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Guide

Clinical Simulation in Nursing: A literature review and guidelines for practice

Karen Edgecombe, Philippa Seaton, Karen Monahan, Salome Meyer, Susie LePage and Gwen Erlam

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Authors

Karen Edgecombe, Dr Philippa Seaton, Karen Monahan, Dr Salomé Meyer, Susie LePage and Gwen Erlam, AUT

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Wellington 6140

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1 Introduction

Simulation is a teaching and learning strategy that is increasingly used in nursing education to prepare students for the clinical workplace. The Collaboration in Clinical Simulation project addressed the need in New Zealand undergraduate nursing education to enhance teaching and learning quality in simulation by creating a collaborative community of practice. While the Schools of Nursing in New Zealand have differing levels of equipment, resources and staffing allocation to simulation; this project considered the use of teaching and learning simulation strategies across the range of simulation fidelity and modalities. The Collaboration in Clinical Simulation project has produced guidelines for teaching and learning for effective simulation with undergraduate nursing students (refer section 2 of this document), based on a literature review (refer section 3). The collaboration and its outcomes are described in a separate document (Edgecombe, Seaton, Monahan, Meyer, Le Page and Erlam, 2013).

2 New Zealand Undergraduate Nursing Education Teaching and Learning Guidelines for Effective Simulation

2.1 Overview

The goal of any educational intervention, whether it is a focused skill, simulation-based scenario, clinical decision making or team work exercise, is to increase the knowledge and breadth of the students' learning. From this, the lecturer needs to utilise best practices in using simulation as a teaching method. There are a number of recommendations and strategies that can be implemented when considering teaching and learning guidelines in simulation.

2.2 Orientation to the simulator/simulation exercise

All students participating in simulation-based exercises or scenarios should be introduced to the simulation manikin. This could be done by:

- explaining the concept of the session and simulator manikin
- outlining the objectives of the session
- demonstrating and explaining the capabilities of the manikin
- reinforcing the professional student behaviours expected in the scenario
- considering the use of student information platforms (*e.g.* Moodle) to include short videos or orientation packages for simulation.

2.3 Objectives

The simulation experience should provide clear learning objectives and outcomes for the student. The objectives should:

- be clearly displayed within the course framework/session objectives
- demonstrate clear linking to current course under study
- be congruent with the experience level of the student
- detail the behaviours, skills and attitudes expected within the session
- identify expected outcomes of the session for the student
- be achievable within an appropriate time limit
- incorporate evidence-based practice
- link to and reinforce teaching and learning methodologies within the simulation.

2.4 Realism

In order to implement simulation for teaching and learning the simulation should reflect reality. This can be achieved by:

- ensuring that equipment (*e.g.* patient monitors) and the surrounding environment is similar to the practice environment; *e.g.* a hospital room for an in-hospital experience or a simulated living room for a community-based experience
- using 'props' to aid a sense of realism to the manikin *e.g.* patient pyjamas, wigs, dressings, moulage for wounds
- using resources that the student would encounter in the clinical environment, *e.g.* intravenous lines, dressings, catheter bags, patient identification bracelets
- ensuring that all paperwork, forms and patient charts are similar to the clinical environment
- utilising evidence-based practice to inform realism *e.g.* date all intravenous lines, use appropriate dressings and dressing techniques.

2.5 Debriefing

All simulation experiences should include a planned debriefing session that utilises reflective thinking as a premise for learning. The debriefing session should:

- be facilitated by a person who was involved in the simulation scenario
- be facilitated by a person who is familiar with the process of debriefing
- use evidence-based debriefing methodologies
- be based on a structured framework for debriefing
- be based on the objectives, the learners and the outcome of the simulated experience
- be conducted in an environment that supports confidentiality, trust, open communication, self-analysis and reflective thinking (INACSL Board of Directors, 2011).

3 Literature Review

3.1 Introduction

Simulation is a practice that resembles reality. It has existed in nursing education in many forms and the first healthcare simulation manikins were introduced in the early 1960s (Jeffries, 2007). As science, technology and education have progressed, simulation has become a sophisticated and innovative learning and teaching approach encompassing a vast spectrum of educational modalities. These range from computer games, role plays and skills-based trainers to patient manikins or human patient simulation (HPS).

This style of teaching and learning is highly interactive, allowing multiple learning objectives in a realistic simulated environment whilst mirroring the clinical setting (Murray, Grant, Howarth, & Leigh, 2008; Valler-Jones, Meechan, & Jones, 2011). Jeffries (2005, p. 97) defines simulated practice as:

activities that mimic the reality of a clinical environment and are designed to demonstrate procedures, decision making and critical thinking through techniques such as role playing and the use of devices such as interactive videos or manikins. A simulation may be very detailed and closely simulate reality, or it can be a grouping of components that are combined to provide some semblance of reality.

Simulation is an educational strategy and not a technology (Decker, Sportsman, Puetz, & Billings, 2008; Gaba, 2004; Ricketts, 2011). The purpose of simulation is to achieve specific goals related to learning or evaluation. Simulation does not replace the need for learning in the clinical practice setting, but allows the student to develop their assessment, critical thinking and decision-making skills in a safe and supportive environment (Medley & Horne, 2005; Valler-Jones *et al*., 2011). This also allows for the assessment and evaluation of the student performance, whereby if the student demonstrates a mistake, inaccurate patient assessment or slow clinical decision making, patient health is not affected and the student has the opportunity to learn from the experience. The primary aim of simulation is to improve patient safety and to help the student nurse achieve competence, linking their theoretical knowledge with clinical practice (Ricketts, 2011).

Within undergraduate nursing education, there is an increased focus on using simulation as a teaching and learning methodology. Internationally, simulation has been endorsed by nursing professional bodies (National League for Nursing [NLN], 2003; Nursing & Midwifery Council [NMC], 2007) and is a requirement by the Nursing Council of New Zealand (NCNZ) in the undergraduate nursing educational standards, where it is mandated that "all students have access to simulation learning resources in order to prepare them appropriately for clinical experiences to ensure the safety of health consumers, students and staff" (NCNZ, 2010).

While research and documented experience with using simulation in nursing education is increasing, there is limited research pertaining to evidence-based principles or theory on how students learn with simulation (Walton, Chute, & Ball, 2011). This review will examine the literature on simulation as a teaching and learning methodology within undergraduate nursing. It will specifically address ways in which clinical simulation impacts on student learning, identifying the positive teaching and learning practices within simulation and undergraduate nursing education.

3.2 Methodology

3.2.1 Search strategy

Prior to conducting a database search for relevant literature, two research questions were determined. They were:

(a) In what ways does clinical simulation impact on student learning?
(b) What are good practices for teaching and learning in clinical simulation?

