning to patient care settings. *Resuscitation*, 83, pp. 395– 398.

LIAW, S.Y., WONG, L.F., LIM, E.Y.P., ANG, S.B.L., MUJUMDAR, S., HO, J.T.Y., MORDIFFI, S.Z. and ANG, E.N.K., 2016. Effectiveness of a web-based simulation in improving nurses' workplace practice with deteriorating ward patients: a pre- and postintervention study. *Journal of Medical Internet research*, 18(2), p. e37.

LICHTMAN, M. 2010. *Qualitative research in education: A user's guide*. 2nd ed. Thousand Oaks, CA: SAGE Publications.

LIKERT, R. 1932. A technique for the measurement of attitudes. *Archives of Psychology*, 22(140), pp. 1–55.

LINCOLN, Y. S. and GUBA, E. G.,1985. *Naturalistic inquiry*. Beverly Hills, CA: Sage.

LINCOLN, Y.S., LYNHAM, S.A. and GUBA, E.G., 2011. Paradigmatic controversies, contradictions, and emerging confluences, revisited. In: N.K. DENZIN and Y.S. LINCOLN, eds. *The Sage handbook of qualitative research.* 4th ed. Thousand Oaks, CA. Sage. Chapter 6, pp.97-128.

LINDSTROM-HAZEL, D. and WEST-FRASIER, J. 2004. The issue is: Preparing students to hit the ground running with problem-based learning standardized simulations. *American Journal of Occupational Therapy*, 58, pp. 236–239.

LINNARD-PALMER, L. R., PHILLIPS, W., FINK, M., CATOLICO, O., and SWEENY, N. 2013. Testing a mnemonic on response skills during simulated codes. *Clinical Simulation in Nursing*, 9(6), pp. e191-e197.

LINSTONE, H.A., 1978. The Delphi technique. In: R.B. FOWLES, ed. *Handbook of Futures Research.* Westport, CT: Greenwood Press.

LINSTONE, H.A. and TUROFF, M., eds., 1975. *The Delphi method: techniques and applications*. Massachusetts: Addison-Wesley Publishing Company Inc.

LINSTONE, H.A. and TUROFF, M., eds., 2002. *The Delphi method: techniques and applications*. New York: New Jersey Institute of Technology.

LÖFMARK, A. and MÅRTENSSON, G., 2017. Validation of the tool assessment of clinical education (AssCE): study using Delphi method and clinical experts. *Nurse Education Today*, 50, pp. 82–86.

LOVELL, R.B. 1980. *Adult learning*. London: Croom-Helm.

LUNDBERG, K.M., 2008. Promoting self-confidence in clinical nursing students. *Nurse Educator,* 33(2), pp. 86–89.

MACKWAY-JONES K., CARLEY S.D. and ROBSON J. 1999. Planning for major incidents involving children by implementing a Delphi study. *Archives of Diseases in Childhood*, 80(5), pp. 410-413.

MADENCI, A.L., SOLIS, C.V. and DEMOYA, M.A. 2014. Central venous access by trainees: a systematic review and meta-analysis of the use of simulation to improve success rate on patients. *Simulation in Health Care,* 9(1), pp. 7-14.

MANSELL, I., BENNETT, G., NORTHWAY, R., MEAD, D. and MOSELEY, L., 2004. The learning curve: the advantages and disadvantages in the use of focus groups as a method of data collection. *Nurse Researcher*, 11(4), pp. 79-89.

MARAN, N.J. and GLAVIN, R.J., 2003. Low-to-high-fidelity simulation: a continuum of medical education, *Medical Education,* 37, (Suppl 1), pp. 22-28.

MARCHAIS-ROUBELAT, A. and ROUBELAT, F., 2011. The Delphi method as a ritual: Inquiring the Delphic Oracle. *Technological Forecasting & Social Change*, 78(9), pp. 1491–1499.

MARCUS, H., VAKHARIA, V., KIRKMAN, M.A., MURPHY, M. and NANDI, D., 2013. Practice Makes Perfect? The Role of Simulation-Based Deliberate Practice and Script-Based Mental Rehearsal in the Acquisition and Maintenance of Operative Neurosurgical Skills. *Neurosurgery*, 72, (Suppl 1), pp. A124–A130.

MASSEY, V.H. and WARBLOW, N.A., 2005. Using a clinical simulation to assess program outcomes. *Annual Review of Nursing Education*, 3, p. 95.

MAY, W., PARK, J.H. and LEE, J.P., 2009. A ten-year review of the literature on the use of standardized patients in teaching and learning: 1996–2005. *Medical Teacher*, 31(6), pp. 487-492.

MCCAFFERY, P., 2018. *The higher education manager's handbook: effective leadership and management in universities and colleges*. 3rd ed. Abingdon: Routledge.

MCCALLUM, J., NESS, V. and PRICE, T., 2011. Exploring nursing students' decision-making skills whilst in a Second Life clinical simulation laboratory. *Nurse Education Today,* 31(7), pp. 699-704.

MCCAUGHEY, C.S. and TRAYNOR, M.K., 2010. The role of simulation in nurse education*. Nurse Education Today,* 30(8), pp. 827-832.

MCCONNELL-HENRY, T., JAMES, A., CHAPMAN, Y. and FRANCIS, K., 2010. Researching with people you know: issues in interviewing. *Contemporary Nurse*, 34(1), pp. 2-9.

MCDERMID, F., PETERS, K., JACKSON, D and DALY, J., 2014. Conducting qualitative research in the context of pre-existing peer and collegial relationships. *Nurse Researcher*, 21(5), pp. 28-33.

MCGAGHIE, W. C., ISSENBERG, S. B., PETRUSA, E. R. and SCALESE, R. J., 2010, A critical review of simulation-based medical education research: 2003–2009. *Medical Education*, 44(1), pp. 50–63.

McGAGHIE, W.C. 2010. Medical Education Research as Translational Science. *Science Translational Medicine,* 2(19), p. 1-3.

McGAGHIE, W.C., ISSENBERG, S.B. PETRUSA, E.R. and SCALESE, R.J. 2006. Effect of practice on standardised learning outcomes in simulation-based medical education. *Medical Education,* 40(8), pp. 792-797.

McGAGHIE, W.C., ISSENBERG, S.B., BARSUK, J.H. and WAYNE, D.B. 2014. A critical review of simulation-based mastery learning with translational outcomes. *Medical Education*, 48(4), pp. 1365-2923.

MCKENNA H, HASSON F. and KEENEY S., 2006. Surveys. In: K. GERRISH and LACEY, A., eds. *The research process in nursing*. 5th ed. Oxford: Blackwell Publishing.

MCKENNA, H.P., 1994. The Delphi technique: a worthwhile approach for nursing*? Journal of Advanced Nursing*, 19(6), pp. 1221-1225.

MCLAFFERTY, E., 2007. Developing a questionnaire to measure nurses' attitudes towards hospitalized older people. *International Journal of Older People Nursing*, 2(2), pp. 83-92.

MCMILLAN, S.S., KING, M. and TULLY, M. P., 2016. How to use the nominal group and Delphi techniques. *International Journal Clinical Pharmacology*, 38, pp. 655-662.

MCNEILL, J., PARKER, R.A., NADEAU, J., PELAYO and L.W. COOK, J., 2012. Developing nurse educator competency in the pedagogy of simulation. *Journal of Nursing Education*, 51(12), pp. 685-691.

MCNEILL, P. and CHAPMAN, S., 2005. *Research methods*. 3rd ed. London: Routledge.

MERCER, J., 2007. The challenges of insider research in educational institutions: wielding a double-edged sword and resolving delicate dilemmas. *Oxford Review of Education*, 33(1), pp. 1-17.

MERRIAM, S. 2001. Andragogy and self-directed learning: pillars of adult learning theory. *New Directions for Adult and Continuing Education*, 89(Spring), pp. 3-14.

MERRIMAN, C. D., STAYT, L. C. and RICKETTS, B. 2014. Comparing the effectiveness of clinical simulation versus didactic methods to teach undergraduate adult nursing students to recognize and assess the deteriorating patient. *Clinical Simulation in Nursing*, 10(3), pp. e119-e127.

MEYER, M.N., CONNORS, H., HOU, Q. and GAJEWSKI, B. 2011. The effect of simulation on clinical performance: a junior nursing student clinical comparison. S*imulation in Healthcare*, 6(5), pp. 269-277.

MILES, M.B. and HUBERMAN, A.M., 1994. *Qualitative data analysis: an expanded sourcebook*. Thousand Oaks, CA: Sage.

MILLER, D.W. 2006. *Out of error: further essays on critical rationalism.* Farnham: Ashgate.

MILLER, G.E., 1990. The assessment of clinical skills/ performance/competence. *Academic Medicine*, 65(9), pp. S63-S67.

MILLS, C.W., 1959. *The sociological imagination*. New York: Oxford University Press.

MOHER, D., LIBERATI, A., TETZLAFF, J. and ALTMAN, D.G. 2009. The PRISMA Group. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Medicine*, 6(7), p. e1000097.

MOULE, P., 2011. Simulation in nurse education: past, present and future. *Nurse Education Today*, 31(7), pp. 645-646.

MURAD, M.H., CHU, H., LIN, L., WANG, Z., 2018. The effect of publication bias magnitude and direction on the certainty in evidence. *BMJ Evidence-Based Medicine*, 23(3), pp. 84-86.

MURPHY, E., 1997. *Constructivism: from philosophy to practice*. [online]. Washington, DC: ERIC Database, Institute of Education Sciences. Available from: https://eric.ed.gov/?id=ED444966 [Accessed 6 September 2019].

MURPHY, M.K., BLACK, N.A., LAMPING, D.L., MCKEE, C.M., SANDERSON, C.F.B., NASKHAM, J. and MARTEAU. T., 1998. Consensus development methods, and their use in clinical guideline development. *Health Technology Assessment*, 2(3), pp. i-iv.

NAGLE, B.M., MCHALE, J.M., ALEXANDER, G.A. and FRENCH, B.M., 2009. Incorporating scenario-based simulation into a hospital nursing education programme. *Journal of Continuing Education in Nursing*, 40(1), pp. 18-25.

NAOUR, P., 2009. *E.O. Wilson and B.F. Skinner: a dialogue between ocio-biology and radical behaviourism.* Pella: Springer Science and Business Media.

NASH, R. and HARVEY, T., 2017. Student nurse perceptions regarding learning transfer following high-fidelity simulation. *Clinical Simulation in Nursing*, 13(10), pp. 471-477.

NATIONAL INSTITUTE FOR HEALTH RESEARCH, 2017. *Guidance on applying for feasibility studies*. London: Department of Health and Social Care. Available from: https://www.nihr.ac.uk/documents/nihr-research-for-patient-benefit-rfpb-programme-guidance-on-applying-for-feasibility-studies/20474 [Accessed 7 January 2019].

NEHRING, W.M., 2008. US boards of nursing and the use of high-fidelity patient simulators in nursing education. *Journal of Professional Nursing*, 24(2), pp. 109-117.

NESTEL, D. and BEARMAN, M. 2015. Theory and simulation-based education: definitions, worldviews and applications. *Clinical Simulation in Nursing*, 11(8), pp. 349-354.

NESTEL, D. and KNEEBONE, R., 2010. Authentic patient perspectives in simulations for procedural and surgical skills. *Academic Medicine*, 85(5), pp. 889-893.

NHS RESEARCH SCOTLAND, 2019. *Research Ethics Structure in Scotland*. [online]. Clydebank: NHS Research Scotland. Available from: http://www.nhsresearchscotland.org.uk/services/research-ethics [Accessed 5 January 2019].

NICKERSON, M. and POLLARD, M., 2010. Mrs Chase and her descendants: a historical view of simulation. *Creative Nursing,* 16(3), pp. 101-105.

NIELSEN, B. and HARDER, N., 2013. Causes of student anxiety during simulation: what the literature says. *Clinical Simulation in Nursing*, *9*(11), pp. e507-e512.

NOE, R.A. and SCMITT, N.M., 1986. The influence of trainee attitudes on training effectiveness: test of a model. *Personnel Psychology*, 39, pp. 497-523.

NORCINI, J. 2010. The power of feedback. *Medical Education*, 44(1), pp. 16–17.

NORMAN, J. 2018. Differences in Learning Outcomes in Simulation: The observer role. *Nurse Education in Practice*, 28, pp.242-247.

NORMAN, J., 2012. Systematic review of the literature on simulation in nursing education. *ABNF Journal*, 23(2), pp. 24-28.

NOVICK, G., 2008. Is there a bias against telephone interviews in qualitative research? *Research in Nursing and Health*, 31(4), pp. 391-398.

NULTY, D.D., 2008. The adequacy of response rates to online and paper surveys: what can be done? *Assessment and Evaluation in Higher Education*, 33(3), pp. 301–314.

NURSING and MIDWIFERY COUNCIL (NMC) and COUNCIL OF DEANS FOR HEALTH, 2007. *Simulation and practice learning project: outcome of a pilot study to test the principles for auditing simulated practice learning environments in the pre-registration nursing programme: final report.* London: NMC.

NURSING AND MIDWIFERY COUNCIL (NMC), 2018. *Part 1: Standards framework for nursing and midwifery education*. [online]. London: NMC. Available from: https://www.nmc.org.uk/globalassets/sitedocuments/education-standards/education-framework.pdf [Accessed 28 March 2019].

NURSING and MIDWIFERY COUNCIL (NMC), 2018. *Standards for education.* [online]. London: NMC.
Available from: https://www.nmc.org.uk/education/standards-for-education2/ [Accessed 28 March 2019].

NURSING AND MIDWIFERY COUNCIL (NMC), 2018. *Standards of proficiency for registered nurses*. [online]. London: NMC. Available from: https://www.nmc.org.uk/standards/standards-for-nurses/standards-of-proficiency-for-registered-nurses/ [Accessed 28 March 2019].

NURSING AND MIDWIFERY COUNCIL (NMC), 2018. *The Code: Professional standards of practice and behaviour for nurses, midwives and nursing associates.* [online]. London: NMC. Available from: https://www.nmc.org.uk/standards/code/ [Accessed 20 December 2018].

OERMANN, M.H., KARDONG-EDGREN, S.E. and ODOM-MARYON, T., 2011. Effects of monthly practice on nursing students' CPR psychomotor skill performance. *Resuscitation*, 82(4), pp. 447-453.

OH, P.J., JEON, K.D. and KOH, M.S., 2015. The effects of simulation-based learning using standardized patients in nursing students: a meta-analysis. *Nurse Education Today*, 35(5), pp. e6-e15.

OXFORD ENGLISH DICTIONARY, 2019. *[Definition of "model"]*. [online]. Oxford: Lexico. Available from: https://en.oxforddictionaries.com/definition/model [Accessed 2 March 2019].

OXFORD ENGLISH DICTIONARY, 2017. *Oxford English Dictionary*. [online]. Oxford: Oxford University Press. Available from: http://dictionary.oed.com. [Accessed 9 September 2017].

PALYS, T., 2008. Purposive sampling. In: L.M. GIVEN, ed. *The Sage encyclopaedia of qualitative research methods.* London: Sage. pp.697-698.

PARAHOO, K., 2014. *Nursing research: principles, process and issues*. 3rd ed. Basingstoke: Palgrave Macmillan.

