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Simulation learning for critical care nurses:

An integrative review.

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Abstract

Background

Recommendations have been made that simulation learning should be included in nursing undergraduate education. This advice has been in response to concerns that nursing education lacks adequate practical experience and clinical support in order to prepare nurses for clinical practice. While simulation learning is not thought to replace clinical practice, simulated learning environments are considered to be a means of presenting unique learning opportunities that add to the experiential learning process.

Leading medical and nursing educationists have endorsed simulation learning as a positive step in clinical education within the complex environment of modern healthcare. Previous literature reviews of simulation learning have however, criticised the inconsistencies of methodology and lack of rigor peppering the research into simulation learning outcomes. Personal experience, of the author of this study, has found that some nurses can feel overwhelmed and anxious in simulation scenarios. This experience has prompted the author to investigate the whole notion of simulation further including the experiences of simulation participants.

Objectives

This integrative review sought to investigate the current literature on simulation learning as a learning tool for critical care nursing education. The central questions aimed to identify how the evidence demonstrated simulation was an effective learning tool for nurses who are involved in critical care. Secondly this study endeavoured to explore the
experiences of both nurses and educators utilising simulation learning to prepare for critical care nursing.

Methods

The integrative review was chosen in order to capture a broad range of nursing research from both quantitative and qualitative perspectives. A systematic process was followed to ensure a structured and consistent approach to reviewing the literature. The Joanna Briggs Institute quality appraisal tools and data extraction tables were utilised for this purpose. The fifteen articles meeting the inclusion criteria had various methods, participants, settings and simulation interventions. A thematic analysis was applied to the studies to elicit the common themes and concepts that answered the two central questions of simulation effectiveness and experiences. The data extracted was synthesised and has been reported in a narrative form.

Conclusions

Simulation learning within the critical care environment had been initiated to improve; patient safety and quality care, training standards and the personal development of the student. The participants of simulation found the experience generally positive with improvements in confidence, anxiety and knowledge. Further clarity into how well simulation learning transfers into the clinical context would be useful, with longitudinal multicentre controlled research designs. Eliciting the attitudes and perceptions of experienced versus inexperienced nurses would also be useful information for nurse educators, to enable them to understand the confounding issues with simulation learning participants and ensure targeted learning.
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Chapter 1 Introduction and Background

1.1 Introduction

Preparing nurses for the complexity and challenges of clinical situations and environments provides a challenge for nursing educators. As Jefferies states, “making sound decisions in unpredictable health care situations requires critical thinking, time sensitive action and skilled task performance” (Jeffries, 2007, p3).

Historically, simulated educational practices have been a common methodology for training medical and nursing fraternities (Bradley, 2006; Jefferies, 2007). In the 1960’s the first manikin for practicing ‘mouth to mouth’ resuscitation was introduced (www.laerdal.com). The last decade however, has seen the use of simulated scenarios to assist with the complex learning needs of nurses become increasingly popular (Jeffries, 2007; Rudd, Freeman, Swift, & Smith, 2010). The interest in simulation learning from healthcare professionals is reflected in the emergence of two new peer reviewed journals since 2006. Both journals are devoted to research and sharing experiences of simulated learning, these journals are Simulation in Healthcare and Clinical Simulation in Nursing. The aim of this integrative review was to gain a greater understanding of the role simulation learning could have on the clinical education of critical care nurses.

This narrative details the systematic review process beginning with a definition of simulation learning from the academic healthcare literature. The background chapter
includes a discussion of simulation learning and its current role in nursing education that led to the development of the research questions.

The literature searching and inclusion criteria are detailed in the methods chapter. This chapter also gives an explanation of the process by which the literature was reviewed, evaluated and critiqued. The data extraction phase included coding, synthesis and a thematic analysis. The findings of this review are presented in the results chapter with detail of the themes that emerged from the synthesis stage. A more in depth discussion and critique of these themes occurs in the discussion chapter. This is followed by a discussion of the quality of the articles and identification of the limitations of the study. Finally there are recommendations suggested for future nursing research in this area.

1.2 Background

Academic literature has been explored to provide the background of simulation learning within the nursing education domain. This chapter provides a definition and discussion about the background of simulation as a learning tool. This includes the theoretical concepts of experiential learning and the nursing and medical education communities’ perspective of the effective components of simulation learning. The emergence of simulation as a learning tool in nursing education curricula will be discussed within global and cultural perspectives. A critique of simulation learning will include ethical and economic concerns raised in the literature.
1.2.1 A working definition for this study

Simulation learning within the health education field has no singular definition. For the purposes of this review the definition of simulation learning has been based on definitions from leading simulation learning academics and summarised by the author as follows.