A search of the literature was undertaken to find studies that examined the use of simulation in nursing education in relation to these two questions. Search terms included *nursing education and simulation, teaching and learning and nursing education, nursing, undergraduate, practicum, simulation, clinical, learning, teaching and learning, good practice, pedagogical approaches, effective strategies, nursing education* Inclusion criteria for this review were:

- the setting of the study was within the undergraduate nursing context
- the primary objective of the study was related to teaching and learning practices in simulation
- the article/study needed to provide some recognition of or recommendation for best teaching and learning practices in simulation
- the article was published within an English-language journal and was peer reviewed prior to publication
- the article was published within the last ten years.

The time period of ten years was set as it was recognised that there have been rapid changes over the last decade in nursing and education. The nursing role has further evolved as health changes and patient complexity have determined the on-going need for knowledgeable and clinically competent practitioners (Jeffries, 2007). Simulation in nursing education has provided increasingly more sophisticated manikins and these have become a more readily available resource within the educational setting.

The following databases were accessed for the period from 2002 to 2012:

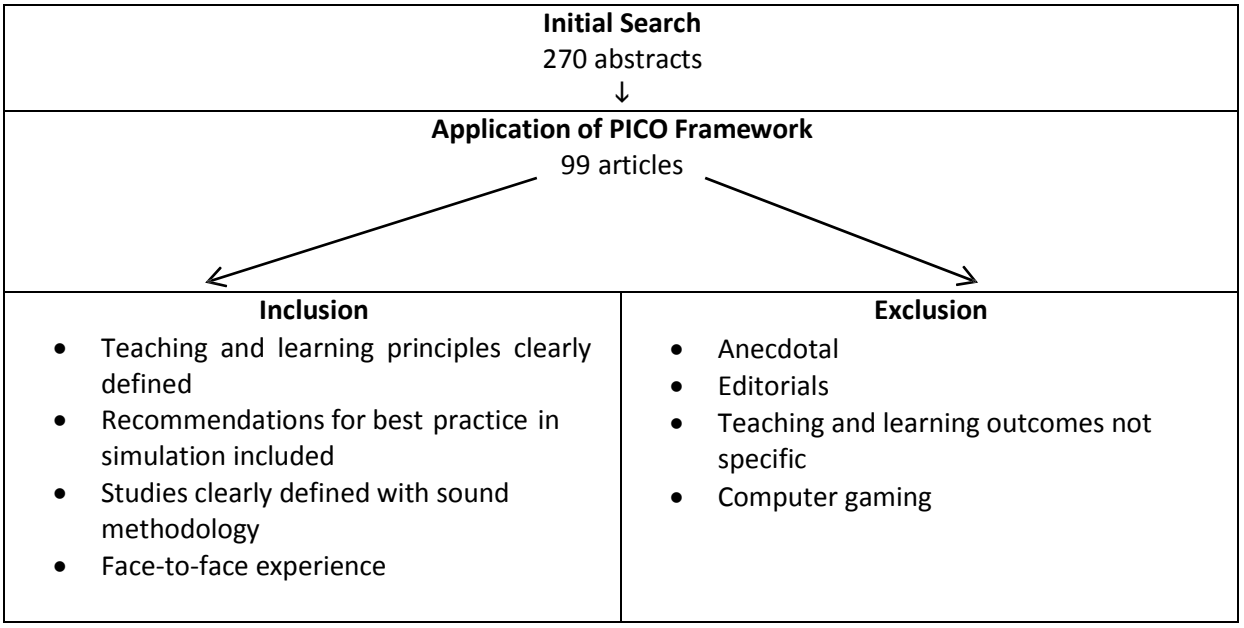
- CINAHL (Cumulative Index to Nursing and Allied Health Literature)
- Masterfile Elite
- Medline
- PubMed
- Cochrane Library
- Science Direct
- Proquest
- ERIC
- Johanna Briggs
- Specialist simulation journals content pages
- Thesis collections
- Google Scholar.

The initial search resulted in over 270 publications.

It was clear that there was some erroneous literature that had appeared within the search strategy and so the search was refined using the PICO (Population, Intervention, Comparator, Outcome) framework

to review the abstracts. (See Appendix A for a summary of the PICO framework). This resulted in 99 articles; however, on further investigation, while all addressed clinical simulation and learning in some context, not all addressed the teaching and learning principles adequately and so were excluded on this basis.