PARKER, B.A. and GRECH, C., 2018. Authentic practice environments to support undergraduate nursing students' readiness for hospital placements. A new model of practice in an on campus simulated hospital and health service. *Nurse Education in Practice*, *33*, pp. 47-54.

PARTIN, J. L., PAYNE, T. A. and SLEMMONS, M. F., 2011. Students' perceptions of their learning experiences using high-fidelity simulation to teach concepts relative to obstetrics. *Nursing Education Perspectives*, 32(3), pp. 186-188.

PATTON, M.Q., 1999. Enhancing the quality and credibility of qualitative analysis. *Health Services Research*, 34(5 Pt 2), pp. 1189-1208.

PEARSALL, J., ed. 1999. *The concise Oxford English Dictionary*. 10th ed. Oxford: Clarendon.

PEYTON, J.W.R., ed., 1998. *Teaching and learning in medical practice*. Rickmansworth: Manticore Europe.

POLIT, D.F. and BECK, C.T., 2006. The Content Validity Index: are you sure you know what's being reported? Critique and recommendations. *Research in Nursing and Health*, 29, pp. 489–497.

POOLMAN, R.W., STRUIJS, P.A., KRIPS, R., SIEREVELT, I.N., MARTI, R.K., FARROKHYAR, F. and BHANDARI, M., 2007. Reporting of outcomes in orthopaedic randomized trials: does blinding of outcome assessors' matter? *JBJS*, 89(3), pp. 550-558.

POPA, F., GUILLERMIN, M. and DEDEURWAERDERE, T., 2015. A pragmatist approach to transdisciplinarity in sustainability research: From complex systems theory to reflexive science. *Futures*, 65, pp.45-56.

POSTAREFF, L., LINDBLOM-YLÄNNE, S. and NEVGI, A., 2007. The effect of pedagogical training on teaching in higher education. *Teaching and Teacher Education*, 23, pp. 557–571.

POWELL, K. 2006. Inside-out and outside-in: Participant observation in Taiko drumming. In *Innovation in educational ethnography: Theory, methods, and results*, ed. G. SPINDLER AND L. HAMMOND, pp.33–64. Mahwah, NJ: Lawrence Erlbaum.

PRASLOVA, L., 2010. Adaptation of Kirkpatrick's four level model of training criteria to assessment of learning outcomes and program evaluation in higher education. *Educational Assessment, Evaluation and Accountability*, 22(3), pp. 215-25.

PRESSER, S., COUPER, M.P., LESSLER, J.T., MARTIN, E., MARTIN, J., ROTHGEB, J.M. and SINGER, E., 2004. Methods for testing and evaluating survey questions. *Public Opinion Quarterly*, 68(1), pp. 109–130.

PATTEN, M.L., 2016. *Questionnaire research: a practical guide*. 4th ed. Abingdon: Routledge.

PRION, S. 2008. A practical framework for evaluating the impact of clinical simulation experiences in pre-licensure nursing education. *Clinical Simulation in Nursing*, 4(5), pp. e69-e78.

PRITCHARD, S.A., BLACKSTOCK, F.C., NESTEL, D. and KEATING, J.L., 2016. Simulated patients in physical therapy education: systematic review and meta-analysis. *Physical Therapy*, 96(9), pp. 1342-1353.

QSR INTERNATIONAL PTY LTD., 2015. *NVivo software*. Version 11. Doncaster, Victoria 3108, Australia.

RAEMER, D., ANDERSON, M., CHENG, A., FANNING, R., NADKARNI, V. and SAVOLDELLI, G., 2011, Research regarding debriefing as part of the learning process. *Simulation in Healthc*are, 6(7), pp. S52–S57.

RAVIK, M., HAVNES, A. and BJØRK, I.T. 2015. Exploring nursing students' transfer of peripheral venous cannulation from skills centre to the clinical setting. *Journal of Nursing Education and Practice*, 5(3), pp. 59-70.

REBER, J.S., DOWNS, S.D. and PETERSON-NELSON, J.A., 2017. Effects of three pedagogies on learning outcomes in a psychology of gender lecture: a quasi-experimental study. *Teaching of Psychology*, 44(2), pp. 134-144.

REHMANN, A. J., MITMAN, R. D. and REYNOLDS, M. C., 1995. *A handbook of flight simulation fidelity requirements for human factors research*. [online]. Atlantic City, NJ: U.S. Department of Transportation Federal Aviation Administration. Available from: https://apps.dtic.mil/dtic/tr/fulltext/u2/a303799.pdf [Accessed 24 August 2017].

REHN, M., ANDERSEN, J.E., VIGERUST, T., KRÜGER, A.J. and LOSSIUS, H.M., 2010. A concept for major incident triage: full-scaled simulation feasibility study. *BMC Emergency Medicine*, 10(1), p. 17.

REID-SEARL, K., EATON, A., VIETH, L. and HAPPELL, B., 2011. The educator inside the patient: student insights into the use of high-fidelity silicone patient simulation. *Journal of Clinical Nursing*, 20(19-20), pp. 2752-2760.

RESEARCH COUNCIL UK (RCUK), 2015. *RCUK Common Principles on Data Policy*. [online]. London: RCUK. Available from: http://www.rcuk.ac.uk/research/datapolicy/ [Accessed 12 December 2017].

RESEARCH COUNCIL UK, 2015. *Guidance on best practice in the management of research data*. [online]. London: RCUK. Available from: https://www.ukri.org/files/legacy/documents/rcukcommonprinciplesondatapolicy-pdf/ [Accessed 11 January 2019].

RHODES, H., 2011. Practice to live by. *Kansas Nurse*, 86(6), pp.22-24.

RICHARDSON, W.S., WILSON, M.C., NISHIKAWA, J. and HAYWARD, R.S., 1995. The well-built clinical question: a key to evidence-based decisions. *ACP Journal Club*, 123, pp. A12.

RICKETTS, B. 2011. The role of simulation for learning within pre-registration nursing education: a literature review. *Nurse Education Today*. 31(7), pp. 650-654.

RIDLEY, R.T., 2009. Assuring ethical treatment of students as research participants. *Journal of Nursing Education*, 48(10), pp. 537-541.

ROBERT GORDON UNIVERSITY, 2015. *Research Governance and Integrity Policy*. [online]. Aberdeen: RGU. Available from: https://www.rgu.ac.uk/research/university-research-policies/research-governance-ethics [Accessed 6 September 2019].

ROBERTS, F.E. and COOPER, K., 2018; The effectiveness of high-fidelity simulation versus low fidelity simulation on practical/clinical skills development in

pre-registration physiotherapy students: A systematic review. *JBI Database of Systematic Reviews & Implementation Reports*, 17(6), pp. 1229-1255.

ROSS, J.G., 2015. The Effect of Simulation Training on Baccalaureate Nursing Students' Competency in Performing Intramuscular Injection. *Nursing Education Perspectives*, 36(1), pp.48-49.

ROTH, C., BREWER, M. and WIECK, K. L. 2017. Using a Delphi method to identify human factors contributing to nursing errors. *Nursing Forum*, 52(3), pp. 173–179.

ROWE, G. and WRIGHT, G., 1999. The Delphi technique as a forecasting tool: issues and analysis. *International Journal of Forecasting*, 15(4), pp. 353-375.

ROWE, G. and WRIGHT, G., 2001. Expert opinions in forecasting: the role of the Delphi technique. In: J.S. ARMSTRONG, ed. *Principles of forecasting.* Springer, Boston, MA. Section 4, pp. 125-144.

ROWE, G., WRIGHT, G. and BOLGER, F., 1991. Delphi: a re-evaluation of research and theory. *Technological Forecasting and Social Change*, 39(3), pp. 235-251.

ROYAL COLLEGE of NURSING (RCN), 2019. *Members crucial to securing safe staffing law*. [online]. London: RCN. Available from: https://www.rcn.org.uk/magazines/bulletin/2019/march/members-crucial-to-securing-safe-staffing-law [Accessed 26 March 2019].

ROYSE, M. and NEWTON, S., 2007. How gaming is used as an innovative strategy for nursing education. *Nursing Education Perspectives*, 28(5), pp. 263-268.

RUTHERFORD-HEMMING, T., 2012. Learning in simulated environments: effect on learning transfer and clinical skill acquisition in nurse practitioner students. *Journal of Nursing Education,* 51(7), pp. 403-406.

RUTHERFORD-HEMMING, T. and ALFES, C.M., 2017. The use of hospital-based simulation in nursing education: a systematic review. *Clinical Simulation in Nursing*, 13(2), pp.78-89.

RUTHERFORD-HEMMING, T., KELSEY, N.C., GRENIG, D.L., FELICIANO, M., SIMKO, L. and HENRICH, C.M., 2016. Multisite single-blinded randomized control study of transfer and retention of knowledge and skill between nurses using simulation and online self- study module. *Simulation in Healthcare,* 11(4), pp. 264–270.

RUTHERFORD-HEMMING, T., NYE, C. and CORAM, C., 2016. Using simulation for clinical practice hours in nurse practitioner education in the United States: a systematic review. *Nurse Education Today*, 37, pp. 128-135.

RYAN F, COUGHTAN M. and CRONIN P., 2009. Interviewing in qualitative research: the one-to-one interview. *International Journal of Therapy and Rehabilitation,* 16(6), pp. 309-314.

RYOO, E.N. and HA, E.H., 2015. The importance of debriefing in simulation-based learning: comparison between debriefing and no debriefing. *CIN: Computers, Informatics, Nursing*, 33(12), pp.538-545.

SACKMAN, H., 1974. *Delphi assessment: Expert opinion, forecasting, and group process*. [online]. San-Francisco, CA: Berrett-Koehler Publishers. Available from: https://www.rand.org/pubs/reports/R1283.html [Accessed 6 September 2019].

SANDELOWSKI M., 1995. Qualitative analysis: what it is and how to begin. *Research in Nursing and Health,* 18, pp. 371–375.

SANDELOWSKI, M. 2014. Un-mixing mixed-methods research. *Research in Nursing and Health*, 37(1), pp. 3–8.

SANDELOWSKI, M., 2010. What's in a name? Qualitative description revisited. *Research in Nursing and Health*, 33(1), pp. 77–84.

SANDELOWSKI M. and BARROSO J., 2003. Classifying the findings in qualitative studies. *Qualitative Health Research*, 13, pp. 905–923.

SANDO, C., FARAGHER, J., BOESE, T. and DECKER, S., 2011. Simulation standards development: an idea inspires. *Clinical Simulation in Nursing*, 7(3), pp. e73-e74.

SAUNDERS, M., LEWIS, P. and THORNHILL, A. 2007. *Research methods for business students.* 4th ed. Harlow: Pearson Education.

SCHAAR, G. L., OSTENDORF, M. J. and KINNER, T. J. 2013. Simulation: linking quality and safety education for nurses competencies to the observer role. *Clinical Simulation in Nursing*, 9(9), pp. e401-e404.

SCHNEIDER, P.J., PEDERSEN, C.A., MONTANYA, K.R., CURRAN, C.R., HARPE, S.E., BOHENEK, W. and WELLMAN, K.E., 2006. Improving the safety of medication administration using an interactive CD-ROM program. *American Journal of Health System Pharmacy,* 63(1), pp. 59–64.

SCHNEIDER, S.M. and MORRIS, E.K., 1987. A history of the term radical behaviourism: From Watson to Skinner. *Behaviour Analyst*, 10(1), pp. 27-39.

SCHOENING, A.M., SITTNER, B.J. and TODD, M.J., 2006. Simulated clinical experience: nursing students' perceptions and the educators' role. *Nurse Educator,* 31(6), pp. 253–258.

SCHOFIELD, R. 2018. Entry-to-practice public health nursing competencies: a Delphi method and knowledge translation strategy. *Nurse Education Today*, 65, pp. 102–107.

SCHON, D. A. 1991. *The reflective practitioner: how professionals think in action*. Aldershot: Avebury.

SCHON, D.A., 1987. *Educating the reflective practitioner: toward a new design for teaching and learning in the professions*. San Francisco, CA: Jossey-Bass.

SCHULZ, K.F. and GRIMES, D.A., 2002. Blinding in randomised trials: hiding who got what. *The Lancet*, *359*(9307), pp. 696-700.

SCOTTISH CLINICAL SKILLS NETWORK, 2019. *Scottish Clinical Skills Network*. [online]. Aberdeen: Scottish Clinical Skills Network. Available from: https://www.scsn.scot.nhs.uk/ [Accessed 6 September 2019].

SCOTTISH FUNDING COUNCIL (SFC), 2019. Intake targets for the controlled subject of Pre-registration Nursing and Midwifery in universities for academic tear 2018-19. [online]. Edinburgh: SFC.
Available from:
http://www.sfc.ac.uk/web/FILES/announcements_sfcan042018/SFCAN042018_Intake_Targets_for_Pre-registration_Nursing_and_Midwifery_2018-19.pdf
[Accessed 29 March 2019].

SEARS, K., GOLDSWORTHY, S. and GOODMAN, W.M., 2010. The relationship between simulation in nursing education and medication safety. *Journal of Nursing Education*, 49(1), pp. 52-55.

SENGE, P., 1990. The art and practice of the learning organization. In: M. RAY and A. RINZLER, eds. *The new paradigm in business: emerging strategies for leadership and organizational change.* New York: Tarcher/Putnam. Ch. 13, pp.126-138.

SHUY, R.W., 2003. In-person versus telephone interviewing. In: J.A HOLSTEIN and J.F. GUBRIUM. *Inside interviewing: new lenses, new concerns*. London: Sage. Ch. 9, pp.175-193.

SINGH, S., SEDLACK, R.E. and COOK, D.A., 2014. Effects of simulation-based training in gastrointestinal endoscopy: a systematic review and meta-analysis. *Clinical Gastroenterology and Hepatology*, 12(10), pp. 1611-1623.

SKINNER, B.F. 1953. *Science and human behaviour*. New York: Free Press.

SKULMOSKI, G.J., HARTMAN, F.T. and KRAHN, J., 2007. The Delphi method for graduate research. *Journal of Information Technology Education*, *6*, pp. 1-21.

SMAGORINSKY, P., 2011. *Vygotsky and literacy research: a methodological framework*. Rotterdam: Sense Publishers.

SPARKES, A., 2005. Narrative analysis: exploring the what's and how's of personal stories. In: I. HOLLOWAY, ed. *Qualitative research in health care*. Maidenhead: Open University Press. Ch 11, pp.191–208.

STEPHENS, N., 2007. Collecting data from elites and ultra-elites: telephone and face-to-face interviews with macroeconomists. *Qualitative Research*, 7(2), pp. 203-216.

STEWART, D., GIBSON-SMITH, K., MACLURE, K., MAIR, A., ALONSO, A., CODINA, C., CITTADINI, A., FERNANDEZ-LLIMOS, F., FLEMING, G., GENNIMATA, D., GILLESPIE, U., HARRISON, C., JUNIUS-WALKER, U., KARDAS, P., KEMPEN, T., KINNEAR, M., LEWEK, P., MALVA, J., MCINTOSH, J., SCULLIN, C. and WIESE, B. 2017. A modified Delphi study to determine the level of consensus across the European Union on the structures, processes and desired outcomes of the management of polypharmacy in older people. *PLoS ONE*, 12(11). [online]. Available from: https://doi.org/10.1371/journal.pone.0188348 [Accessed 14 November 2018].