Simulation learning is defined as imitating the conditions of a clinical situation to represent that situation as real, for the purpose of training and education (Bradley, 2006; Gaba, Howard, Fish, Smith, & Sowb, 2001; Issenberg, McGaghie, Petrusa, Gordon, & Scalese, 2005; Jeffries, 2007). Participants are expected to respond in the simulation exercise as they would in a real clinical situation. Simulation learning is a teaching technique that provides the students with guided experience that has the flexibility to be paused, and repeated to enable reflection and development. In addition, this teaching modality avoids the difficult issues of patient safety (Gaba, 2004). The ultimate aim of simulation learning is for individuals and teams to become competent and confident practitioners who are able to deliver safe health care (Cant & Cooper, 2010; Gaba, 2004; Issenberg et al., 2005; Pike & O’Donnell, 2010).

Parallels have been drawn between the medical profession and other high risk, highly technical professions such as aviation, nuclear power stations and the military. Simulation learning is well immersed in the culture of these organisations as a means of practicing and rehearsing the technical aspects of their roles from the perspective of individuals and teams (Bradley, 2006; Gaba et al., 2001; Issenberg et al., 2005; Jeffries, 2007). The aviation industry discovered that failures in team cohesion in the cockpit was a contributor to serious flight disasters and developed flight simulators and team based simulation learning termed cockpit/crew resource management (CRM) (Gaba et al., 2001; Grogan et al., 2004).
Gaba et al. (2001) believe the issue of working with humans is more complex than the military or aviation settings. However they still believe that there is an important role for simulation learning in medical education and designed anaesthesia training around the aviation model of CRM training.

The principles of CRM training include managing fatigue, recognising adverse signs, working as part of a team, communication and debriefing (Grogan et al., 2004). These concepts have been applied to the medical context by Gaba (2001) and Grogan (2005) with their research into simulation learning for critical care teams. In the United States of America (USA), the Institute of Medicine [IOM] (2000) strongly suggest that safety processes focus on team development and system testing in order to improve patient safety and cite simulation training as a method for achieving this.

The definition of critical care was accessed from the College of Intensive Care Medicine (CICM) of Australia and New Zealand which states that intensive care "encompasses the assessment, resuscitation and ongoing management of critically ill patients with life threatening single and multiple organ system failure" (CICM, 2012, para 1). Critical care nurses are highly specialised nurses who care for patients with life threatening or potentially life threatening illnesses or injury (Elliot, Aitken & Chaboyer, 2012).

The parameters for this study have been obtained from the above definitions, descriptions and concepts of simulation learning, as introduced by some of the leading simulation
The following narrative further discusses these concepts including the theoretical foundations, and relevance to nursing and critical care teams.

1.2.2 Simulation in nursing

In addition to the medical fraternity there is an emergence of simulation as a learning technique in undergraduate nursing curricula. Traditionally clinical learning has been based in the clinical environment with a clinical mentor or teacher as support (Dowie & Phillips, 2011). However the nurses’ role has been evolving with the technological advances and increasing concerns around patient safety (Jeffries, 2007). Today, nurses are expected to make complex clinical decisions within busy and stressful environments (Dowie & Phillips, 2011). Nursing education has changed from an apprenticeship model based in hospitals to a more academic focus based in universities with limited clinical practice hours and placements (Jefferies, 2007). Therefore there has been a reduction in the availability of clinical practice opportunities along with the number of quality clinical mentors to support new staff in the clinical environment (Dowie & Phillips, 2011; Rudd et al., 2010; Wilford & Doyle, 2006). Simulated learning techniques have emerged as a response to these issues and are thought to be a valuable adjunct to in situ clinical learning (Jefferies, 2007).

Nurses new to an area of practice, can gain experience through the protected environment of simulation. There is some evidence to suggest that the simulation experience can improve the individual practitioner’s confidence (Bland & Ousey, 2010; Leigh, 2008; Pike & O’Donnell, 2010; Wilford & Doyle, 2006) and critical thinking ability (Lapkin, Levett-
Both confidence and critical thinking are important to successful learning and effective performance and are explored in detail later in this chapter.

*International perspectives*

In New Zealand and Australia, recent undergraduate nursing education recommendations suggest simulation should be part of the undergraduate nursing curriculum (Nursing Council of New Zealand, 2012; Rudd et al., 2010). This follows trends from the USA and the United Kingdom (UK) where simulation learning has also been recommended to assist with nursing student undergraduate education as an adjunct to clinical practice (National Council of State Boards of Nursing, 2005; Nursing and Midwifery Council, 2007). In spite of these recommendations, the National Council of State Boards of Nursing (2005) in the USA, clearly states that simulation learning must not replace nursing student exposure to actual patient experience. In New Zealand, the Nursing Council of New Zealand (2012) has stated simulation learning must not be part of the minimum 1100 clinical practice hours required for undergraduate registration. Australia and the USA have not specified a specific limit for simulation hours. However, in the UK the Nursing and Midwifery Council (2007) have put a limit of 300 hours for simulated clinical practice out of the stipulated 2300 clinical hours in nurse education. Simulation is not thought of as a replacement for clinical experience but to enhance students’ experiential learning (Gaba, 2004; Issenberg et al., 2005; Rudd et al., 2010).
There seems to be a paucity of published position documents regarding the development and use of simulation learning as a teaching methodology in countries outside of the UK, USA and Australasia. There were no deliberate attempts made to exclude other countries perspective, the inclusion criteria was open to articles from a global perspective, however the limited countries that transpired in the results, occurred naturally during the literature search phase.