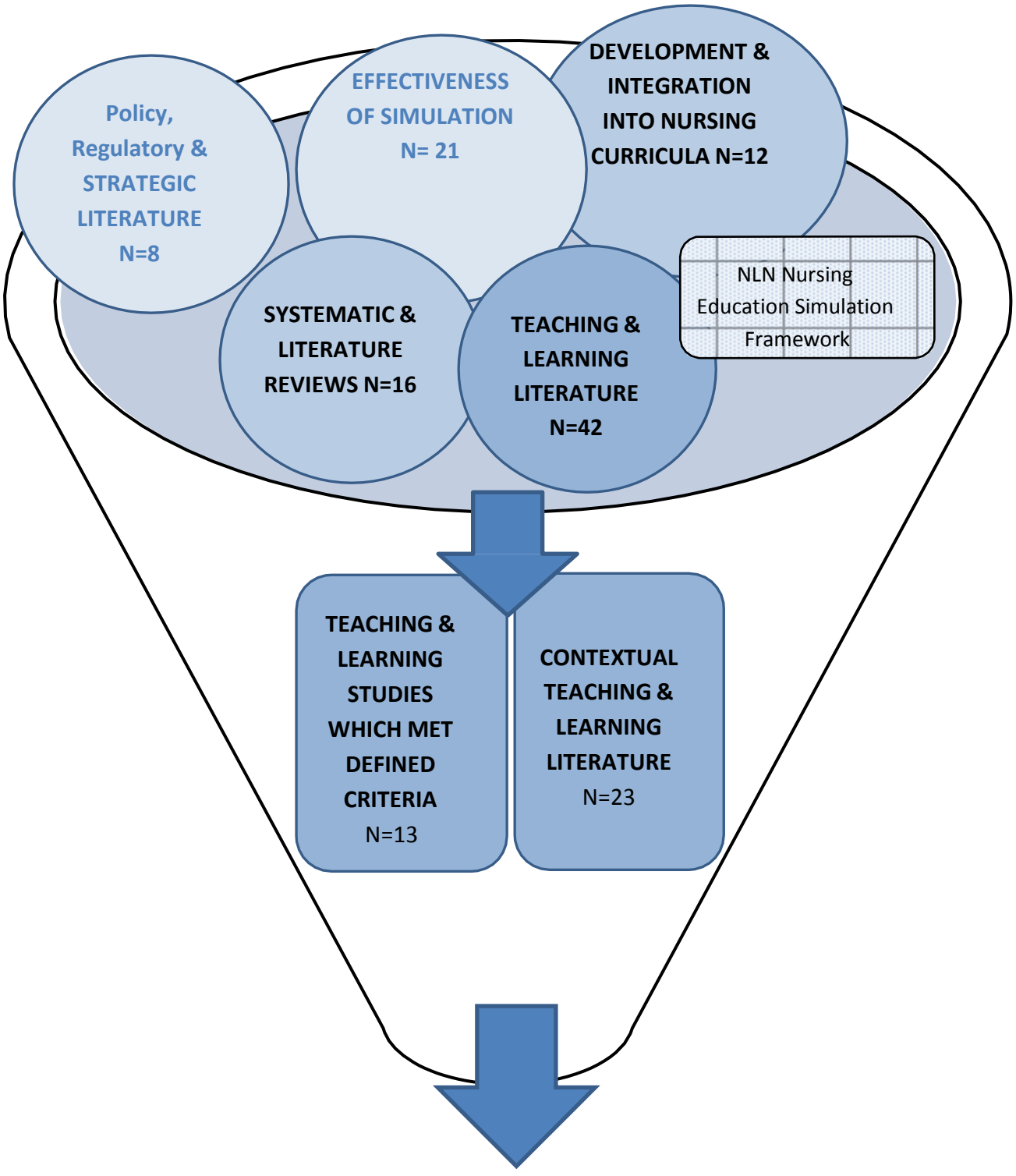
Table 1: Search Strategy



The literature was sorted into broad topics (see Figure 1). These included: government-based and strategic literature; curriculum integration; effectiveness of simulation; literature and systematic reviews; and lastly the literature that focused on the teaching and learning within simulation. Within these topics it was clear that there were articles which did not relate specifically to teaching and learning within simulation; however, they were included in the general review of literature as they did outline information pertaining to facets of simulation that enhance and enable the simulation process alongside the creation of barriers to effective simulation.

INITIAL LITERATURE SEARCH

PICO REVIEW



Policy, regulatory and strategic literature: Eight articles were included in the category of governmental and strategic literature, two of which were authored by Health Workforce Australia (HWA) examining the use of simulated learning environments in the Australian health context (HWA, 2010a) and also focusing on enhancing the capacity of clinical placements in nursing through the use of simulated learning environments (HWA, 2010b). Both projects were tasked by the Australian Government, reviewing the use of simulated learning environments in the Australian healthcare sector. A similar project was conducted in England, which focused on the use of simulation to support pre-registration nursing students with clinical skills prior to clinical practice (Moule, Wilford, Sales, Haycock, & Lockyer, 2006). A survey in the USA addressing whether high-fidelity simulation could replace clinical experience was reported on by Nehring (2008). Of particular interest was the collaborative simulation report between Laerdal and the NLN (Jeffries & Rizzolo, 2006), which outlined a national, multi-site, multi-method project. The purpose of this project was primarily to develop and test models that nursing faculty could implement when using simulation to promote student learning.

Development and integration of simulation into nursing curricula: Twelve articles were included that reviewed the integration and embedding of simulation into nursing curricula. The articles were based in the USA, Canada and England and included literature that described completed studies, alongside anecdotal articles reviewing the integration of simulation into nursing education. Primarily these articles all described simulation as a positive teaching methodology, revealing increased student self-confidence, improved decision making and enhanced learning opportunities. Alongside these positive aspects were the barriers of time, faculty buy-in and the perceived student performance anxiety produced by the simulation process.

Effectiveness of simulation: The effectiveness of simulation was another category that emerged from the literature sorting. Within this, the literature evaluated the use of simulation in nursing students and their ability to manage deteriorating patients, the effect of simulation on their self-confidence and self-efficacy and their critical thinking skills. The literature sorting yielded both formal studies and anecdotal articles.

Systematic and literature reviews: Sixteen literature or systematic reviews were included in the article database. These reviews covered a broad range of topics within simulation in undergraduate nursing education. For example, in a systematic review Lapkin *et al*. (2010) considered the effectiveness of patient simulation manikins in teaching clinical reasoning; Leigh (2008) reviewed the use of high-fidelity patient simulation and nursing students' self-efficacy; while Neil and Wotton (2011) completed a literature review on high-fidelity simulation debriefing in nursing education.

Teaching and learning literature: This was the largest category of literature that was initially reviewed. There were a high number of articles in this category that addressed teaching and learning concepts in some way; however, there was a limited focus on the teaching methodologies behind the simulation process. Studies generally utilise student evaluations of simulated learning and are quantitative with Likert-type scales (Bremner, Adduddell, Bennet, & van Geest, 2006; Fero *et al.*, 2010; Guhde, 2011; Kaplan, & Ura, 2010; Kardong-Edgren, Starkweather, & Ward, 2008; McCaughey & Traynor, 2010; Ravert, 2008; Smith & Roehrs, 2009). A number of articles base their research on the Nursing Education Simulation Framework developed for the National League for Nursing (NLN) (Jeffries, 2005; Kardong-Edgren *et al.*, 2008; Schlairet & Pollock, 2010; Smith & Roehrs, 2009).

This framework was the result of a collaborative alliance between the NLN and the Laerdal Corporation. The primary objective of this collaboration was to develop a model for teaching and learning in simulation that would promote student learning. The resulting Nursing Education Simulation Framework is a consistent, empirically supported model that guides and supports the design, implementation and evaluation of simulation within nursing education (Jeffries, 2005). The framework is now available and is utilised by nursing education within the simulation setting.

3.2.2 Data analysis

The studies included in this review had sufficient limitations in their methodologies to render them unsuitable for meta-analysis or meta-synthesis of the findings. Given this constraint of study design in the published literature available, qualitative interpretive data analysis techniques were the appropriate method for the analysis of these studies.

The aim of the qualitative analysis was to identify common themes occurring in the literature to underpin the subsequent development of teaching and learning guidelines for undergraduate nursing education. Accordingly, inductive, interpretive analytic strategies (Dixon-Woods, Cavers, & Agarwal, 2006) were used in the analysis. These strategies involved iterative reading of the studies, analysis of individual studies, and comparison of findings between the studies (Dixon-Woods, *et al*., 2006; Thomas & Harden, 2008). The findings of each study were first considered to develop codes for individual studies. Subsequent comparisons across the 13 studies enabled identification of themes within the data (Whittemore & Knafl, 2005), resulting in an integrative review. It should be noted that the resulting themes are descriptive rather than explanatory, due to the level of data contained in the studies. With a view to ensuring rigour in the interpretation, the research team members read the literature review findings with a view to clarifying and/or challenging the interpretations and themes as needed.