STRAUSS, M.B., 1968. Familiar medical quotations [online]. Available from: https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=STRAUSS%2C+M.B.%2C+1968.+Familiar+medical+quotations+&btnG [Accessed 18 January 2019]

STULL, A. and MAYER, R. 2007. Learning by doing versus learning by viewing: three experimental comparisons of learner-generated versus author-provided graphic organizers. *Journal of Educational Psychology*, 99(4), pp. 808-820.

STURGES, J.E. and HANRAHAN, K.J., 2004. Comparing telephone and face-to-face qualitative interviewing: a research note. *Qualitative Research*, 4(1), pp. 107-118.

SULLIVAN, E. and BYRE, C. 1983. Nursing's future: Use of the Delphi technique for curriculum planning. *Journal Nursing Education*, 22(5), pp. 187-198.

SULLIVAN, J.R., 2012. Skype: an appropriate method of data collection for qualitative interviews? *The Hilltop Review*, 6(1), article 10. [online]. Available from: https://scholarworks.wmich.edu/cgi/viewcontent.cgi?article=1074&context=hilltopreview [Accessed 6 September 2019].

SURVEYMONKEY®, 2019. *SurveyMonkey*. [online]. London: SurveyMonkey. Available from: http://surveymonkey.co.uk [Accessed 6 September 2019].

SUTHERLAND, P. 1995*. Cognitive development today: Piaget and his critics.* London: Paul Chapman.

TASHAKKORI, A. and TEDDLIE, C., eds., 2009. *SAGE handbook of mixed methods in social and behavioural research.* 2nd ed. Thousand Oaks, CA: Sage.

TASHAKKORI, A. and TEDDLIE, C., 1998. *Mixed methodology: Combining qualitative and quantitative approaches.* London: Sage.

TAUSIG, J.E. and FREEMAN, E.W., 1988. The next best thing to being there: conducting the clinical research interview by telephone. *American Journal of Orthopsychiatry*, 58, pp. 418–427.

TEDDLIE, C. and TASHAKKORI, A., 2009. *Foundations of mixed methods research: Integrating quantitative and qualitative approaches in the social and behavioural sciences*. London: Sage.

THIDEMANN, I.J. and SÖDERHAMN, O., 2013. High-fidelity simulation among bachelor students in simulation groups and use of different roles. *Nurse Education Today*, 33(12), pp. 1599-1604.

THOMAS, C.M., SIEVERS, L.D., KELLGREN, M., MANNING, S.J., ROJAS, D.E. and GAMBLIAN, V.C., 2015. Developing a theory-based simulation educator resource. *Nursing Education Perspectives*, 36(5), pp. 340-342.

TOMLIN, G., 2005. The use of interactive video client simulation scores to predict clinical performance of occupational therapy students. *American Journal of Occupational Therapy*, 59, pp. 50–56.

TOSTESON, DC., 1979. Learning in medicine. *New England Journal of Medicine*, 301, pp. 690-694.

TRIER-BIENIEK, A., 2012. Framing the telephone interview as a participant-centred tool for qualitative research: a methodological discussion. *Qualitative Research*, 12(6), pp. 630–644.

TUN, J.K., ALINIER, G., TANG, J. KNEEBONE, R.L., 2015. Redefining simulation fidelity for healthcare education. *Simulation and Gaming*, 46(2), pp. 159-174.

TUN, J. K. and KNEEBONE, R., 2011. Bridging worlds: Applying the science of motor learning to clinical education. *Medical Education*, 45(1), pp. 111-114.

TUROFF, M. 1970. The design of a policy Delphi. *Technological Forecasting and Social Change*, 2, pp. 149-171.

TUULIKKI, K., 2011. Teachers' conceptions and their approaches to teaching in virtual reality and simulation-based learning environments. *Teachers and Teaching*, 17(1), pp. 131-147.

TUZER, H., DINC, L., and ELCIN, M., 2016. The effects of using high-fidelity simulators and standardized patients on the thorax, lung, and cardiac

examination skills of undergraduate nursing students. *Nurse Education Today*, 45, pp. 120–125.

TYERMAN, J., LUCTKAR-FLUDE, M., GRAHAM, L., COFFEY, S. and OLSEN-LYNCH, E., 2019. A systematic review of healthcare pre-simulation preparation and briefing effectiveness. *Clinical Simulation in Nursing*, 27, pp. 12-25.

UYS, Y. and TREADWELL, I., 2014. Using a simulated patient to transfer patient-centered skills from simulated practice to real patients in practice. *Curationis*, 37(1), pp. 1-6.

VAISMORADI, M., TURUNEN, H. and BONDAS, T., 2013. Content analysis and thematic analysis: implications for conducting a qualitative descriptive study. *Nursing and Health Sciences*, 15(3), pp. 398-405.

VAN TEIJLINGEN, E. and HUNDLEY, V., 2001. The importance of pilot studies. *Social Research Update*, 35. [online]. Available from: http://sru.soc.surrey.ac.uk/SRU35.html [Accessed 6 September 2019].

VANDERBILT, A.A., GROVER, A.C., PASTIS, N.J., FELDMAN, M., GRANADOS, D.D., MURITHI, L.K. and MAINOUS, A.G., 2015. Randomized controlled trials: a systematic review of laparoscopic surgery and simulation-based training. *Global Journal of Health Science*, 7(2), p. 310.

VENKATASALU, M.R., KELLEHER, M. and SHAO, C.H., 2015. Reported clinical outcomes of high-fidelity simulation versus classroom-based end-of-life care education. *International Journal of Palliative Nursing*, 21(4), pp. 179-186.

VERNON, W. 2009. The Delphi technique: a review. *International Journal of Therapy and Rehabilitation,* 16(2), pp. 69-77.

VYGOTSKY, L.S., 1962. *Thought and language*. Cambridge: MIT Press.

WALKER, S.F., 1992. A brief history of connectionism and its psychological implications. In: A. CLARK and R. LUTZ. *Connectionism in Context*. London: Springer. pp. 123-144.

WALKER, L.O. and AVANT, K.C., 2005. *Strategies for theory construction in nursing*. 4th ed. Upper Saddle River, NJ: Pearson.

WALKER, A.M. and SELFE, J. 1996. The Delphi method: a useful tool for the allied health researcher. *British Journal of Therapy and Rehabilitation*, 3(12), p. 677–681.

WALTON, J., CHUTE, E. and BALL, L., 2011. Negotiating the role of the professional nurse. The pedagogy of simulation: a grounded theory study. *Journal of Professional Nursing*, 27(5), pp. 299-310.

WARR, P., BIRD, M. and RACKHAM, N., 1971. *Evaluation of management training: a practical framework, with cases, for evaluating training needs and results*. London: Gower Press.

WATKINS, D. and GIOIA, D. 2015. *Mixed methods research*. Oxford: Oxford University Press.

WAXMAN, K. T. and ELLES, C. L., 2009. The use of Benner's framework in high-fidelity simulation faculty development: The Bay Area Simulation Collaborative model. *Clinical Simulation in Nursing*, *5*, pp. e231-e235.

WEBSTER, B.J., GOODHAND, K., HAITH, M. and UNWIN, R., 2012. The development of service users in the provision of verbal feedback to student nurses in a clinical simulation environment. *Nurse Education Today*, 32(2), pp. 133-138.

WENGER, E. 1998. *Communities of practice.* Cambridge: Cambridge University Press.

WHITEHEAD, A.L., SULLY, B.G.O. and CAMPBELL, M.J. 2014. Pilot and feasibility studies: is there a difference from each other and from a randomized controlled trial? *Contemporary Clinical Trials*, 38, pp.130-133.

WHITTEMORE, R. and KNAFL, K., 2005. The integrative review: updated methodology. *Journal of Advanced Nursing*, 52(5) pp. 546-553.

WILFORD, A. and DOYLE, T.J., 2006. Integrating simulation training into the nursing curriculum. *British Journal of Nursing*, 15(17), pp. 926-930.

WILLIS, D.G., SULLIVAN-BOLYAI, S., KNAFL, K. and COHEN, M.Z., 2016. Distinguishing features and similarities between descriptive phenomenological and qualitative description research. *Western Journal of Nursing Research*, 38(9), pp. 1185–1204.

WILSON, L. and WITTMANN-PRICE, R. A., 2015. *Review manual for the certified healthcare simulation educator exam*. New York, NY: Springer.

YUAN, H.B., WILLIAMS, B.A. and FANG, J.B., 2012. The contribution of high-fidelity simulation to nursing students' confidence and competence: a systematic review. *International Nursing Review*, 59(1), pp. 26-33.

ZENDEJAS, B., BRYDGES, R., HAMSTRA S.J. and COOK, D.A., 2013a. State of the evidence on simulation-based training for laparoscopic surgery: a systematic review. *Annals of Surgery*, 257(4), pp. 586-593.

ZENDEJAS, B., WANG, A.T. BRYDGES, R., HAMSTRA, S.J. and COOK, D.A., 2013b. Cost: the missing outcome in simulation-based medical education research: a systematic review. *Surgery*, 153(2), pp. 160-176.

ZIMMERMAN, B.J., 1990. Self-regulated learning and academic achievement: an overview. *Educational Psychologist*, 25(1) pp. 3-17.

ZITZELSBERGER, H., COFFEY, S. and GRAHAM, L., 2017. Exploring simulation utilization and simulation evaluation practices and approaches in undergraduate nursing education. *Journal of Education and Practice*, 8(3), pp. 155-164.

XERRI, D., 2018. Two Methodological Challenges for Teacher-researchers: Reflexivity and Trustworthiness, The Clearing House*: A Journal of Educational Strategies, Issues and Ideas*, 91(1), pp.37-41,

APPENDICES

CHAPTER ONE

Appendix 1: List of relevant thesis dissemination 2018 – 2019

GOODHAND, K., COOPER, K., HANCOCK, L. 2019. Presentation at the 8th International clinical Skills Conference, *What the e-Delphi expert panel said about… simulation best practice statements for pre-registration nurse education in Scotland*, Prato, Italy, May 2019

GOODHAND, K., COOPER, K., HANCOCK, L. 2018. Presentation at the Scottish Clinical Skills Network conference: *Student nurses' transfer of learning from simulation to clinical practice: An integrative review*, Glasgow, June 2018.

Appendix 2: JBI Appraisal Checklists

Table 2.3

A JBI Critical Appraisal Checklist for Systematic Reviews and Research Syntheses

	Question number											
Main author	1	2	3	4	5	6	7	8	9	10	11	Total
Bennett et al. 2017 (lit review)	Y	Y	Y	N	NA	Y	U	Y	N	Y	Y	7
Cook et al. 2015	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	11
Cox et al. 2015.	Y	Y	U	U	NA	U	U	U	U	Y	Y	4
Hegland et al. 2017	Y	Y	Y	Y	Y	Y	Y	U	Y	Y	Y	10
Jansson et al. 2013	Y	Y	Y	Y	NA	Y	Y	U	Y	Y	Y	9
Roberts and Cooper 2018.	Y	Y	Y	Y	NA	Y	NA	Y	Y	Y	Y	9
Key: Q1. Is the review question clearly and explicitly stated? **Q2**. Were the inclusion criteria appropriate for the review question? **Q3**. Was the search strategy appropriate? **Q4.** Were the sources and resources used to search for studies adequate? **Q5**. Were the criteria for appraising studies appropriate? **Q6.** Was critical appraisal conducted by two or more reviewers independently? **Q7.** Were there methods to minimize errors in data extraction? **Q8**. Were the methods used to combine studies appropriate? **Q9**. Was the likelihood of publication bias assessed? **Q10.**were recommendations for policy and/or practice supported by the reported data? **Q11.** Were the specific directives for new research appropriate?												

B JBI Critical Appraisal Checklists for Randomised Controlled Trial

	Question Number										
Main author	1	2	3	4	5	6	7	8	9	10	Total
Cannon et al. 2014	Y	Y	Y	Y	U	Y	Y	U	Y	Y	8
Domuracki et al. 2009	Y	Y	Y	U	U	U	U	U	Y	N	4
Fraser et al. 2011	Y	Y	Y	U	U	Y	Y	U	Y	Y	7

Jensen et al. 2014	Y	N	Y	N	U	U	Y	U	Y	U	4
Key: Yes =Y No= N Can't tell = U NA = Not applicable **Q1.** Did the trial address a clearly focused issue? **Q2**. Was the assignment of patients to treatments randomised? **Q3.** Were all the patients who entered the trial properly accounted for at its conclusion? **Q4.** Were patients, health workers and study personnel 'blind' to treatment? **Q5.** Were the groups similar at the start of the trial? **Q6.** Aside from the experimental intervention, were the groups treated equally? **Q7**. How large was the treatment effect? **Q8.** How precise was the estimate of the treatment effect? **Q9.** Can the results be applied to the local population, or in your context? **Q10.** Were all clinically important outcomes considered?											

C JBI Critical Appraisal Checklist for Quasi-Experimental Studies (non-randomized experimental studies)

	Question Number									
Main author	1	2	3	4	5	6	7	8	9	Total
Barsuk et al. 2016	Y	U	U	Y	Y	Y	Y	Y	Y	7
Jiang et al. 2011	Y	U	U	Y	Y	Y	Y	Y	Y	7
Lavelle et al. 2017	Y	U	Y	N	Y	Y	Y	U	Y	6
Rutherford-Hemming et al. 2012	Y	U	Y	N	N	Y	Y	U	Y	5
Key: Yes =Y No= N Can't tell = U NA = Not applicable **Q1**. Is it clear in the study what is the 'cause' and what is the 'effect' (i.e. there is no confusion about which variable comes first)? **Q2**. Were the participants included in any comparisons similar? **Q3**. Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest? **Q4**. Was there a control group? **Q5**. Were there multiple measurements of the outcome both pre and post the										

intervention/exposure? **Q6**. Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analysed? **Q7**. Were the outcomes of participants included in any comparisons measured in the same way? **Q8**. Were outcomes measured in a reliable way? **Q9**. Was appropriate statistical analysis used?

D JBI Critical Appraisal Checklist for Qualitative Research

Qualitative data	Question Number										
Main author	1	2	3	4	5	6	7	8	9	10	Total
Aura et al. 2016 for 2nd aim	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	9
Buckley and Gordon 2011	Y	Y	Y	U	Y	Y	Y	Y	Y	Y	9
De Melo et al. 2018	Y	Y	Y	U	Y	Y	Y	Y	Y	Y	9
Kumar et al. 2016	Y	N	N	N	N	Y	Y	Y	Y	Y	6
Key: Yes =Y No= N Can't tell = U NA Not applicable **Q1**. Was there a clear statement of the aims of the research? **Q2**. Is a qualitative methodology appropriate? **Q3**. Was the research design appropriate to address the aims of the research? **Q4.** Was the recruitment strategy appropriate to the aims of the research? **Q5**. Was the data collected in a way that addressed the research issue? **Q6.** Has the relationship between researcher and participants been adequately considered? **Q7**. Have ethical issues been taken into consideration? **Q8**. Was the data analysis sufficiently rigorous? **Q9.** Is there a clear statement of findings? **Q10**. How valuable is the research?											

Appendix 3: Blank Data collection coding chart

Table 4.1 Blank Data collection coding chart

Author(s)	Title	Date	Journal reference and source	Type of study
Aim/objectives	Methodology	Context/ country	Sample size / composition / type	Stage of student
Method Focus of simulation and type used	Analysis	Validity	Results	Author's conclusion
My Summary				Kirkpatrick level

A JBI Critical Appraisal Checklists for Randomised Controlled Trial

	Question Number													
Main author	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
Kirkman	U	N	U	N	N	N	Y	Y	Y	Y	Y	Y	U	6
Sears	U	NA	NA	NA	NA	U	Y	Y	Y	Y	Y	Y	Y	7

Key: Yes =Y No= N Can't tell = U NA = Not applicable

RCT Questions **Q1**. Was true randomization used for assignment of participants to treatment groups? **Q2**. Was allocation to treatment groups concealed? **Q3**. Were treatment groups similar at the baseline? **Q4**. Were participants blind to treatment assignment. **Q5.** Were those delivering treatment blind to treatment assignment? **Q6**. Were outcomes assessors blind to treatment assignment? **Q7**. Were treatment groups treated identically other than the intervention of interest? **Q.8**. Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analysed. **Q9**. Were participants analysed in the groups to which they were randomized. **Q10**. Were outcomes measured in the same way for treatment groups? **Q11**. Were outcomes measured in a reliable way. **Q12**.Was appropriate statistical analysis used? **Q13.** Was the trial design appropriate, and any deviations from the standard RCT design (individual randomization, parallel groups) accounted for in the conduct and analysis of the trial?

B JBI Critical Appraisal Checklist for Quasi-Experimental Studies (non-randomized experimental studies)

	Number of questions									
Main author	1	2	3	4	5	6	7	8	9	Total
Avraham	Y	U	Y	N	Y	Y	NA	U	Y	5
Harris	Y	Y	Y	Y	N	Y	Y	U	Y	7
Meyer	Y	U	Y	Y	N	Y	U	N (not a validated tool)	Y	5
Ross	Y	Y	Y	Y	N	U	Y	Y	Y	7
Tuzer	U	U	U	U	U	U	Y	Y	Y	3

Key: Yes =Y No= N Can't tell = U NA = Not applicable

Q1. Is it clear in the study what is the 'cause' and what is the 'effect' (i.e. there is no confusion about which variable comes first)? **Q2**. Were the participants included in any comparisons similar? **Q3**. Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest? **Q4**. Was there a control group? **Q5**. Were there multiple measurements of the outcome both pre and post the intervention/exposure? **Q6**. Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analysed? **Q7**. Were the outcomes of participants included in any comparisons measured in the same way? **Q8**. Were outcomes measured in a reliable way? **Q9**. Was appropriate statistical analysis used?

C JBI Critical Appraisal Checklist for Qualitative Research

	Questions										
Main author	1	2	3	4	5	6	7	8	9	10	Total
Debourgh	U	Y	Y	U	U	N	N	Y	Y	Y	5
Ewertsson	U	Y	Y	Y	Y	Y	Y	Y	Y	Y	9
Liaw	U	Y	Y	Y	Y	Y	Y	Y	Y	Y	9
Nash	U	Y	Y	Y	Y	U	U	Y	U	Y	6
Ravik	Y	Y	Y	N	Y	N	Y	Y	X		6
Venkatsalu	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	10

Key: Yes =Y No= N Can't tell = U NA Not applicable

Q1. Was there a clear statement of the aims of the research? **Q2**. Is a qualitative methodology appropriate? **Q3**. Was the research design appropriate to address the aims of the research? **Q4.** Was the recruitment strategy appropriate to the aims of the research? **Q5**. Was the data collected in a way that addressed the research issue? **Q6**. Has the relationship between researcher and participants been adequately considered? **Q7.** Have ethical issues been taken into consideration? **Q8**. Was the data analysis sufficiently rigorous? **Q9.** Is there a clear statement of findings? **Q10.** How valuable is the research?

Appendix 5: e-Delphi Introductory email

Dear XXXX,

Thank you very much for taking the time to read this email. Firstly, I would like to introduce myself; my name is Kate Goodhand and I work at Robert Gordon University, Aberdeen, as a lecturer. I am currently studying for a Doctor of Professional practice and my topic is simulation in pre-registration nursing curricula.

I aim to facilitate an e-Delphi study to establish Scottish nursing academics' expert opinions on the use of best-practice statements for the use of simulation in pre-registration nursing.

I would like you to consider taking part in the e-Delphi study. Inclusion criteria for the study are listed below and full details of the study can be found in the attached participant information sheet. If you are interested in participating in this study as an expert panel member please reply to this e-mail, confirming your answers to the questions below. If you would like further information, please contact me directly at k.goodhand@rgu.ac.uk or telephone me on 01224 262965.

Thank you very much for your time,
Kind regards Kate Goodhand

Inclusion Criteria

To participate in this study please can you confirm a yes to question 1a or b and a yes to question 2 a, b, c, or d.

PARTICIPANT ELIGIBILITY QUESTIONS:

1. **Do you have any involvement with simulation in the pre -registration nursing programme?**
   a. Are you directly involved in planning, delivering and evaluating simulation sessions?
   b. Are you directly involved with the strategic planning of simulation in the School of Nursing/with other healthcare professionals?

2. **Do you have any involvement with simulation in the wider simulation community?**
   a. Have you published in a nursing text book on simulation?
   b. Have you published an article in a peer reviewed nursing journal on simulation?
   c. Have you presented/been a guest speaker at a national/international simulation conference on simulation?
   d. Are you a member of ASPiH (or other simulation group)?

Determining consensus on simulation best-practice statements for use in pre-registration nursing education in Scotland: An e-Delphi study.

You are being invited to take part in an online research study. Before you decide whether to take part it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Please ask if there is anything that is not clear or if you would like more information. Thank you for reading this.

The purpose of the study is to develop best-practice statements for the potential use of simulation in pre-registration nursing curricula in Scotland, and to explore nurse educators' willingness to adopt them

All participants must be registered nurses who are involved in simulation at an operational or strategic level. In addition, one or more of the following criteria are essential. To have been:

- Editors or chapter authors about simulation in nursing text books.
- Authors of peer reviewed nursing journal articles about simulation
- Accepted as speakers/ presenters at national/ international conferences about simulation
- Members of simulation groups, such as Association for Simulation Practice in Healthcare (ASPiH).

It is up to you to decide whether to take part. If you do decide to take part, you will confirm consent by engaging in the questionnaire. If you decide to take part, you are still free to withdraw at any time and without giving a reason.

This study is being conducted by an e-Delphi technique which is a group communication tool, a way of collecting geographically dispersed expert opinions on an important concept. The name Delphi comes from Ancient Greece - the oracle at Delphi was the God Apollo's informant (Schneider et al. 2007). It is a crucial

aspect of a Delphi technique that the anonymity of participants is assured to allow participants freedom to express their own opinions. This will be a critical element of this study and confidentially of all Schools of Nursing and participants will be assured.

The e-Delphi study will be facilitated by Kate Goodhand, lead researcher. It will be provided in an online format to your work email address. There will be 3 participative rounds that will take place over a five-week period from **5th March – 8th April 2018**

Round 1 e-Delphi: **5th March – 11th March**
Information gathering about simulation in your institution and demographics and views on best-practice statements:
Questionnaire 1. Appraising statements from current simulation models and best-practice statements/quality indicators by agreeing or disagreeing with their inclusion in a final set. A text box will be provided for panel members to state their rationale for choosing each statement. Free-text boxes will be provided for any further comments and for the addition of any statement not present.
Collating the data: 12th-18th March 2018
Round 2 e-Delphi: 19th – 25th March 2018
Consensus Questionnaire 2. A list of the selected best-practice statements will be provided to the panel and consensus sought that this list definitive. Free-text boxes will again be available.
Collating the data: 26th March – 1st April 2018
Round 3 e-Delphi: 2nd – 8th April 2018
A Likert scale will be adopted to gauge opinion on willingness of individuals and institutions to adopt them.
Collating the data: 9th – 22nd April 2018
Thank you and results: 23rd April 2018

At the end of the study all members of the expert panel will be thanked for participating and the results will be shared. You will have access to a set of best-practice statements that have been agreed by an expert panel that you may use when facilitating simulation sessions. There also will be the potential to engage

in national research studies in the future. The simulation best-practice statements will be shared with the expert panel group.

We do not anticipate any disadvantages to taking part in the study. We will protect individual and institutional identities. All the information you share during the e-Delphi study, including your name and other details personal to yourself, will be kept confidential and your identity kept anonymous in any reports or publications. The data will be stored on password-protected drives on PC's. Individual anonymised quotes from free-text comment boxes may be used to illustrate research findings in papers and reports. All information will be collected and stored within the requirements of the Data protection Act (1998) and RGU policies on data storage and retention.
You will receive the final set of best-practice statements. Publication of the results will be sought in an academic journal and may also be presented at an academic conference.

This study is being led by a doctoral student, Kate Goodhand, to meet in part, the requirements of a doctorate in professional practice. There is no funding for this study and no third-party involvement. Kate works as a lecturer at Robert Gordon University.

If you have any complaint about the conduct of this study, you should contact Mrs Liz Hancock, Head of School of Health Sciences, Robert Gordon University, 01224 263251 (l.hancock@rgu.ac.uk) The School of Health Sciences (RGU) Research Review Group has approved this study.

I would be happy to answer any questions you may have. If you are interested in taking part, your consent will be implied by taking part in the e-Delphi study that you will receive by email. Thank you for considering taking part in this research study. Please discuss this information with anyone you wish prior to deciding.

Contact for further information: Kate Goodhand, Telephone: 01224 262965

Email: k.goodhand@rgu.ac.uk Or contact Kay Cooper (academic supervisor) k.cooper@rgu.ac.uk

Appendix 7: Email invitation staff telephone interviews

Dear XXXX,

Thank you very much for taking the time to read this email. Firstly, I would like to introduce myself; my name is Kate Goodhand and I work at Robert Gordon University, Aberdeen, as a lecturer. I am currently studying for a Doctor of Professional practice and my topic is simulation in pre-registration nursing curricula.

I recently ran an e-Delphi study to establish Scottish nursing academics' expert opinions on the use of best-practice statements for the use of simulation in pre-registration nursing. Some interesting points came up for discussion around staff development. I would like you to consider taking part in a telephone interview to discuss this further. If you would like to be interviewed please reply to this e-mail and we can arrange a mutually convenient time. Calls will be no longer than 30 minutes.

If you would like further information, please contact me directly at k.goodhand@rgu.ac.uk or telephone me on 01224 262965.

Thank you very much for your time
Kind regards Kate Goodhand

Appendix 8: Participant Information Leaflet staff telephone interviews (Study Number: SHS/17/28)

Study Title:

Nurse Lecturer's views on the use of simulation in pre-registration nursing education and staff education.

You are being invited to take part in a research study. Before you decide to take part, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Please ask by return of email if there is anything that is not clear or if you would like more information. Thank you for reading this.

What is the purpose of this study?

The purpose of the study is to find out nurse lecturer's view on simulation practices in Higher Education Institutions in Scotland for pre-registration student nurses and staff training for simulation.

Why have I been chosen?

You have been chosen as you are involved in pre-registration nursing student's education including simulation.

Do I have to take part?

No, it is up to you to decide whether you take part. If you do decide to take part you will confirm consent verbally. If you decide to take part you are still free to withdraw at any time and without giving a reason.

What will happen to me if I take part?

The study will be facilitated by Kate Goodhand, lead researcher. At a pre-arranged mutually convenient time Kate will call you on the telephone to conduct an interview that is expected to last around 30 minutes. The call will be audio recorded. Consent will be taken by verbal responses to a series of questions.

What are the possible disadvantages and risks of taking part?

We do not anticipate any disadvantages to taking part in the study. We will protect individual identities of both place and person.

What are the possible benefits of taking part?

The study results will add to the body of knowledge on the use of simulation in pre-registration nurse education.

What happens when the research study stops?

The results will be written-up as part of my doctoral thesis. Publication of the results may also be sought in an academic journal and they may also be presented at an academic conference. You will not be identified in any reports or publications.

What if something goes wrong?

If you have any complaints about the conduct of this study, you should contact Dr Hector Williams, Convenor School Research Review group (h.williams@rgu.ac.uk) or Mrs Liz Hancock, Head of the School of Health Sciences, Robert Gordon University, 01224 263251 (l.hancock@rgu.ac.uk)

Will my taking part in the study be kept confidential?

All the information you share during the study, including your name and other details personal to yourself, will be kept confidential and your identity and that of your institution will be kept anonymous. The data will be stored on a password-protected PC. Your name will not appear in any research papers produced from this research. Individual anonymised quotes may be used to illustrate research findings in papers and reports. All information will be collected and stored within the requirements of the Data Protection Act (2018) and RGU policies on data storage and retention.

What will happen to the results of the research study?

The results will be written-up as part of my doctoral thesis. Publication of the results will also be sought in an academic journal and they may also be presented at an academic conference. You will not be identified in any reports or publications.

Who is organising the research?

This study is being led by a doctoral student, Kate Goodhand, to meet in part, the requirements of a doctorate in professional practice. There is no funding for this study and no third-party involvement. Kate works as a lecturer at Robert Gordon University.

Who has reviewed the study?

The School of Health Sciences (RGU) Research Review Group has approved this study (Reference No: SHS17/28).

What do I do now?

If you have any questions or are interested in taking part please email k.goodhand@rgu.ac.uk.

Thank you for considering taking part in this research study.

Contact for further information:

Kate Goodhand
k.goodhand@rgu.ac.uk
Or the principal research supervisor Kay Cooper k.cooper@rgu.ac.uk

Appendix 9: Consent statement staff telephone interviews

The consent statements are to be read out by the primary researcher/interviewer to participants willing to engage in a telephone interview. Participants must reply 'YES' to the following statements before the interview commences.

"*Please respond YES to the following statements if you agree to give your consent to take part in this telephone interview….*

Do you agree that you have read and fully understand the information leaflet about this study and that you have had the opportunity to ask questions?

Do you agree to this telephone interview being recorded and subsequently transcribed?

Are you assured confidentiality of place and person will be maintained by the primary researcher?

Are you aware that any data will be used towards the primary researcher's doctoral studies and may be used in publications and conference proceedings?

Finally, do you agree to consent to take part in this telephone interview?"

Appendix 10: Semi-structured Interview Questions and Prompts for staff telephone interviews

1. Please can you briefly describe how simulation is conducted in your institution?
   PROMPT: BY whom? When? Who for? Resources? Do you use debrief time?

2. What is your involvement in simulation for pre-registration student nurses?

3. Do you use simulation best practice statements?
   PROMPTS: A Simulation Model? Quality indicators?

4. If not in use would you consider their use?
   PROMPT: Which ones?

5. What teaching qualification have you obtained/ are you working towards? Was/ is simulation included in the syllabus?

6. Have you received any training specifically in relation to simulation?
   PROMPTS: By colleagues/internal academics? External agencies? Manufacturers of simulation equipment?

7. Do you consider further training is required for simulation?
   PROMPTS: If so when? For whom? What sort? What is available to you? How prepared did you/do you feel prepared to deliver simulation?

8. Do you use? Have you seen/ heard of the CSMEN Three-Tier framework for simulation educators?
   PROMPTS: If so, would it be useful for your institution? Any changes? Amendments? Positives? Negatives?