3.2.3 Final review literature/articles

Thirteen studies were included in the final review. They are listed in the table below:

Author, Date, Country	Article	Method	Sample Size	Findings
Adamson (2011) USA	Piloting a method for comparing two experiential teaching strategies.	Quasi-experimental, non-equivalent comparison group study Case study versus human patient simulation	14 Senior Baccalaureate Nursing Students	No significant differences between groups in teaching strategies: simulation vs case study clinical conferences Suggest: orientation to simulation/exercise
Bremner, *et al*. (2006) USA	The Use of Human Patient Simulators: Best Practices With Novice Nursing Students	Questionnaire (2-part) • Likert Scale • Short Answer	56 Junior Nursing Students	Valuable Realistic Would have preferred extra time/further orientation to simulator
Buykx, *et al*. (2011) Australia	FIRST2ACT: Educating nurses to identify patient deterioration: A theory-based model for best practice simulation education	MCQ Participant self-appraisal/evaluation	51 Senior Undergraduate Student Nurses 35 Student/Postgraduate Midwives (did not work with Student Nurses or compare results to)	Improvement in self-rated knowledge Reflective review and feedback necessary for learning Realism of environment important
Cordeau (2010) USA	The Lived Experience of Clinical Simulation of Novice Nursing Students	Hermeneutic phenomenology	19 Undergraduate Nursing Students	Realism important for application to clinical practice Anxiety of students was high Debriefing necessary Simulation assisted in preparing for clinical practice
Dreifuerst (2009) USA	The Essentials of Debriefing in Simulation Learning: A Concept Analysis	No study attached Author links to literature and describes 'model cases' within article		
Guhde (2011) USA	Nursing Students' Perceptions of the Effect on Critical Thinking, Assessment, and Learner Satisfaction in Simple Versus Complex High-Fidelity Simulation Scenarios	Survey • Utilises NLN Nursing education simulation framework	134 Junior Nursing Students	Both scenarios improved student awareness of assessment skills, critical thinking and priorities Linking to learning objectives Debriefing

Howard, *et al*. (2010) USA	Human Patient Simulators and Interactive Case Studies: A comparative analysis of learning outcomes and student perceptions	Quantitative quasi-experimental pre-test/post-test design comparing two teaching strategies	49 Senior Nursing Students	Results indicated simulation decreased anxiety, linked to learning, able to transfer knowledge Link to Learning objectives/outcomes
Kaplan & Ura (2010) USA	Use of Multiple Patient Simulators to Enhance Prioritizing and Delegating Skills for Senior Nursing Students	Survey	97 Senior Nursing Students	Strongly supported simulation Realism Decision making Working within the team
Lasater (2007) USA	High-Fidelity Simulation and the Development of Clinical Judgment: Students' Experiences	How do I write this up? Focus groups Study embedded into larger qualitative study	39 Junior Nursing Students	Debriefing Personal characteristics of faculty supporting debriefing process important
Mikkelsen, *et al*. (2008) Norway	Nursing students' learning of managing cross-infections: Scenario-based simulation training versus study groups	Focus groups	141 second-year Nursing Students	Simulation-based training increased student awareness of complexity Repetition of scenario important Reflection/debriefing Teacher's role vital Time and expense of simulation-based training
Shepherd, *et al*. (2010) UK	Investigating the use of simulation as a teaching strategy	Longitudinal, comparative quasi-experimental design	28 Senior Nursing Students	Simulation as a teaching strategy contributes to students' learning Unexpected findings related to student ability
Smith & Roehrs (2009) USA	High-fidelity simulation: Factors correlated with nursing student satisfaction and self- confidence	Descriptive, correlational design	68 Junior Nursing Students	Link to learning objectives Debriefing Realism
Walton, *et al*. (2011) USA	Negotiating the role of the professional nurse: the pedagogy of simulation: A grounded theory study	Grounded theory	26 Senior Nursing Students	Supportive faculty traits/coaching Anxiety/fear Realistic pace of environment

3.2.4 Learning through simulation

There is a need to alter teaching methods to fit the demands of the student learner today (Medley & Horne, 2005). Simulation is an innovative and technologically advanced teaching and learning approach that combines a problem-based approach with experiential learning. The student learns through 'doing' and 'experiencing', utilising their knowledge base, psychomotor skills and clinical decision making based on the information before them. This may appeal to some students, who may have already experienced higher levels of technology through previous education. However, along with the attraction to the technology, there is also the negative aspect of anxiety provoked by the simulation and the expectation for the student to competently complete the exercise.

Experiential learning theory was the basis for the work of Buykx, *et al*. (2011) in the development of their educational model, FIRST2ACT. The authors believed that didactic teaching methods were unlikely to prepare the student nurse for the clinical skills and knowledge required when nursing a deteriorating patient. The simulation-based model FIRST2ACT incorporates five components: developing core knowledge; assessment (learning stimulus); simulation; reflective review; and performance feedback (Buykx, *et al*., 2011). Their belief was that the learning would occur through the experience, where the learner moves through the four phases of experiencing, reflecting, thinking and acting when integrating new knowledge (Kolb, 1984). This is further reinforced in simulation as it demands more participation from the student in comparison to traditional methods of note taking or listening in class without action (Valler-Jones, *et al*., 2011). In the study by Buykx *et al*. (2011), experiential learning is reflected in the knowledge, clinical assessment skills and management of the deteriorating patient by the student.

The FIRST2ACT study involved 51 final-year student nurses, along with undergraduate and postgraduate midwives. The participants did not work together but instead had separate simulation exercises, and the researchers utilised the data from all participant groups. Simulator manikins were only used in the student nurse participants, whereas the student midwives and postgraduate midwives completed their simulations with human patients. Data was gathered from the participants completing a self-evaluation form at the end of the exercise, rating their experience on a five-point scale extending from 'not achieved' to 'achieved'. All participants had the opportunity to review their performance through video review and this session was supported by a clinical expert who guided them through the review and reflection process.

The findings of the study indicated that the students recognised the need to ensure basic patient assessment and observation skills and a reinforcement of emergency management skills. There was a significant improvement in self-rated knowledge following participation in all groups. The nursing students did not show significant improvement in self-rated confidence and competence. The students were able to review their personal attributes and ability to keep calm and confident under pressure and the necessity for positive interpersonal skills. All participants found the debriefing session valuable.

Buykx *et al*. (2011) believe that the FIRST2ACT teaching model could be used in many areas of nursing education. Teaching and learning approaches should expand to include these innovative opportunities with knowledge and skill delivery. The experiential learning process incorporating reflective review and feedback within this study allows a stronger learning opportunity that more traditional models of teaching could provide.