9. What barriers would exist in your institution to facilitate further training about simulation for academic staff?

10. What enablers exist in your institution to facilitate further training about simulation for academic staff?

11. In relation to nurse education: What would be your ideal scenario for staff training about simulation?

Thank you for taking part your time and contribution is much appreciated.

Appendix 11: Itinerary staff interviews: simulation and staff training

Number	Date	Time	Code	Recorded length time/words
1	13 November	13–1330	P/G	29 minutes 55 seconds 4442 words
2	13 November	1530-16	I/C	27 minutes 24seconds 3213 words
3	14 November	930-10	L/D	22 minutes 34 seconds 2724 words
4	22 November	10-1030	C/A	27 minutes 30 seconds 3472 words
5	22 November	1130-12	Ni/F	28 minutes 34 seconds 4868 words
6	23 November	1015-1045	D/B	24 minutes 6 seconds 3165 words
7	26 November	10-1030	T/I	21 minutes 14 seconds 3088 words
8	27 November	13-1330	S/H	20 minutes 3 seconds 1861 words
9	30 November	10-1030	Na/E	21 minutes 44 seconds 2590 words
10	17 December	16-1630	G/J	28 minutes 5 seconds 3567
11	18 December	9-130	Je/K	25 minutes 2 seconds 3085 words
12	10 January 2019 (17.12 cancelled first interview due to respondent illness)	1330-14	Ja/L	23 minutes 21 seconds 3052 words

Appendix 12: e-Delphi study Round 1 questionnaire (pp. 366-373)

Demographics and base line information. If you have no objections, please can you supply the following:

Age:

Gender:

Years in education:

Role:

Please answer the following questions with respect to your own School of Nursing:

How much simulation occurs in your pre-registration nursing programmes? Please identify by hour(s) for each stage and field:

	Adult	Children & Young People	Mental Health	Learning Disability
Stage 1				
Stage 2				
Stage 3				
Stage 4				

Do you use any simulated hours to replace clinical hours? How many? Under what conditions?

How many staff are engaged in delivering simulation? Please list using their role titles not their names.

Do you have any form of staff training for simulation? Please describe type/hours available/who delivers…

Do you follow a model for simulation? If so, please state which one and why you chose it?

Do you use simulation practice standards/best-practice statement indicators? If so, please state which ones and why you chose them?

If you don't use a model/standards/best-practice statement indicator, please outline why below?

Would your School be prepared to adopt a simulation model/practice standards/best-practice statement indicator? If so why? Why not? Which one?

Questionnaire Round 1

Please consider the following simulation best-practice statements

a. You can choose to remove any best-practice statements.
b. You can choose to keep individual statements.
c. You can reword best-practice statements.
d. Please add any best-practice statements you feel are missing.

Example of how statements will be presented:

1. *Simulation experiences are aligned with the curriculum and course objectives.*

Agree Disagree Change to wording Rationale or any further comments

Complete List of Simulation Best-Practice Statements

1. The facility has a clear strategic plan which addresses wider organisational and stakeholders' needs.
2. There is a clear vision and mission statement to demonstrate aims and objectives of the facility.
3. A designated individual oversees the strategic delivery of SBE programmes and ensures that appropriate maintenance of simulation equipment is undertaken.
4. A designated lead with organisational influence and accountability manages the simulation activity.
5. There is a clear alignment to the wider organisational and stakeholders' needs, acting as a quality and risk management resource for organisations to help achieve the goals of improved patient safety and care quality.
6. Evidence-based practice should be incorporated into simulation scenario development, implementation, and debriefing using appropriate participant outcomes.
7. Simulation experiences are aligned with the curriculum and course outcomes.
8. Simulation-based education programmes are developed in alignment with formal curriculum mapping or learning/training needs analysis undertaken in clinical or educational practice.
9. The patient perspective is central to simulation and demonstrated within educational planning.
10. Simulation design characteristics include pre-briefing, preparation work, outcomes, fidelity, complexity, cues and debriefing.
11. Consistent terminology should be used between simulation, theory and practice and different disciplines. This will provide guidance and clear communication and reflect shared values in simulation experiences, research, and publications. Knowledge and ideas are clearly communicated with consistent terminology to advance the science of simulation.
12. Simulation experiences, in some form, are integrated into all clinical courses and progress in complexity throughout the program.
13. There is scaffolding of learning experiences throughout the curriculum; and the required knowledge, psychomotor skills, clinical reasoning and reflective thinking skills, and use of health care technologies are taught prior to their implementation into simulation experiences.

14. Educational practices include active learning, feedback, student faculty interaction, collaboration, high expectations, diverse learning, time on task.
15. Student programme, level and age are considered.
16. A coherent matrix illustrates how simulation experiences are integrated throughout curriculum.
17. Facilitator designs the simulation-based learning experience at the appropriate level for the participant.
18. Participant outcomes should be congruent with overall program outcomes.
19. The usage of simulation technologies and approaches used are consistent with learning objectives, resource availability and cost effectiveness. These include but are not limited to, low, and medium or high-fidelity human patient simulation manikin or part-task trainers.
20. Multiple methods of facilitation are available and use of a specific method is dependent on the learning needs of the participant(s) and the expected outcomes.
21. Learning outcomes guide all aspects of simulation design including student preparation activities, clinical scenario, group size, inclusion of observers or students from other disciplines, selection of manikin fidelity and other equipment, level of student support during the simulation, and method of debriefing.
22. Identify facilitation methods that support simulation objectives.
23. Outcomes should be appropriate to the level of the participant and the programme.
24. Identify facilitation methods that enable participants' achievement of expected outcomes.
25. The facilitator communicates the objectives and expected outcomes prior to the simulation-based experience. The level of detail revealed to participants will depend on the objectives.
26. Completion of participant objectives should be achievable within the designated timeframe (i.e., minutes to hours).May need period of reflection or be part of a series.
27. Outcomes are measured: these include learning outcomes (knowledge) skill performance, learner satisfaction, critical thinking and self-confidence.
28. Participant objectives should include the domains of learning.

29. Participant objectives should incorporate holistic care. This will depend as not all simulations will be holistic as may break into segments
30. All simulation-based learning experiences begin with development of clearly written participant objectives, which are available prior to the experience.
31. Objectives should be appropriate to the level of the participant.
32. Faculty engage in continuing professional development with regular evaluation of performance by both learner and fellow faculty.
33. A structured orientation is provided for students prior to the simulation session and, depending on the students' prior exposure to simulation activities, includes: introduction to and an opportunity to become familiar with the learning objectives, structure, timing and process of the session; the simulation environment, equipment, manikin, monitoring devices, and information and communication technology to be used.
34. Staff who design scenarios, conduct the simulation sessions, facilitate debriefing and manage the technology have each undertaken appropriate training.
35. Staff who design simulation scenarios and program manikins are familiar with curriculum and course objectives, have relevant clinical knowledge and understand the technological capabilities of manikins.
36. Simulation technicians and technologists, whose primary role is to support delivery of Simulation Based Education (SBE), have gained or are working towards professional registration with the Science Council.
37. Training is provided to all faculty to engage with Simulated Patients, where there is an active Simulated Patient programme.
38. Teacher demographics are considered.
39. Environmental fidelity is developed in line with the learning outcomes of the simulation session.
40. Contextually appropriate clinical equipment and the availability of hardcopy or electronic patient information and charts are used to enhance the realism of the simulation experience.
41. Simulation is developed with the level of fidelity needed to meet the desired outcomes.
42. A variety of simulation modalities, including Simulated Patients, is incorporated into simulation programmes to create appropriate realism of

the learning environment and achieve the objectives of the session being taught.

43. The assessment is based on the intended learning outcomes of the exercise, with clarity regarding the knowledge, skills and attitudes to be evaluated and is appropriately tailored to the professional curricula to be evaluated.
44. Formative feedback provides information for improving performance and behaviours associated with the three domains of learning: cognitive (knowledge), affective (attitude), and psychomotor (skills).
45. Because familiarity with participants is a significant source of observer bias, the influence of observer's previous knowledge of participants should be avoided whenever possible.
46. Faculty ensure that a safe learning environment is maintained for learners and encourages self-reflection on learning.
47. Faculty have a responsibility for patient safety and to raise concerns regarding learner performance within educational settings, including Simulation Based Education (SBE) interventions.
48. Establishment of a safe learning environment
49. To preserve the integrity of simulation scenarios and provide an equitable experience for each participant, confidentiality is essential.
50. Professional integrity related to confidentiality of the performances, scenario content, and participant experience is required during and after any simulation. Confidentiality is expected in live, recorded, or virtual simulation experiences.
51. Facilitators' professional and ethical behaviours are required in the simulated environment.
52. Participants are expected to demonstrate professional integrity.
53. The simulation learning, assessment and evaluation environments will be areas where mutual respect among participants and facilitator(s) is expected and supported and as such, it is essential to provide clear expectations for the attitudes and behaviours of simulation participants.
54. Staff who facilitate simulation sessions have relevant clinical knowledge, understand course objectives, and possess expert clinical teaching skills to enable students to relate theory to practice during debriefing.

55. Depending on the simulation objectives, opportunities for discussion of students' non-technical skills such as clinical reasoning, situation awareness, communication, leadership and teamwork are included in debriefing.
56. Create a safe environment for participant debriefing
57. Structured debriefing is provided immediately following the simulation
58. Feedback and debriefing to simulation participants must be constructive.
59. Faculty are competent in the process of debriefing.
60. The debriefing facilitates students' reflection on practice, self-evaluation and feedback on their perceptions of the experience.
61. Focus debriefing on the participant objectives and outcomes.
62. Feedback are incorporated to promote safe rehearsal and consolidation of skills.
63. Identify the facilitator's responsibilities during the debriefing process.
64. Participants should receive and provide constructive feedback during simulation and debriefing.
65. Identify the structural elements of debriefing to include the optimal time and duration required to achieve the objectives.
66. Regular evaluation of programmes and faculty is undertaken to ensure that content and relevance is maintained.
67. A faculty member with expertise in simulation-based education oversees the simulation programme design and ensures that it is regularly peer reviewed, kept up to date and relevant to the organisation goals, clinical needs and curriculum to which it is mapped.
68. Summative evaluation focuses on measurement of outcomes or achievement of objectives.
69. The facilitator is responsible for the evaluation of all aspects of the simulation experience

[Adapted from Arthur et al. (2013); Jeffries (2015) & INASCL (2017); ASPiH (2016)]

Appendix 13: e-Delphi round two Questionnaire

1. These were the best-practice statements that were generated and agreed by the first questionnaire. Do you agree with the addition of the following statements/ rewording/removal of?

Appendix 14: e-Delphi round three Questionnaire

This is the final set of best-practice statements generated by the expert panel:

1. Please indicate your agreement that the above statements should be included in a national tool for best-practice statements for simulation in Nursing Schools across Scotland.

5	4	3	2	1
Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree

Please outline any barriers or facilitators below:

2. How willing would you as an individual be to use these best-practice statement indicators for simulation in pre-registration nursing curricula?

5	4	3	2	1
Very willing	Willing	Unsure	Not willing	Not willing at all

Please outline any barriers or facilitators below:

3. How willing do you think your colleagues would be to use these best-practice statement indicators for simulation in pre-registration nursing curricula?

5	4	3	2	1
Very willing	Willing	Unsure	Not willing	Not willing at all

Please outline any barriers or facilitators below:

4. As an institution how willing do you think your School of Nursing would be to use these best-practice statement indicators for simulation in pre-registration nursing curricula?

5	4	3	2	1
Very willing	Willing	Unsure	Not willing	Not willing at all

Please outline any barriers or facilitators below:

5. How willing would you be to join in future national research projects further exploring simulation in pre-registration nursing curricula?

5	4	3	2	1
Very willing	Willing	Unsure	Not willing	Not willing at all

Please outline any barriers or facilitators below:

	The facility has a clear strategic plan which addresses wider organisational and stakeholders' needs.	9	6
	There is a clear vision and mission statement to demonstrate aims and objectives of the facility.	9	9
	A designated individual oversees the strategic delivery of SBE programmes and ensures that appropriate maintenance of simulation equipment is undertaken.	9	8
	A designated lead with organisational influence and accountability manages the simulation activity.	7	4
	There is a clear alignment to the wider organisational and stakeholders' needs, acting as a quality and risk management resource for organisations to help achieve the goals of improved patient safety and care quality.	8	6
	Evidence-based practice should be incorporated into simulation scenario development, implementation, and debriefing using appropriate participant outcomes.	9	9
	Simulation experiences are aligned with the curriculum and course outcomes.	9	9
	Simulation-based education programmes are developed in alignment with formal curriculum mapping or learning/training needs analysis undertaken in clinical or educational practice.	9	9
	The patient perspective is central to simulation and demonstrated within educational planning.	9	6
	Simulation design characteristics include pre-briefing, preparation work, outcomes, fidelity, complexity, cues and debriefing.	9	8

	Consistent terminology should be used between simulation, theory and practice and different disciplines. This will provide guidance and clear communication and reflect shared values in simulation experiences, research, and publications. Knowledge and ideas are clearly communicated with consistent terminology to advance the science of simulation.	9	8
	Simulation experiences, in some form, are integrated into all clinical courses and progress in complexity throughout the program.	8	4
	There is scaffolding of learning experiences throughout the curriculum; and the required knowledge, psychomotor skills, clinical reasoning and reflective thinking skills, and use of health care technologies are taught prior to their implementation into simulation experiences.	8	4
	Educational practices include active learning, feedback, student faculty interaction, collaboration, high expectations, diverse learning, time on task.	7	6
	Student programme, level and age are considered.	5	6
	A coherent matrix illustrates how simulation experiences are integrated throughout curriculum.	8	6
	Facilitator designs the simulation-based learning experience at the appropriate level for the participant.	5	7
	Participant outcomes should be congruent with overall program outcomes.	9	9
	The usage of simulation technologies and approaches used are consistent with learning objectives, resource availability and cost	9	8

effectiveness. These include but are not limited to, low, and medium or high-fidelity human patient simulation manikin or part-task trainers.		
Multiple methods of facilitation are available and use of a specific method is dependent on the learning needs of the participant(s) and the expected outcomes.	9	9
Learning outcomes guide all aspects of simulation design including student preparation activities, clinical scenario, group size, inclusion of observers or students from other disciplines, selection of manikin fidelity and other equipment, level of student support during the simulation, and method of debriefing.	9	9
Identify facilitation methods that support simulation objectives.	8	4
Outcomes should be appropriate to the level of the participant and the programme.	5	7
Identify facilitation methods that enable participants' achievement of expected outcomes.	6	5
The facilitator communicates the objectives and expected outcomes prior to the simulation-based experience. The level of detail revealed to participants will depend on the objectives.	8	5
Completion of participant objectives should be achievable within the designated timeframe (i.e., minutes to hours). May need period of reflection or be part of a series.	7	6
Outcomes are measured: these include learning outcomes (knowledge) skill performance, learner satisfaction, critical thinking and self-confidence.	6	5
Participant objectives should include the domains of learning.	8	4

	Participant objectives should incorporate holistic care.	8	5
	All simulation-based learning experiences begin with development of clearly written participant objectives, which are available prior to the experience.	7	5
	Objectives should be appropriate to the level of the participant.	8	7
	Faculty engage in continuing professional development with regular evaluation of performance by both learner and fellow faculty.	9	9
	A structured orientation is provided for students prior to the simulation session and, depending on the students' prior exposure to simulation activities, includes introduction to and an opportunity to become familiar with the learning objectives, structure, timing and process of the session; the simulation environment, equipment, manikin, monitoring devices, and information and communication technology to be used.	8	7
	Staff who design scenarios, conduct the simulation sessions, facilitate debriefing and manage the technology have each undertaken appropriate training.	8	7
	Staff who design simulation scenarios and program manikins are familiar with curriculum and course objectives, have relevant clinical knowledge and understand the technological capabilities of manikins.	8	5
	Simulation technicians and technologists, whose primary role is to support delivery of Simulation Based Education (SBE), have gained or are working towards professional registration with the Science Council.	6	3

Training is provided to all faculty to engage with Simulated Patients, where there is an active Simulated Patient programme.	7	4
Teacher demographics are considered.	7	4
Environmental fidelity is developed in line with the learning outcomes of the simulation session.	9	7
Contextually appropriate clinical equipment and the availability of hardcopy or electronic patient information and charts are used to enhance the realism of the simulation experience.	9	9
Simulation is developed with the level of fidelity needed to meet the desired outcomes.	7	6
A variety of simulation modalities, including Simulated Patients, is incorporated into simulation programmes to create appropriate realism of the learning environment and achieve the objectives of the session being taught.	8	7
The assessment is based on the intended learning outcomes of the exercise, with clarity regarding the knowledge, skills and attitudes to be evaluated and is appropriately tailored to the professional curricula to be evaluated.	9	8
Formative feedback provides information for improving performance and behaviours associated with the three domains of learning: cognitive (knowledge), affective (attitude), and psychomotor (skills).	9	9
Because familiarity with participants is a significant source of observer bias, the influence of observer's previous knowledge of participants should be avoided whenever possible.	6	2
Faculty ensure that a safe learning environment is maintained for learners and encourages self-reflection on learning.	9	9

Faculty have a responsibility for patient safety and to raise concerns regarding learner performance within educational settings, including Simulation Based Education (SBE) interventions.	9	9
Establishment of a safe learning environment	8	6
To preserve the integrity of simulation scenarios and provide an equitable experience for each participant, confidentiality is essential.	9	7
Professional integrity related to confidentiality of the performances, scenario content, and participant experience is required during and after any simulation. Confidentiality is expected in live, recorded, or virtual simulation experiences.	9	8
Facilitators' professional and ethical behaviours are required in the simulated environment.	9	8
Participants are expected to demonstrate professional integrity.	9	9
The simulation learning, assessment and evaluation environments will be areas where mutual respect among participants and facilitator(s) is expected and supported and as such, it is essential to provide clear expectations for the attitudes and behaviours of simulation participants.	8	6
Staff who facilitate simulation sessions have relevant clinical knowledge, understand course objectives, and possess expert clinical teaching skills to enable students to relate theory to practice during debriefing.	9	9
Depending on the simulation objectives, opportunities for discussion of students' non-technical skills such as clinical reasoning,	9	9

situation awareness, communication, leadership and teamwork are included in debriefing.		
Create a safe environment for debriefing	9	9
Structured debriefing is provided immediately following the simulation	9	9
Feedback and debriefing to simulation participants must be constructive.	9	9
Faculty are competent in the process of debriefing.	9	9
The debriefing facilitates students' reflection on practice, self-evaluation and feedback on their perceptions of the experience.	8	9
Focus debriefing on the participant objectives and outcomes.	8	8
Feedback are incorporated to promote safe rehearsal and consolidation of skills.	8	8
Identify the facilitator's responsibilities during the debriefing process.	8	6
Participants should receive and provide constructive feedback during simulation and debriefing.	8	6
Identify the structural elements of debriefing to include the optimal time and duration required to achieve the objectives.	8	6
Regular evaluation of programmes and faculty is undertaken to ensure that content and relevance is maintained.	8	9
A faculty member with expertise in simulation-based education oversees the simulation programme design and ensures that it is regularly peer reviewed, kept up to date and relevant to the organisation goals, clinical needs and curriculum to which it is mapped.	8	6

Summative evaluation focuses on measurement of outcomes or achievement of objectives.	7	5
The facilitator is responsible for the evaluation of all aspects of the simulation experience	6	5

Key: a difference of 3 or below indicates stability

5 statements out of 69 were not stable – highlighted in blue.

A difference of more than three equals significantly different and therefore is not stable.

Appendix 16: Student Introductory email (Study Number: SHS/18/04.)

Study Title:

An evaluation of simulation-based education: the development of chest auscultation skills in physiotherapy students.

Dear student,

Thank you very much for taking the time to read this email. Firstly, I would like to introduce myself; my name is Kate Goodhand, I work as a lecturer at Robert Gordon University, School of Nursing and Midwifery, Aberdeen. I am currently studying for a Doctorate of Professional Practice (DPP), my topic is simulation.

I aim to run a study involving physiotherapy students and this email has been sent to you on my behalf by your course leaders. In your current curriculum, you are taught the skill of chest auscultation; which you can then practise in your clinical placements. I would like to find out how much of this skill is applied when you go out to practice areas.

It is very important for you to be aware that all data will be anonymised and treated confidentiality; therefore, personal information will not be shared with your lecturers and cannot affect your grades or progression on the course in anyway. Rather, this information will be used to enhance clinical skills teaching and inform future developments in simulation. Please read the attached participant information sheet and ask any questions you may have before you volunteer to take part in the study. Consent forms will be provided in one of your time-tabled classes.

If you would like further information please contact me directly at k.goodhand@rgu.ac.uk or telephone me on 01224 262965.

Thank you very much for your time. Kind regards Kate Goodhand

Appendix 17: Student Participant Information Sheet (Study Number: SHS/18/04)

Study Title:

An evaluation of simulation-based education: the development of chest auscultation skills in physiotherapy students.

You are being invited to take part in a research study. Before you decide to take part, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Please ask if there is anything that is not clear or if you would like more information. Take time to decide whether you wish to take part. Thank you for reading this.

What is the purpose of this study?

To enhance simulation practices: to see if learning in simulation is transferred to clinical practice areas.

Why have I been chosen?

You have been chosen because you are a student who has been taught the skill of chest auscultation and who is likely to have the opportunity to practise this skill on clinical placement.

Do I have to take part?

No, it is up to you to decide whether to take part. If you do decide to take part you will be asked to complete a consent form. If you decide to take part you are still free to withdraw at any time and without giving a reason.

What will happen to me if I take part?

The feasibility evaluation study will be facilitated by Kate Goodhand, lead researcher. You will engage in your normal curricula. You will be taught how to perform chest auscultation. You will be asked to complete a short questionnaire. When you are on clinical placement starting from October – December 2018. You will also be asked to fill in a short questionnaire after the simulation and after placement.

What are the possible disadvantages and risks of taking part?

We do not anticipate any disadvantages to taking part in the study. We will protect individual identities.

What are the possible benefits of taking part?

You will have access to your own feedback around the skill of chest auscultation and if you wish the summary of the research findings.

What happens when the research study stops?

The findings from the feasibility study will be used towards my final thesis, and may contribute to conference presentations and journal articles and the development of simulation practices.

What if something goes wrong?

If you have any complaints about the conduct of this study, you should contact Dr Hector Williams, Convenor School Research Review group (h.williams@rgu.ac.uk) or Mrs Liz Hancock, Head of School of Health Sciences, Robert Gordon University, 01224 263251 (l.hancock@rgu.ac.uk)

Will my taking part in the study be kept confidential?

All the information you share during the study, including your name and other details personal to yourself, will be kept confidential and your identity will be kept anonymous. The data will be stored on a password-protected PC. Your name will not appear in any research papers produced from this research. Individual anonymised quotes from free text comment boxes may be used to illustrate research findings in papers and reports. All information will be collected and stored within the requirements of the Data Protection Act (1998), EU-General Data protection Regulation (2016) and RGU policies on data storage and retention.

What will happen to the results of the research study?

The results will be written-up as part of my doctoral thesis. Publication of the results will also be sought in an academic journal and they may also be

presented at an academic conference. You will not be identified in any reports or publications.

Who is organising the research?

This study is being led by a doctoral student, Kate Goodhand, to meet in part, the requirements of a doctorate in professional practice. There is no funding for this study and no third-party involvement. Kate works as a lecturer at Robert Gordon University.

Who has reviewed the study?

The School of Health Sciences (RGU) Research Review Group has approved this study (Reference No: SHS18/04).

What do I do now?

I would be happy to answer any questions you may have. If you are interested in taking part, your consent will be documented on a consent form.

Thank you for considering taking part in this research study. Please discuss this information with anyone you wish prior to deciding.

Contact for further information:

Kate Goodhand
01224 262965 / k.goodhand@rgu.ac.uk
or the research supervisor Kay Cooper k.cooper@rgu.ac.uk

Appendix 18: Student Consent Form (Study Number: SHS/18/04)

Title of study:

An evaluation of simulation-based education: the development of chest auscultation skills in physiotherapy students.

Participant Identification Number:

Please initial each box

1	I agree that I have read and understand the information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.	
2	I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason.	
3	I agree to take part in the above study and complete a questionnaire post simulation and post placement.	
4	I agree to the publication of direct quotations from the questionnaires. I understand that I will not be identified.	

Version 3 2018

Two copies of the consent form are required: One copy for you the participant to retain and one copy for the researcher. Many thanks.

Appendix 19: Questionnaire for students' pre-placement SHS/18/04

Participant identification number (PIN):

1. How helpful was the simulation session on chest auscultation? 5 Very helpful 1 not very helpful at all 5 4 3 2 1 Response
2. What was the least helpful aspect about learning this skill by simulation? Response
3. What did you learn from the simulated practice opportunity? Response
4. Do you think this learning will be transferrable to practice?

Very likely	Likely	Unsure	Not likely	Extremely unlikely

Please outline when you think this will happen and why?

5. How confident do you feel about performing chest auscultation on real patients in clinical practice?

Very confident	Confident	Unsure	Slightly confident	Not very confident

6. How anxious do you feel about performing chest auscultation on real patients in clinical practice?

Not all anxious	Slightly anxious	Unsure	Anxious	Extremely anxious

Any comments:

Thank you very much for completing this questionnaire. Your views are very useful and important to us. And finally:

Can you suggest any changes that are needed to this questionnaire?

How long did it take you to complete?

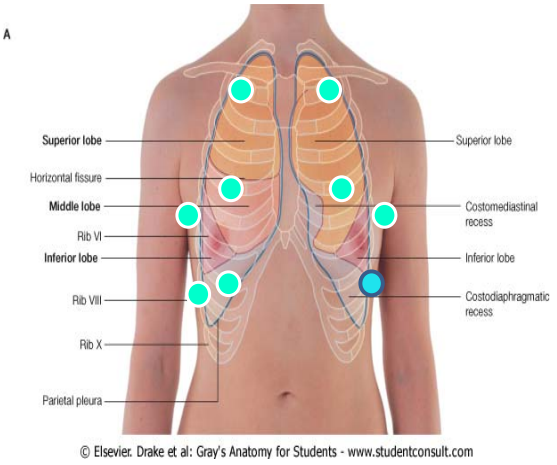
Please return to reception level 4 Health Sciences for the attention of Kate Goodhand

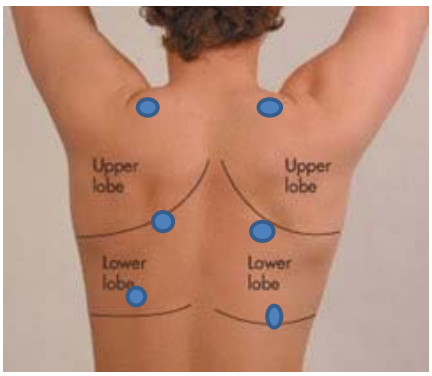
Should you have any queries please contact Kate Goodhand by email on k.goodhand@rgu.ac.uk

Appendix 20: Educational material for simulation session

AUSCULTATION CHECKLIST

Auscultation

<table>
<tr><td></td><td>yes</td><td>no</td><td colspan="2">comment</td></tr>
<tr><td>Did they introduce themselves with full name and ‘student physiotherapist’?</td><td></td><td></td><td colspan="2"></td></tr>
<tr><td>Did they check it was the correct patient?</td><td></td><td></td><td colspan="2"></td></tr>
<tr><td>Did they ask what the patient would like to be called?</td><td></td><td></td><td colspan="2"></td></tr>
<tr><td>Did they explain what their role was and what they were going to do?</td><td></td><td></td><td colspan="2"></td></tr>
<tr><td rowspan="9">Stethoscope positions
Apices
 

© Elsevier. Drake et al: Gray's Anatomy for Students - www.studentconsult.com
 
</td><td colspan="2">Appropriate position</td><td></td></tr>
<tr><td colspan="2">Apices</td><td>comments</td></tr>
<tr><td colspan="2">Mid</td><td></td></tr>
<tr><td colspan="2">Bases</td><td></td></tr>
<tr><td colspan="2">Lateral – mid</td><td></td></tr>
<tr><td colspan="2">Lateral - base</td><td></td></tr>
<tr><td colspan="2">Posterior</td><td>Comments</td></tr>
<tr><td colspan="2">apice</td><td></td></tr>
<tr><td colspan="2">mid</td><td></td></tr>
<tr><td colspan="2">base</td><td></td></tr>
<tr><td>Did they consider their own back care?</td><td colspan="3">Yes/No Comment:</td></tr>
</table>

Assessment Case Study - Physio

Mrs Dee Zees

HPC Mrs Zees was admitted overnight. She had breathlessness and a cough which have been worsening over the last 3 days. During this time, she has been hot and shivery. She usually has very mild breathlessness on exertion but yesterday she struggled with the stairs. During the night she was distressed, coughing +++ but unable to expectorate. Called 999.

PMH Bronchiectasis since age 12 due to chicken pox

SH not available

Handover from Nursing staff

The nurses report that Mrs Zees is a little less breathless than on admission but still struggling to expectorate.

Since admission She has been 2 hourly salbutamol nebs, Pulmicort nebulisers and 50% oxygen via venturi mask.

Commenced IV fluids 4mins ago after medical staff ward round.

Physiotherapy Notes for Mrs Zees

S – Ask the appropriate questions

O - Sat up in chair, appears tired. Blood results back and WCC 24

A – Self ventilating on 50% Oxygen via venturi mask

B - SaO_2 96%, RR 22 (recently increased after coughing +++), audible wheeze apparent, breathing pattern – increased activity and fixing with arms intermittently, obvious hypertrophy of neck accessory muscles

- Has finger clubbing
- Auscultation: BS throughout, widespread expiratory wheeze and crackles left and right base
- Palpation - reduced expansion bases. Apices L=R.
- Tactile fremitus bases
- Pale but lips and peripheries pink

C - HR 121 BP 108/55, commenced IV fluids, not catheterised and no urine output noted since admission – just commenced on fluid balance chart. No ankle oedema

D – 'A' VPU

E - Temp 38.9^{o}C

Patient copy

Assessment Case Study - Patient

Mrs Dee Zees

HPC Mrs Zees was admitted overnight. She had breathlessness and a cough which have been worsening over the last 3 days. During this time, she has been hot and shivery – felt awful, didn't want to eat. Managing sips of water only. She usually has very mild breathlessness on exertion but yesterday she struggled with the stairs. During the night she was distressed, coughing +++ but unable to expectorate. Called 999.