While Buykx *et al*. (2011) believe that the nursing students in their study were able to recognise the need for basic patient assessment and nursing skills through simulation, Adamson (2011) could not detect a discernible difference in a pilot study conducted with 14 senior baccalaureate nursing students. This quasi-experimental, non-equivalent comparison group study used two student groups who received either case study conferences or HPS activities to determine the best teaching strategy in caring for a patient with congestive heart failure (CHF). These two teaching approaches were used as they both applied experiential learning theory, and the purpose of the pilot study was to compare the cognitive, affective and psychomotor learning outcomes between the two strategies.

The participants all completed a computer-based, self-directed learning module related to the content of the clinical case study conference or the HPS, and they also completed an independent learning module on CHF. After this, the participants were randomly assigned into four groups and completed the knowledge pre-test. Participants in two of the groups also completed a survey on student satisfaction and self-confidence in learning at this time. All groups received the same patient profile information and while the HPS groups completed the activity through simulation, the clinical case study conference group completed the activity through group discussion. All groups completed a post-test knowledge exam and the remaining two groups completed the survey on student satisfaction and self-confidence in learning at this time.

Following on from this encounter, seven participants were randomly chosen to participate in an individual standardised patient student performance evaluation. This was to test overall learning and the students' ability to transfer the previous learning to further practice. This session was also video-taped.

The pre-tests, post-tests and surveys were scored manually and the video-recorded simulations were analysed by an independent faculty member. However, through all the analysis, there was no discernible difference between any of the groups in cognitive, affective or psychomotor learning outcomes. The author recognises that the sample size was very small and this may have affected the study results. The two different experiential learning activities were also led by different faculty members, which may have had influence on the outcomes.

While the study by Adamson (2011) did not show an obvious difference or strength of using simulation as a teaching and learning method, Howard, Ross, Mitchell and Nelson (2010) completed a similar research project that proved simulation to be a sound teaching and learning approach. The authors examined the use of interactive case studies and compared it to HPS to determine if the cost of simulation equipment was justified. Howard *et al*. (2010) utilised a quantitative quasi- experimental two-group pre-test and post-test design to compare the two teaching strategies with 49 senior nursing students.

The participants were randomly allocated into two teaching strategy groups and all participated in the pre-test and post-test. Student perceptions of the teaching method were measured by questionnaire, where they rated their experience on a four-point Likert scale indicating from 'strongly disagree' to 'strongly agree'. The participant groups each viewed the same PowerPoint presentation on the topic and the interactive case-study group analysed the nursing care and answered questions within a group discussion. The HPS group received an orientation to the simulation manikin and then completed a head-to-toe assessment of the manikin, analysing the data presented and completing the nursing cares as required.

The findings by Howard *et al*. (2010) indicated that the students in the HPS group agreed more significantly than the interactive case-study group that the teaching method assisted their critical thinking and was a valuable learning experience. They believed that they could transfer the knowledge to the clinical setting and that the experience would enable them to decrease their anxiety in clinical. The pre-test results of both groups possessed similar results. However, the post-test scores for the interactive case-study group actually decreased. The authors believed that this could have been related to fatigue due to the passive nature of the learning and that the experiential learning process of the HPS technology of HPS may have increased student interest and thus assisted with the learning activity. The authors concluded their findings with a recommendation to utilise HPS as a teaching and learning strategy, citing its effectiveness in enhancing student learning outcomes.

These studies have shown the experiential learning opportunities of simulation as a teaching and learning strategy. The small participant number in Adamson's study (2011) appeared to significantly affect the findings, whereas the similar study by Howard *et al*. (2010), which utilised a larger participant group, indicated HPS was an effective teaching and learning strategy. This experiential educational model assists the student in gaining confidence in their nursing care, patient assessment and decision making, and allows them to apply their theoretical knowledge to the experience (Jeffries, 2007).

3.2.5 Realism

The active production of simulation scenarios so that they are as realistic as possible allows fidelity and belief in the activity by students (Cordeau, 2010; Garrett, MacPhee, & Jackson, 2010; Medley & Horne, 2005; Sanford, 2010; Traynor, Gallagher, Martin, & Smyth, 2010). Realism assists the student in using their cognitive, affective and psychomotor skills to provide knowledgeable and effective nursing care (Cordeau, 2010). Realism offers a true strength to simulation as a teaching and learning approach; it should include realistic medical equipment, clothing, lighting and even sounds in the replication of the environment (Jeffries, 2007).

Bremner *et al*. (2006) examined the value of HPS as an educational methodology from the perspective of 56 novice nursing students. The study reviewed the student's perceptions in four areas of interest including the realism of the HPS. The simulation involved the student completing an initial head-to-toe assessment of the simulator manikin. The scenario was completed twice, with the presenting clinical signs of the manikin changing the second time. The students then completed a two-part questionnaire about their experiences. The questionnaire involved a Likert scale to identify the student's overall perceptions of their experience with the HPS, with other questions relating to the use of simulation in increasing their confidence and decreasing anxiety levels. The second component of the questionnaire involved written comments after completion of their clinical course.

The results showed value in HPS in four areas of teaching and learning: utility, realism, confidence and limitations. The participants believed that the scenario was realistic and provided active learning, allowing them to build confidence in their assessment and nursing skills. From these the authors developed recommended best practice in using HPS. Reference to realism is included in these guidelines, with the authors recognising the value in organising the environment, the manikin and including paperwork that realistically reflects the clinical environment. The research results and best practice guidelines also acknowledge the importance of ensuring that the learning outcomes are well articulated for the HPS session along with the on-going training of faculty in HPS.

In the study by Buykx *et al*. (2011), it is of note that the students requested the simulation be completed with people and not manikins in order to affect greater realism within the simulation. The study authors actually changed the simulation component for the midwifery students and postgraduate participants groups based on this feedback. While there were no comparisons in terms of learner outcomes made in the study between the participant groups, the authors recognised that there was benefit in 'fitting' the simulation to the resources in order to provide greater realism.

3.2.6 Linking to learning objectives

Linking the simulation experience to learning outcomes and establishing a clear association with learning objectives are imperative to enable the student to build their knowledge base and provide a more focused and deeper learning experience that promotes critical thinking and clinical reasoning (Medley & Horne, 2005; Ricketts, 2011; INACSL Board of Directors, 2011a). Smith and Roehrs (2009) recognise the factors that lead to positive simulation outcomes and completed a descriptive correlational study in HPS. While this study primarily addressed the student reporting self-confidence and satisfaction with HPS, the study results clearly indicated the need for clear learning objectives.

Smith and Roehrs (2009) used the Nursing Education Simulation Framework (Jeffries, 2007) to guide the study. The sample size in Smith and Roehrs' work consisted of 68 junior students experiencing simulation during their first medical/surgical course. The students worked in groups of four, with two participants working as the nursing students and the other two students acting as observers. Within the simulation, the scenario involved an elderly respiratory patient experiencing respiratory distress. The scenario had a 20-minute time limit; however, it was able to conclude earlier if the students took the appropriate nursing measures and interventions to assess and relieve the respiratory distress.