PMH Bronchiectasis since age 12 due to chicken pox

Normally expectorate 2 egg cups full of green sputum daily. Takes nebulised antibiotics but can't remember the name. Also has blue inhaler for wheeze. Doesn't like doing physio – has been taught some new-fangled techniques in the past but can't remember what they were. Usually just tries to keep active. Been getting more infections over recent years though and seems to be getting more sputum as well.

SH not available

You have just been coughing for 10 minutes trying to clear secretions and haven't managed. Feels like there's lots there but just seems to clag up.

Assessment Case Study - Physio

Mr Del Toid

HPC - 70-year-old admitted to acute medical unit by GP.

Last few days been feeling increasingly wheezy and breathless. Put it down to the recent damp, cold weather. Last night couldn't get his breath and thought he was going to die. Called GP.

PMH – 15-year history of COPD with significant deterioration over past 18/12.

DH – Spiriva, budesonide, salbutamol, frusemide,

SH - lives with wife who is fit and well.

Full medical notes not on ward yet.

<u>Handover from Nursing staff</u>

The nurses report that Mr Toid is a little less breathless than on admission but still very breathless

Since admission he has been 2 hourly salbutamol nebs, Pulmicort nebulisers and 28% oxygen via venturi mask.

Physiotherapy Notes for Mr Toid

S – Ask the appropriate questions

O - Sat up in chair, appears tired. Blood results back and WCC 6

Chest looks barrel shaped with slight kyphosis

A – Self ventilating on 28% Oxygen via venturi mask

B - SaO_2 91% (prev notes indicate Sao2 on d/c 93%), RR 26, audible wheeze apparent, breathing pattern – increased activity and fixing with arms intermittently, obvious hypertrophy of neck accessory muscles, using abdominal muscles ++++

- Has finger clubbing
- Auscultation: BS throughout although difficult to hear, widespread expiratory wheeze
- Palpation - reduced expansion everywhere.
- Pale but lips and peripheries pink

C - HR 121 BP 158/75, mild ankle oedema

D – 'A' VPU

E - Temp 36.5^{o}C

Assessment Case Study - Patient

Mr Del Toid

HPC - 70-year-old admitted to acute medical unit by GP.

Last few days been feeling increasingly wheezy and breathless. Put it down to the recent damp, cold weather. Last night couldn't get his breath and thought he was going to die. Called GP. Normally very breathless, until last year was managing to walk to the shop 500yds away from home but now finding it increasingly difficult to get up the stairs

PMH – 15-year history of COPD with significant deterioration over past 18/12.

DH – spiriva, budesonide, salbutamol, frusemide,

SH - lives with wife who is fit and well.

Full medical notes not on ward yet.

You don't feel hot but breathing is a struggle. You usually find a fan blowing in your face helps but even this hasn't worked just now. Nurses insist you stay in bed but you really feel you need to sit up higher. Breathing much worse than normal – would usually rate breathlessness about 5/10 at rest, now 8/10.

Appendix 21: Student interview email introduction

Sent on behalf of Kate Goodhand

Dear student,

Thank you very much for taking the time to read this email. My name is Kate Goodhand, I work as a lecturer at Robert Gordon University, School of Nursing and Midwifery, Aberdeen. I am currently studying for a Doctorate of Professional Practice (DPP), my topic is simulation.

You may remember I met you all in year 2 when you were given the opportunity to complete consent forms and a short questionnaire. This is the follow up to that piece of work and I would like to ask for your help again. In your current curriculum, you are taught the skill of chest auscultation; which you can then practise in your clinical placements. I would like to find out how much of this skill is applied when you go out to practice areas. I would like to conduct a recorded telephone interview with you at a time convenient to you. To achieve this, I will require a date and time and telephone number to contact you.

It is very important for you to be aware that any data collected will be anonymised and treated confidentiality; therefore, personal information will not be shared with your lecturers and cannot affect your grades or progression on the course in any way. Rather, this information will be used to enhance clinical skills teaching and inform future developments in simulation.

There is a participant information sheet enclosed for you to read.

If you would like further information or would like to take part I would be very grateful and can be contacted by email k.goodhand@rgu.ac.uk or 07738728835.

Thank you very much for your time

Kind Regards
Kate Goodhand

Appendix 22: Student interview consent questions and schedule

The consent statements are to be read out by the primary researcher/interviewer to participants willing to engage in a telephone interview. Participants must reply 'YES' to the following statements before the interview commences.

"*Please respond YES to the following statements if you agree to give your consent to take part in this telephone interview….*

Do you agree that you have read and fully understand the information leaflet about this study and that you have had the opportunity to ask questions?

Do you agree to this telephone interview being recorded and subsequently transcribed?

Are you assured confidentiality of place and person will be maintained by the primary researcher?

Are you aware that any data will be used towards the primary researcher's doctoral studies and may be used in publications and conference proceedings?

Finally, do you agree to consent to take part in this telephone interview?"

1. Can you tell me a bit about what happened in the simulation?

   PROMPTS

How did you learn?

What did you learn?

Did any learning happen before simulation?

What did you think of the simulation with volunteers?

Was it useful?

Did you feel prepared to perform a chest auscultation on a real patient?

2. Have you had experience of carrying out a chest auscultation on a real patient?

PROMPTS

What area are you on placement?

What was different to simulation?

What was the same?

How did it go?

Could you transfer skills?

3. Anything that could have been done in university to prepare you better?

PROMPTS

Suggestions for improving simulation.

Anything you want to add?

Thank you for taking part your time and is much appreciated.

Appendix 23: Questionnaire for students' post-placement SHS/18/04

Participant Name:

Now you have been on clinical placement please reflect to your chest auscultation simulation session with volunteer patients:

1. What do you think now was the most helpful aspect about learning chest auscultation by simulation? Response
2. What do you think now was the least helpful aspect about learning chest auscultation by simulation? Response
3. Do you think the simulation you had prior to placement could be improved in any way? Response, please circle your answer: Yes No Please provide any details of how:
4. Where did you go on placement?
Did you get the opportunity to practice chest auscultation? Response, please circle your answer: Yes No

Did you apply in practice what you learned in simulation? Yes, No Partially Please provide any details of application:
Did you have any issues with performing chest auscultation on placement Response, please circle your answer: Yes No Please provide any information which would have helped with any issues you had

Thank you very much for completing this questionnaire. Your views are very useful and important to us. And finally:

Can you suggest any changes that are needed to this questionnaire?
How long did it take you to complete?

Please return to your facilitators or to reception level 4 Health Sciences for the attention of Kate Goodhand

Should you have any queries please contact Kate Goodhand by email on k.goodhand@rgu.ac.uk

Appendix 24: Staff Introductory email (Study Number: SHS/18/04.)

Study Title:

An evaluation of simulation-based education: the development of chest auscultation skills in physiotherapy students.

Dear …….,

Thank you very much for taking the time to read this email. Firstly, I would like to introduce myself; my name is Kate Goodhand, I work as a lecturer at Robert Gordon University, School of Nursing and Midwifery, Aberdeen. I am currently studying for a Doctorate of Professional Practice (DPP), my topic is simulation.

I aim to run an evaluation study involving physiotherapy students and this email has been sent to you on my behalf of the pre-registration physiotherapy course leaders. In the current curriculum, students are taught the skill of chest auscultation; which they can then practise on clinical placements. I would like to evaluate the use of simulation best-practice statements and the impact of practicing chest auscultation in simulation to see how much of this skill is then applied when students go out to clinical areas.

It is very important for you to be aware that all data will be anonymised and treated confidentiality; therefore, personal information will not be shared with anyone. This study will be used to enhance clinical skills teaching and inform future developments in simulation.

Please read the information leaflet and ask any questions before signing the consent form if you wish to take part.

If you would like further information please contact me directly at k.goodhand@rgu.ac.uk or telephone me on 01224 262965.

Thank you very much for your time
Kind regards Kate Goodhand

Appendix 25: Staff Participant Information Sheet (Study Number: SHS/18/04)

Study Title:

An evaluation of simulation-based education: the development of chest auscultation skills in physiotherapy students.

You are being invited to take part in a research study. Before you decide to take part, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Please ask if there is anything that is not clear or if you would like more information. Take time to decide whether you wish to take part. Thank you for reading this.

What is the purpose of this study?

Students will be taught chest auscultation using simulation. The purpose of the study is to evaluate simulation practices: to see if learning in simulation is transferred to clinical practice areas. The use of simulation best-practice statements will be explored.

Why have I been chosen?

As the simulation facilitator we are interested in your views.

Do I have to take part?

No, it is up to you to decide whether you take part. If you do decide to take part you will confirm consent by completing a consent form. If you decide to take part you are still free to withdraw at any time and without giving a reason.

What will happen to me if I take part?

The feasibility evaluation study will be facilitated by Kate Goodhand, lead researcher. The student will engage in their normal curricula. They will be taught how to perform chest auscultation. As a simulation facilitator you will be asked

your opinion on using simulation best-practice statements. You will be then asked to complete a short questionnaire.

What are the possible disadvantages and risks of taking part?

We do not anticipate any disadvantages to taking part in the study. We will protect individual identities.

What are the possible benefits of taking part?

You will have access to a summary of the research findings.

What happens when the research study stops?

The results will be written-up as part of my doctoral thesis. Publication of the results will also be sought in an academic journal and they may also be presented at an academic conference. You will not be identified in any reports or publications.

What if something goes wrong?

If you have any complaints about the conduct of this study, you should contact Dr Hector Williams, Convenor School Research Review group (h.williams@rgu.ac.uk) or Mrs Liz Hancock, Head of School of Health Sciences, Robert Gordon University, 01224 263251 (l.hancock@rgu.ac.uk)

Will my taking part in the study be kept confidential?

All the information you share during the study, including your name and other details personal to yourself, will be kept confidential and your identity will be kept anonymous. The data will be stored on a password-protected PC. Your name will not appear in any research papers produced from this research. Individual anonymised quotes from free text comment boxes may be used to illustrate research findings in papers and reports. All information will be collected and stored within the requirements of the Data Protection Act (1998), EU-General Data protection Regulation (2016) and RGU policies on data storage and retention.

What will happen to the results of the research study?

The results will be written-up as part of my doctoral thesis. Publication of the results will also be sought in an academic journal and they may also be presented at an academic conference. You will not be identified in any reports or publications.

Who is organising the research?

This study is being led by a doctoral student, Kate Goodhand, to meet in part, the requirements of a doctorate in professional practice. There is no funding for this study and no third-party involvement. Kate works as a lecturer at Robert Gordon University.

Who has reviewed the study?

The School of Health Sciences (RGU) Research Review Group has approved this study (Reference No: SHS18/04).

What do I do now?

I would be happy to answer any questions you may have. If you are interested in taking part, your consent will be documented on a consent form.

Thank you for considering taking part in this research study. Please discuss this information with anyone you wish prior to deciding.

Contact for further information:

Kate Goodhand
01224 262965 / k.goodhand@rgu.ac.uk
or the research supervisor Kay Cooper k.cooper@rgu.ac.uk

Appendix 26: Staff Consent Form (Study Number: SHS/18/04)

Title of study:

An evaluation of simulation-based education: the development of chest auscultation skills in physiotherapy students.

Participant Identification Number:

Please initial each box

1	I agree that I have read and understand the information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.	
2	I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason.	
3	I agree to take part in the above study and complete a questionnaire.	
4	I agree to the publication of direct quotations from the questionnaires. I understand that I will not be identified.	

Participant Name:
Participant Signature:
Date:
Telephone contact:
E mail Contact:
Researcher (name):
Researcher Signature:
Date:

Two copies of the consent form are required: One copy for you the participant to retain and one copy for the researcher.

Many thanks

Appendix 27: Questionnaire for simulation facilitators post simulation. SHS/18/04

1. How useful do you think these simulation best-practice statements would be? (Using a Likert scale) 5 Most useful 1 not very useful at all 5 4 3 2 1 Response
2. Were there any statement(s) you did not comply with? Which ones(s)? What were the reasons? Response
3. Would you consider adopting these simulation best-practice statements? Please give a rationale for your answer. Response
4. What would act as barriers to you adopting these simulation best-practice statements

Response:
5. What would act as enablers to you adopting these simulation best-practice statements Response:

Thank you very much for completing this questionnaire. Your views are very useful and important to us. And finally:

How long did it take you to complete?
Can you suggest any changes that are needed to this questionnaire?

Please return to reception level 4 Health Sciences for the attention of Kate Goodhand

Should you have any queries please contact Kate Goodhand by email on k.goodhand@rgu.ac.uk

Appendix 28: Simulation best practice statements checklist

Simulation best-practice statements	Met	Partially met	Not met	Not applicable
Institutional and strategic delivery				
There is a clear vision and mission statement to demonstrate aims and objectives of the simulation facility				
A designated individual oversees the strategic delivery of simulation-based education programmes and ensures that appropriate maintenance of simulation equipment is undertaken.				
A staff member with expertise in simulation-based education oversees the simulation programme design and ensures that it is regularly peer reviewed, kept up to date and relevant to the organisation goals, clinical needs and curriculum to which it is mapped.				
Simulation experiences are aligned with the course and module learning outcomes.				
Staff preparation and evaluation				
Staff engage in continuing professional development with regular evaluation of performance by both learner and fellow staff.				
Staff who facilitate simulation sessions have relevant clinical knowledge, understand course and module learning outcomes, and possess expert clinical teaching skills to enable students to relate theory to practice during debriefing				

Regular evaluation of programmes and staff is undertaken to ensure that content and relevance is maintained.				
Safety				
Staff ensure that a safe learning environment is maintained for learners and encourages self-reflection on learning.				
Staff have a responsibility for patient safety and to raise concerns regarding learner performance within educational settings, including simulation-based education interventions.				
Professional and ethical behaviours				
Professional integrity related to confidentiality of the performances, scenario content, and participant experience is required during and after any simulation. Confidentiality is expected in live, recorded, or virtual simulation experiences.				
Facilitators' professional and ethical behaviours are required in the simulated environment.				
Participants are expected to demonstrate professional integrity.				
Learning outcomes, fidelity and resources				
Evidence-based practice should be incorporated into simulation scenario development, implementation, and debriefing using appropriate participant learning outcomes.				
Participant learning outcomes should be congruent with overall course and module learning outcomes.				

The usage of simulation technologies and approaches used are consistent with course and module learning outcomes, resource availability and cost-effectiveness. These include but are not limited to, low, and medium or high-fidelity human patient simulation mannequin or part-task trainers.				
Multiple methods of facilitation are available and use of a specific method is dependent on the learning needs of the participant(s) and the expected learning outcomes.				
Learning outcomes guide all aspects of simulation design including: student preparation activities, clinical scenario, group size, inclusion of observers or students from other disciplines, selection of mannequin fidelity and other equipment, level of student support during the simulation, and method of debriefing.				
Environmental fidelity is developed in line with the learning outcomes of the simulation session.				
Contextually appropriate clinical equipment and the availability of hardcopy or electronic patient information and charts are used to enhance the realism of the simulation experience.				
Assessment and feedback				
Any assessment is based on the intended learning outcomes of the exercise, with clarity regarding the knowledge, skills and attitudes to be evaluated and is appropriately tailored to the professional curricula to be evaluated.				