The simulation session was evaluated by the students using two self-reporting scales. They were the Student Satisfaction and Self-Confidence in Learning Scale[1] and the Simulation and Design Scale. Both instruments were developed by the NLN and are self-reported, five-point Likert scales. From the research Smith and Roehrs (2009) found that the students were satisfied with the teaching method and were confident in their ability to care for the patient. A significant finding was that the design of the simulation had an effect on the student's perception of their learning. Specifically this related to the objectives of the simulation and it was recognised that when the student could view the link between the simulation objectives and their actions, it increased the student's satisfaction levels. This highlights the importance of appropriately planning and implementing HPS experiences for nursing students. The researchers recommend further studies with larger sample sizes, multiple types of learning experiences and studies using experimental design (Smith & Roehrs, 2009).

Cordeau (2010) also reviewed student perspectives in order to guide teaching and learning strategies in achieving simulation objectives. Cordeau believed that in order to effectively use clinical simulation for nursing education, the perspective of the nursing student must first be understood. Hermeneutic phenomenology was used to guide the study and a purposive sampling method gained 19 first-year nursing student participants.

The clinical simulation scenario used in the study by Cordeau (2010) also utilised the Nursing

[1] Further details on the Student Satisfaction and Self-Confidence in Learning Scale can be found here: http://www.nln.org//beta/research/nln_laerdal/instruments.htm

Education Simulation Framework (Jeffries, 2007). All students were familiar with clinical simulation through an orientation session and at least one simulation practice session. They all had been prepared with a copy of the simulation scenario, intended learner outcomes, a description of the patient profile and all the required psychomotor skills and cognitive activities that would be required for the session. This level of student preparation for the simulation was high, although it is noted that the participants were novice nursing students and it could be concluded that their level of orientation and preparation to the scenario may be more intensive than experienced students would require.

The participants were summatively evaluated in the session using a rubric and checklist based on the objectives and this was provided to the student at the end of the debriefing session. The students were given a grade of 'pass' or 'needs improvement', and 10 *percent* of the participants needed to repeat the clinical simulation. The participants were then asked to write about their experience.

Five thematic clusters emerged: (a) perceived anxiety; (b) seeking and imagining; (c) performing in the moment; (d) critiquing the performance; and (e) preparing for nursing practice. Anxiety occurred throughout the simulation and during the debriefing, and the author identified that the summative nature of the simulation may have contributed to this. Preparation and rehearsing the simulation, imagining and practising the scenario assisted the student to interact with the simulator.

The students all had the opportunity to critique their performance through video playback. During this process, faculty provided observations and assessments that assisted the student in the opportunity to learn from their mistakes. The final theme of preparation for clinical practice entailed the students learning from their simulation experience and how it assisted them to combine their knowledge with skill acquisition. Overall the students found the simulation to be a positive experience.

Cordeau (2010) identifies a number of implications for teaching and learning strategies. The preparation of the student for clinical simulation is highly important and determines the success of the simulation experience. The design, implementation and evaluation of the simulation affect the students' perception of their learning and subsequently their experience. Linking to learning objectives and aligning the student with the expectations of them during the simulation assists in the transference of knowledge to clinical skills.

The implications identified by Cordeau align with the objectives for simulation developed by the INACSL Board of Directors (2011a). This series of objectives identify the need for congruence between the simulation activity and programme outcomes, the incorporation of evidence-based practice into the simulation and that the participant level of learning is acknowledged. Additionally the INACSL Board of Directors (2011a) recommends that the simulation be achievable within an appropriate time frame and incorporate aspects of holistic care and cultural awareness where possible.

3.2.7 Using simulation to improve student learning

Simulation is widely discussed in the literature as an effective teaching and learning approach. Linking the simulation activity to learning objectives, a sense of realism and promoting clinical assessment and decision making allows HPS to be a teaching and learning approach that appeals to nursing education. Importantly, HPS provides educators with an effective strategy for teaching the critical thinking skills necessary to make clinical decisions. A study by Kaplan and Ura (2010) demonstrated the effectiveness

of HPS, promoting practice of clinical and communication skills, patient assessment, clinical decision making and working within a team.

Kaplan and Ura's (2010) study used simulation to assist student confidence while enhancing the students' ability to prioritise, delegate and safely care for numerous patients. The authors recognised that the use of multiple concurrent simulators in undergraduate nursing was limited and so they developed a focused case study. The participants were 97 senior nursing students and the overall aim was to review the link between patient simulation and clinical performance improvement.

The simulation exercise used three simulator manikins, each representing a patient from the case study. The format of the simulation exercise was that of a 'shift', with students taking part in a role play. This involved the students participating in the setting of a ward environment, where they were expected to care for a number of patients. The students were introduced to the simulation prior to commencing. Student participants participated in a four-hour simulation experience in groups of 10 to 12 students and a debriefing session followed the simulation.

The sessions were completed over one semester until all students rotated through the simulation. The simulation experience was designed to synthesise material from several different courses so that the student would utilise their skills in leadership, delegation, management and prioritisation. All students had previous simulator experience within the curriculum. Nursing faculty supported the students through the simulation and evaluated student performance on a priority and decision-making scale and a critical action checklist, which was further utilised within the debriefing session. This information reported a wide range of student behaviours in adapting to the professional nursing roles. There were high levels of nervousness, errors occurred in patient care communication with other team members, and cues were missed for appropriate nursing care. The debriefing sessions incorporated these errors into the discussions and focused on patient safety and the importance of correctly identifying patients and their clinical assessment and details.

An anonymous survey was placed on the course Blackboard site for the students to provide an evaluation of their experience. Uptake on completing this survey was high with 96 students reporting their simulation experiences. Primarily the students reported either strongly agreeing or agreeing that the simulation exercise increased their understanding of prioritising and delegating care, their confidence in team work and that the case studies increased their understanding of the clinical case. The students repeatedly reported that the simulation exercise was the most realistic of their previous simulations. However, the data also indicated that 26 *percent* of participants did not believe that the simulation enhanced their confidence or prioritisation abilities, and they reported feelings of inadequacy after the simulation as they realised their lack of knowledge and nursing skills.

As noted previously, all participants had simulation experience. The nursing faculty observers attributed the negative responses to students not recognising the opportunity to delegate and not understanding their role within the simulation. Based on the feedback it was recommended that revisions be made to include more information regarding the roles and scope of practice of other healthcare team members and more guidance on delegation activities.