Formative feedback provides information for improving performance and behaviours associated with the three domains of learning: cognitive (knowledge), affective (attitude), and psychomotor (skills).				
De-briefing				
Staff are competent in the process of debriefing				
Structured debriefing is provided immediately following the simulation				
Staff create a safe environment for participant debriefing				
Feedback and debriefing to simulation participants must be constructive				
Depending on the simulation objectives, opportunities for discussion of students' non-technical skills such as clinical reasoning, situation awareness, communication, leadership and teamwork are included in debriefing.				
The debriefing facilitates students' reflection on practice, self-evaluation and feedback on their perceptions of the experience.				

Appendix 29: Simulation best-practice statements checklist with comments from lead simulation facilitator.

Simulation best-practice statements	Consensus %age	Comments of lead simulation facilitator for the volunteer patient chest auscultation simulation
Institutional and strategic delivery.		
There is a clear vision and mission statement to demonstrate aims and objectives of the simulation facility	**89%**	*We had this but I think it needs revisited. I don't think everybody is aware of it or working towards it.*
A designated individual oversees the strategic delivery of simulation-based education programmes and ensures that appropriate maintenance of simulation equipment is undertaken.	**87%**	*We don't have a strategic lead for simulation-based education in the University, but we do in the School. This has seen the development of simulation-based learning across 4 subject areas in the last 10 years.* *We do have a centre-manager who oversees the simulation centre and equipment though.*

		The enthusiasm of this individual is variable.
A staff member with expertise in simulation-based education oversees the simulation programme design and ensures that it is regularly peer reviewed, kept up to date and relevant to the organisation goals, clinical needs and curriculum to which it is mapped.	**87%**	*Each individual member of staff who uses simulation in their module is responsible for this. They have had no official training. They do map use of simulation to students needs in relation to practice, development of skills and the curriculum*
Simulation experiences are aligned with the course and module learning outcomes.	**96%**	*Absolutely. Simulation is embedded within modules and used to help students achieve learning outcomes.*
Staff preparation and evaluation		
Staff engage in continuing professional development with regular evaluation of performance by both learner and fellow staff.	**91%**	*Not in relation to simulation. Evaluation of simulation activities is often informal if it is undertaken at all.*
Staff who facilitate simulation sessions have relevant clinical knowledge, understand course and module learning outcomes, and possess expert clinical teaching skills to enable students to relate theory to practice during debriefing	**89%**	*Staff have relevant clinical knowledge and understand course and module learning outcomes. The area I would question is their clinical teaching skills in*

		relation to debriefing. I think this is variable across the School. Staff can teach the clinical skills well, but the debriefing element of simulation is lacking on occasion.
Regular evaluation of programmes and staff is undertaken to ensure that content and relevance is maintained.	**89%**	*This would be done on an individual staff basis. I am currently getting an audit of simulation use in place to ensure we can review content and relevance.*
Safety		
Staff ensure that a safe learning environment is maintained for learners and encourages self-reflection on learning.	**98%**	*This is fully embedded. Video clips of simulations are provided to students to enable them to reflect on their performance. This could probably be developed further by asking them to document their reflections or to discuss with personal tutors.*
Staff have a responsibility for patient safety and to raise concerns regarding learner performance within educational	**93%**	*Absolutely. This is inherent in all our simulation practices.*

settings, including simulation-based education interventions.		
Professional and ethical behaviours		
Professional integrity related to confidentiality of the performances, scenario content, and participant experience is required during and after any simulation. Confidentiality is expected in live, recorded, or virtual simulation experiences.	**91%**	*Absolutely. Our students are reminded they are bound by the HCPC rules of professional conduct and that these apply to simulated learning activities as well as true clinical experiences.*
Facilitators' professional and ethical behaviours are required in the simulated environment.	**98%**	*Completely. We always require this.*
Participants are expected to demonstrate professional integrity.	**93%**	*Completely. We always require this.*
Learning outcomes, fidelity and resources		
Evidence-based practice should be incorporated into simulation scenario development, implementation, and debriefing using appropriate participant learning outcomes.	**98%**	*Using best practice, we should be doing this in all simulated activities. Do we currently? Possibly not. Staff have been self-taught in relation to simulated learning and therefore their knowledge of what constitutes EBP for this is limited. EBP for clinical elements however should and is*

		embedded into each scenario. *For the activity undertaken the skills were EBP but there is no evidence that using VPs helps students develop their skills in relation to physiotherapy*
Participant learning outcomes should be congruent with overall course and module learning outcomes.	**89%**	*This is a fundamental. It ensures the activity is appropriate. For the simulated activity the students undertook that was what underpinned.*
The usage of simulation technologies and approaches used are consistent with course and module learning outcomes, resource availability and cost-effectiveness. These include but are not limited to, low, and medium or high-fidelity human patient simulation mannequin or part-task trainers.	**93%**	*This is inherent in all our practices. The simulated learning activity used in this study was based on helping students develop their skills in the most appropriate way possible.*
Multiple methods of facilitation are available and use of a specific method is dependent on the learning needs of the participant(s) and the expected learning outcomes.	**91%**	*During the simulated activity facilitation methods were modified depending on the students and the situation. In some instances, a probing/questioning/reflective approach was*

		used. In others a coaching approach with demonstration.
Learning outcomes guide all aspects of simulation design including: student preparation activities, clinical scenario, group size, inclusion of observers or students from other disciplines, selection of mannequin fidelity and other equipment, level of student support during the simulation, and method of debriefing.	**89%**	*This was a low fidelity activity. It enabled students to go into and out of full clinician mode to enable them to discuss with a peer. This was based on learning outcomes which focused on students developing their basic skill levels. The simulated session was also influenced by resources provided in advance such as directed reading, videos talking through skill performance.*
Environmental fidelity is developed in line with the learning outcomes of the simulation session.	**87%**	*Yes. In this instance low fidelity was appropriate as it was core skill learning. Environmental fidelity would be increased in a subsequent activity when students would be expected to put core skill performance together with clinical reasoning.*

Contextually appropriate clinical equipment and the availability of hardcopy or electronic patient information and charts are used to enhance the realism of the simulation experience.	**91%**	*Patient information and charts were not required for this session as it was such basic learning. Where appropriate however patient information is provided in an accurate format.*
Assessment and feedback		
Any assessment is based on the intended learning outcomes of the exercise, with clarity regarding the knowledge, skills and attitudes to be evaluated and is appropriately tailored to the professional curricula to be evaluated.	**89%**	*The session was not assessed as it was focused on learning. Student skill performance was assessed in the summative assessment however and was based on practical application of all the relevant skills required for practice, including those addressed in the session.*
Formative feedback provides information for improving performance and behaviours associated with the three domains of learning: cognitive (knowledge), affective (attitude), and psychomotor (skills).	**89%**	*This session focused on formative feedback and addressed all areas.*
De-briefing		

Staff are competent in the process of debriefing	**91%**	*The staff member involved is experienced in simulation and has also familiarized themselves with good practice principles. The nature of the session didn't warrant debriefing as it was about skill practice and feedback was provided throughout and students asked on progress. Debriefing was an ongoing process and iterative.*
Structured debriefing is provided immediately following the simulation	**91%**	*In appropriate sessions some staff build this in. Other staff do this with much less structure.*
Staff create a safe environment for participant debriefing	**93%**	*This inherent in all our practices. We emphasize the importance of being able to make mistakes, own them and reflect on them to be able to learn from them.*
Feedback and debriefing to simulation participants must be constructive	**91%**	*Always*
Depending on the simulation objectives, opportunities for discussion of students' non-technical skills such as clinical reasoning, situation awareness,	**93%**	*Most of our simulations require elements of this*

communication, leadership and teamwork are included in debriefing.		*anyway and therefore this is built in.*
The debriefing facilitates students' reflection on practice, self-evaluation and feedback on their perceptions of the experience.	**91%**	*In true simulated activities yes.*

Key: red not met; buff yellow partly met, green fully met, bright yellow not applicable

Appendix 30: Suggestion for a global evaluation tool.

Global evaluation tool			
Does the student?	**Consistently observed 2**	**Occasionally observed 1**	**Not observed 0**
Being an accountable professional			
Treat the patient with dignity and respect			
Wear their uniform correctly and have a smart appearance			
Seek informed consent for the procedure			
Maintain patient confidentiality			
Demonstrate care and compassion			
Introduce themselves, their role and purpose			
Ascertain the patient's identity and preferred manner of address			
Use appropriate tone of voice and body language			
Promoting health and well-being			

Explain the procedure in simple terms			
Ensure dignity of patient			
Initiate health behaviours discussions			
Assessing needs and planning care			
Ensure need for procedure			
Explain to patient and answer any questions			
Providing and evaluating care			
Perform skill correctly following the procedure			
Adapt steps or behaviour as necessary with justification			
Ascertain if the procedure has been successful			
Leading and managing nursing care and working in teams			
Work with appropriate team members in a collegial way			
Work on own initiative			
Teach/advise or act as a role model to other team members			
Improving safety and quality of care			

Practice safely using correct equipment/ infection control procedure				
Work within own limitations				
Seek help or support as required				
Act as patient advocate when required				
Coordinating care				
Pass on relevant information to team members using an SBAR approach				
Document procedure and findings accurately				
Additional comments				
Total score	**50 - 40**		**25 - 39**	**Below 25**

Appendix 31: Ethical framework

Bradford and Ford 2010 adapted from p. 193.

Research contribution	**Suggestions of ways to facilitate**
Do participants understand the purpose of the study?	Participant information leaflet Informed consent form Face to face discussion Opportunity to ask questions
Do participants know that they are contributing to a project to gather generalizable knowledge to help others in the future?	Outline aims in Participant information leaflet
How much information do participants need to understand the nature of the research?	Provide background to study as well as process information
Are participants likely to be confused by the information provided to them?	Pilot information Check terminology
Are participants able to understand the language used in communication to them?	Use lay-man terms
What mechanisms are required to ensure that potential participants can ask questions about the research?	Provide contact details
What external pressures might impact on the fair treatment of participants?	Time restraints Other students/ lecturers

Research relationships	**Suggestions of ways to facilitate**
Do participants understand the relationship that they are entering?	Participant information leaflet
Are participants aware of how the relationship with the researcher/s will differ from other relationships that they may have with them (nurse, educator, manager)?	Participant information leaflet
What are the potential role conflicts?	Data collection by those not teaching students
What strategies are required to manage potential role conflict?	Team researchers
What measures are in place to protect participant confidentiality and in what situations might this need to be overridden?	Removal of names/identifying data NMC Code of conduct state what would have to report
What potential is there for abuse of researcher power?	Team researchers
What mechanisms are in place to minimize the negative influence of researcher power?	Offer external support/ counselling/ contacts
How easy will it be for potential participants to decline to take part in the study?	Online mechanisms rather than paper questionnaire
What mechanisms are in place to facilitate participants' withdrawal from the study if they wish?	Emphasize right to withdraw Explain how this will transpire

Research impact	**Suggestions of ways to facilitate**
Will participants face risks that they would not have faced otherwise?	Outline potential risks Seek Ethical approval
Do participants understand the potential risks of taking part in the research?	Participant information leaflet Informed consent form
What benefits may participants gain from taking part in the research?	Outline future benefits Student partnerships
How can any emotional effects on participants be managed?	Offer extra support
What ongoing mechanisms are required to support/help participants if necessary?	Counselling / pastoral support
Have all potential participants been provided with an equal opportunity to take part in the research?	Email / online / check with disability services

BRADBURY-JONES, C. and ALCOCK, J., 2010. Nursing students as research participants: a framework for ethical practice. *Nurse education today*, *30*(2), pp.192-196.

Appendix 32: Proposal to improve simulation-based education

Situation

Currently, simulation is one method used in the delivery of healthcare education at XXX. It can take many forms from the use of paper-based table top exercises or case studies to high fidelity simulation with computerised mannequins. Each type of simulation has a role and a place in the provision of high-quality teaching, learning and assessment for our students. However, it is recognised that there are improvements that could be made:

- Staff training in simulation is not part of XXX current teaching and learning course and specific training is not provided
- Simulation activities are not evaluated or reviewed.
- Standards for simulation are not being utilised.

Proposed solution

1. Introduce a set of simulation best-practice statements for use at School, module and individual lecturer level: These statements can be used to guide practice and audit simulation activities. Mapping of simulation to each statement using the categories of fully met, partially met, not met can act as an impetus for change and action plans implemented. It is recognised that not all simulation activities will need to adhere to all the statements, for instance assessment may not always be part of the activity, so there is a 'not applicable' option. These action plans should contribute to module enhancement plans.

2. Introduce the Clinical Skills Managed Education Network (CSMEN) Three-Tier approach to those staff involved in simulation activities. The vison of the CSMEN is that:

"Every health care practitioner who uses simulation for teaching and learning requires to undertake appropriate training and needs to demonstrate evidence of ongoing maintenance and development of their role as an SBL educator" (online 2017)

a. Tier One: for practitioner educators – awareness -online theory and a 1-day face to face course, suitable for all new lecturers
b. Tier Two: leaders of SBE – introductory level - for those who lead modules, simulation champions
c. Tier Three: researchers of SBE – advanced level – for those who are conducting research in simulation or manage simulation centres.

3. Introduce simulation to all new lecturers involved in teaching health care related topics.

4. Introduce a buddy system for staff engaged in or wishing to be engaged in simulation; to support those new to simulation and provide a peer assessment model.

5. Provide a bank of simulation scenarios and resources to share good practice and prevent repetition of materials being generated.

6. To co-ordinate multi-site simulation research across Scotland.

Steps involved

1. Submit proposal to xx
2. Present approach at Senior team meetings and at School level.
3. Re-develop simulation strategy
4. Nominate School simulation champions
5. Liaise and support nominated School Simulation champions
6. Meetings each semester to check progress and support development.

Benefits

1. Improve the student experience with potential for greater transferability of skills to clinical practice and the care and safety of patients.
2. Improve staff competence and commitment to simulation as a pedagogy.
3. Evidence towards Teaching for Excellence and overall quality indicators
4. Link to XXX strategy aims: To extend the reach and relevance of learners' opportunities to gain employment and thrive in their professional career; to ensure a high-quality student experience; to grow the globally recognised impactful research of the university.

Potential obstacles

1. Financial
2. Staff attitude
3. Resourcing staff time

Glossary/ abbreviations

SCSN Scottish Clinical Skills Network

CSMEN Clinical Skills Managed Education Network

Definitions

Simulation based-education

Terms have been created to link simulation with learning such as simulation-based education (SBE) and simulation-based learning (SBL). Zitzelsberger et al. (2017) proposed the "*replacement of "simulation" as a stand-alone term with "simulation pedagogy" or "simulation-based learning (SBL)" where the intent is to demonstrate how this approach is used through the development, implementation, and evaluation of quality teaching-learning methods unique to this modality*" (p.162).

Fidelity

Fidelity is the extent to which simulation matches the real world (Nickerson and Pollard 2010). As well as the physical environment being essential, simulation

also relies on psychological fidelity; how well the participant believes it matches reality (Maran and Glavin 2003). A multi-dimensional view of simulator fidelity consisting of environment fidelity, equipment fidelity, and psychological fidelity are critical to the success of simulation (Rehmann et al. 1995).