As technology advances simulator manikins become more complex and overwhelming with added expense and training for faculty. Guhde (2011) recognised that while high-fidelity simulation engages students, there is a question about whether the complexity of simulations was also linked to teaching

and learning effectiveness. Gudhe completed a pilot study that examined the student perceptions of the learning effectiveness of two different level scenarios in simulation: simple vignettes and complex scenarios.

The participants were 135 junior baccalaureate nursing students rotating through the medical/surgical component of their course. They were evaluated on critical thinking, learning and learner satisfaction with the teaching method, and they completed an anonymous survey after the simulation experiences. The participants took part in four simple one-event simulations during their first four weeks of theory, and then proceeded to two complex role-playing scenarios. The simple vignette involved the student completing an assessment of the manikin and writing a response to their actions, which they then reported to a 'buddy'. The complex scenarios involved role playing and completing an assessment of the manikin, with the instructor altering the simulators' clinical manifestations depending on the student actions.

The study was based on outcomes defined within the Nursing Education Simulation Framework of learning, skill practice, learner satisfaction, critical thinking and self-confidence (Jeffries, 2005). The students completed three anonymous surveys to rate the effectiveness of the two different levels of simulation experiences. They evaluated the four simple vignettes together as one level of assignment and the complex scenarios were evaluated separately. In their results, both levels of assignment were viewed positively by the students with no significant differences between the vignettes or complex scenarios. The participants reported that both types of simulation helped improve their awareness of the importance of assessment skills, critical thinking, priority setting and the awareness of the nurses' role (Guhde, 2011).

Guhde (2011) reports that the simple scenarios are as effective as complex role-playing scenarios and recommends that simple scenarios may meet learning objectives more effectively. The author recognises that the student participants were also completing a clinical block concurrently with their theoretical simulations and this may have exposed them to similar clinical cases which may have enhanced their learning. Also, Guhde (2011) does not display any data collected from the nursing faculty observers with the exception of generalised feedback within the literature. The self- reporting nature of the data collection does not measure cognitive or behavioural changes of students and this study is based on the student perception.

Shepherd, McCunnis, Brown and Hair (2010) investigated clinical simulation as a teaching strategy, seeking to establish whether simulation promotes effective learning. Specifically, Shepherd *et al*. (2010) wanted to determine whether one method of simulation was more effective in assisting learning in relation to practice nursing skills, motor skills and affective skills. The project was a longitudinal, comparative, quasi-experimental design, which evaluated 28 final-year nursing students and their cognitive, motor and affective skills. The students also completed self-assessments of confidence and anxiety levels.

Within the study, students were required to measure and assess vital signs in a simulated environment. The assessment was completed on a volunteer patient at Site A, while at Site B a high-fidelity manikin was used. Twenty-eight final-year nursing students participated in the study and were allocated into two site groups. The students at both sites were assessed using a clinical scenario that was appropriate for their stage in the programme. The students were required to complete a patient assessment and specific questions were asked to assess their knowledge, understanding,

decision making and problem solving related to the measuring and assessment vital signs. The students at Site A completed the simulation on a volunteer 'patient', while at Site B a simulation manikin was used. No automated equipment was used during the assessment. All participants were examined under a specific time frame and their performances were video-recorded. Following six months of clinical practice, the participants were reassessed using a similar scenario. This allowed the opportunity to review any changes to the student's performance following clinical placement and at this time the response rate was 24 participants.

The results in phase 1 showed no significant difference between the sites and the students' outcomes in cognitive, motor or affective domains. Pre-test anxiety and confidence were higher in the students at Site A with the volunteer 'patient'; however, the researcher believed that the level of anxiety and confidence did not affect the student performance. During phase 2, the total cognitive scores decreased at both sites, which concerned the researchers as it did not demonstrate that the students were increasing their knowledge, understanding, decision making and problem solving after further clinical experience. Students demonstrated poor manual dexterity when using the equipment, with inaccurate blood pressure cuff positioning and incorrect stethoscope use and also an inability to correctly locate brachial and radial pulses. The researchers linked this potentially to the use of automated equipment in the clinical environment. When taking respirations, some students placed their hand on the manikin's chest, contravening good practice, and it was common for the students to look at the monitors (which were switched off) for confirmation of vital signs.

The author concludes that both forms of simulation realised similar outcomes in terms of the students' scores, except the affective domain, where the role play achieved significantly better results than the simulation manikin. The concerning finding was the lack of improvement in student performance post-clinical experience and the performance of the final-year students in taking basic observations. Shepherd *et al*. (2010) proposed a number of recommendations for practice including linking the simulation to the learning outcome, and ensuring that faculty members are familiar with the teaching strategy and equipment. This study by Shepherd *et al*. (2010) also linked the students and simulation with current practice. The skills and knowledge of students did not improve over the time period of the study and yet in the previous outlined study by Guhde (2011), it was believed that the concurrent clinical practice assisted the students to retain knowledge and demonstrate clinical skills.

The purpose of the study by Mikkleson, Hegg, Reime and Harris (2007) was to determine the most efficient teaching method for managing cross-infections. The sample consisted of 141 second-year nursing students undertaking learning in infection control. The study was based on two infection-control scenarios, and the authors wanted a comparison of three different teaching methods: scenario-based study groups with 12 students and no teacher; study groups with 12 students and a teacher; and lastly, simulation training with four students and a teacher. The study groups were based on theory only, with the simulation training involving practical experiences. Only a quarter of the students participated in the simulation exercise, with most being involved in the two theory study groups. Focus groups were used to gather information after the experience and 21 students accepted the invitation to participate in this process. The reported study does not indicate whether the focus group participants were involved in the simulation activity.

However, the results of the study indicated that the scenario-based simulation training made the students more aware of the complexity of each scenario. The educator's role was viewed as crucial in the process, as the students felt supported and that they benefitted from the educator's knowledge

and assistance. The students had to play various roles in the simulation and they recommended that further information be given regarding the expectations for this. Repetition was viewed as important within the simulation group as was the opportunity for reflection.

Due to the limited available research relating to pedagogical teaching principles within simulation, Walton, Chute and Ball (2011) used grounded theory methodology to explore how nursing students learn using this teaching and learning strategy. The purpose of the study was to gain an understanding of how students learn with simulation and to identify basic social processes and supportive teaching strategies (Walton *et al*., 2011). The authors focused on four research questions: (a) how do students learn using simulation; (b) what is the process of learning with simulations from the students' perspective; (c) what faculty teaching styles promote learning; and (d) how can faculty support students during simulation? The participants consisted of 26 senior baccalaureate nursing students who had also completed two semesters of simulations laboratory courses prior to participating in the study and so were familiar in simulation.

Walton *et al*. (2011) identified a number of phases that student nurses experienced during simulation. These phases followed a path for the student, from feeling like an imposter, making errors and struggling with the learning strategy with feelings of anxiety and discomfort, disorganisation and wanting specific instruction. However, through practice and skills development the students moved through to being able to recognise the simulation as a learning exercise, develop their team leadership skills and believe that they could successfully perform the role of a professional nurse. At this point students reported feeling more self-assured, knowledgeable and less anxious. They viewed themselves as integrating into the healthcare team and advocating for their clients, and they were starting to think about professionalisation and their future as nurses.

The student participants clearly articulated faculty teaching traits and characteristics as important to their learning. These included: providing support using a welcoming voice tone and posture; acknowledging anxiety; allowing a tolerance for joking around; and role modelling. Communication was a key, along with repeating instructions and simulations, slowing the simulation pace, talking through worst-case scenarios and providing individualised specific feedback at the debriefing sessions.

3.2.8 Debriefing

Debriefing is an integral and compulsory component of simulation (Dreifuerst, 2009; Garrett *et al*., 2010; Lasater, 2007; Medley & Horne, 2005; Neill & Wotton, 2011; Parker & Myrick, 2010; INASCL Board of Directors, 2011b; Traynor *et al*., 2010). By providing an active learning opportunity whereby the students and faculty actively examine the clinical simulation, it fosters the development of clinical reasoning and critical thinking through a reflective learning process (Dreifuerst, 2009). This also links to Kolb's experiential learning cycle (1985) whereby the student learns and reflects on their actions and decision making, analyses the content and considers how to develop more skilful nursing actions and practice. The literature highlights the notion that quality learning with simulation is jeopardised without debriefing (Parker & Myrick, 2010).

A major premise underpinning simulation is the concept of constructivism (Dreifeurst, 2009; Neill & Wotton, 2011). In constructivism, students use prior understanding together with current interactions to construct and shape their knowledge, sharing their knowledge and actions with peers (Neill & Wotton, 2011). The faculty role at debriefing is to assist students through active dialogue to reflect upon their clinical decisions and actions, to reconstruct the events, and build on their actions.

Debriefing methods vary across the literature, with many choosing critique, correction and open discussion using video playback or faculty feedback (Dreifuerst, 2009).

The Standards of Best Practice in Simulation, produced by the INASCL Board of Directors (2011), identified outcomes of simulation which debriefing supports. These included: enhancing learning and understanding; promoting the transfer of knowledge; safe and quality patient care; identifying best practices; and increasing the self-confidence of the learner. In order to achieve these outcomes, the INASCL Board of Directors recommends that the debriefing process should: use evidence-based debriefing methodologies; be based on a structured debriefing framework using the objectives and outcomes of the session; and be conducted in an environment that supports confidentiality, trust, open communication, self-analysis and reflection. Furthermore it is recommended that the individual leading the debriefing session is a person who has observed the simulation and is aware of the debriefing methodologies.

Despite the recommendations through the literature that simulation must have a component of quality debriefing, there is minimal research regarding best practice in debriefing for simulation. Lasater (2007) undertook a qualitative exploratory study with 39 baccalaureate nursing students reviewing clinical judgement in high-fidelity simulation. In this study Lasater discovered that debriefing was the most important phase for determining clinical judgement; however, not enough time was spent during this process. Interestingly, the students in the focus group responded by requesting more honest and forthright feedback of both a positive and negative nature. Lasater (2007) also described the personal characteristics of faculty as being important to the debriefing, with a supportive demeanour being essential to the process. This was reinforced by Walton, Chute and Ball (2011) in the study described earlier.

3.3 Limitations

The aim of this literature review was to consider the ways in which clinical simulation impacts on student learning and also to review the good practices for teaching and learning in clinical simulation. However, there were a number of limitations within this literature review. Not all Schools of Nursing in New Zealand have the same level of equipment, resources or staffing allocation to simulation; therefore, when considering the use of teaching and learning simulation strategies, an awareness and engagement with a range of simulation fidelity and modalities is important. While this literature review has included all aspects of teaching and learning in simulation, it is difficult to gain a comparative analysis of the broad range of topics within the simulation modality itself. All the reviewed studies had methodological limitations. These included: the search terms which resulted in a broad range of literature; some studies had very small participant numbers; and it was difficult to evaluate the comparisons between participant groups completing different tasks and learning activities. There was also a range of critique within the literature in terms of reviewing methodologies and study results. The 13 studies in this review originated from only three countries, with only one article from Australasia. This may be due to restrictions of the search, which was limited to articles published in English. The review also only considered articles from the previous 10 years (2002 to 2012). While there were many articles in the initial results, it would be fair to expect that as simulation continues within nursing education there will be more to add to the database of simulation as an educational approach.

While the literature review was limited to undergraduate nursing education, the resulting studies included a broad range of students within this setting. It could be argued that beginning nursing students will have a higher need and less knowledge and skills to pin their simulation experience to in comparison to more experienced and knowledgeable senior students. It could also be argued that gathering student perceptions to review simulation as a teaching and learning practice is flawed and entirely subjective. However, regardless of these points, good practices for teaching and learning would cross all aspects and stages of nursing education, and feedback from students to evaluate teaching and learning tools is vital in order to plan and implement further effective approaches within nursing education.

3.4 Teaching and Learning Guidelines in Simulation for Undergraduate Nursing Education

The goal of any educational intervention, whether it is a focussed skill, simulation-based scenario, clinical decision making or team work exercise, is to increase the knowledge and breadth of the students' learning. From this, the lecturer needs to utilise best practices in using simulation as a teaching method. There are number of recommendations and strategies that can be implemented when considering teaching and learning guidelines in simulation. Refer to section 2 of this document for the proposed guidelines.

3.5 Conclusion

Simulation is an interactive and innovative teaching and learning strategy that has opportunity to provide effective consolidation of clinical knowledge and skills into nursing practice. This literature review has carefully considered the teaching and learning approaches necessary for effective simulation practice. It is acknowledged that the scope of this literature review was wide and initially encompassed a large volume of literature. The authors believe there is further scope to review particular aspects in teaching and learning practice in simulation.

As a teaching method, simulation requires thorough planning and organisation to ensure relevance to clinical nursing practice, the student participants and the clinical environment. Adherence to carefully constructed scenarios utilising relevant nursing skills, nursing knowledge, clinical decision making and reflective thinking contributes to an effective learning environment that reinforces the critical thinking and learning for the student. This literature review has been able to identify and provide recommendations for teaching and learning guidelines in simulation for undergraduate nursing education.

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Appendix A: PICO Framework

	Terms	Exclusions
Population	Undergraduate nurses (in BN programme)	Postgraduate students Other medical professions Specialist post BN students
Intervention	Physical, face-to-face simulation	Informal conversations
Comparator	Any other teaching and learning strategy	
Outcome	Effective teaching and learning outcomes	Self-review, self-satisfaction