_Educators key_

Educators confident and competent in the use of simulation technology are thought to be the key to successful simulation learning (Jefferies, 2007). However, not all educators have the necessary experience and training in simulation learning to fully utilise this technique (Dowie & Phillips, 2011; Rudd et al., 2010). Manikins and part task trainers (such as plastic arms for intravenous cannulation practice), are often purchased but are not necessarily utilised due to educators not feeling comfortable or supported with the use of them (Jones & Hegge, 2007; Rudd et al., 2010). Institutions need to ensure that educators are designated time and opportunity to learn the techniques of simulation learning and curriculum design necessary to integrate the simulated learning into the broader learning objectives for students (Rudd et al., 2010). International opinion suggests that higher education training in simulation is essential for all lecturers involved in clinical education (Benner, Sutphen, Leonard, & Day, 2010; Nursing and Midwifery Council, 2007; Rudd et al., 2010).
In New Zealand, simulation learning support for undergraduate nursing educators has begun to gain momentum with the recent development of the Collaboration for Clinical Simulation group funded by the Ako Aotearoa National Centre for Tertiary Teaching Excellence (Edgecombe, 2012). This group aims to develop an inventory of simulation resources across the schools of nursing in New Zealand, develop guidelines and evidence based practice in simulation learning for educators and provides teaching workshops. An interdisciplinary clinical simulation group has also been established with the New Zealand Association of Simulation in Healthcare (2012). This group provides an annual symposium, simulation courses and opportunity for interdisciplinary networking at a national and international level.

_Criticism of simulation_

However, there is some criticism about the simulation learning technique, which is preventing its widespread introduction into nursing education as a whole. Evidence to support simulated learning is thin (Lapkin et al., 2010). It is difficult to assess the direct learning contribution of simulated learning as knowledge and expertise is thought to be a cumulative process (Benner, 1982; Ericsson, 2004; D. M. Smith & Kolb, 1986) of which the simulated experience is just part of the ‘experiential’ memory and complexity of information learners require (Bandura, 1989; Benner et al., 2010). However the issue that there is little quantitative evidence of the efficacy of simulation learning remains a common concern in the literature (Bradley, 2006; Dowie & Phillips, 2011; Lapkin et al., 2010; Leigh, 2008; Rudd et al., 2010). Although Gaba (2004) notes that the aviation and military industries did not wait for unequivocal proof of the effectiveness of simulation prior to implementing simulation as the gold standard for improving their safety
performances. It is also notable that the aviation industry is required by law to provide simulation training whereas this is not the case for the health industry where institutions can prioritise and restrict funding to education without legal repercussions (Gaba et al., 2001). Issenberg (2005) also notes that while the call for greater quantitative evidence in medical education has been made there is in fact little evidence to suggest other learning modalities are effective, for example whether classroom based lectures are better than reading. While simulation training could be perceived as the common sense approach to becoming familiar with a process, technique or skill it is perhaps not yet well immersed in the health education culture to ensure adequate funding and support for educators to feel comfortable with this technique.

The lack of evidence of the efficacy of simulation combined with the very real hurdle of cost with this method of education may be hampering successful integration of simulated learning into undergraduate institutions (Bradley, 2006; Rudd et al., 2010). It is costly to establish and run a high fidelity simulation suite and to replace the necessary consumables as well as providing adequate time and physical space to run the scenario and debriefing processes (Stefanski & Rossler, 2009).

Ethical perspectives

Before rejecting simulation learning on the basis of the potential financial burden, institutions could consider that simulation learning may assist to avoid ethical issues that could arise in clinical environment. Jefferies (2007) raises the ethical dilemma regarding the exposure of patients to the potential risk of a student or beginner practitioner who may
not be confident or familiar with different care skills. The anxiety and stress that beginner practitioners experience when confronted with new and unfamiliar experiences could also be considered in breach of the rights of an individual who should not be caused emotional distress. There is some validating evidence that suggests simulation learning can decrease stress and anxiety for participants (Pike & O’Donnell, 2010). It may be ethically more appropriate for educators to enable students to practice difficult or complex skills in safe and supported simulated environments prior to exposure to real patients.

While there is a perceived benefit to simulation learning there is little actual evidence that learning in a simulation environment translates well into the clinical environment (Rudd et al., 2010). The success of the simulated education session is dependent on the ability of the human instructors to facilitate and lead this mode of learning. Doubt is also cast on simulation scenarios being able to recreate realistic human interactions well enough to enhance learning of this non-technical skill area (National Council of State Boards of Nursing, 2005; Rudd et al., 2010).

1.2.3 Educational theory.

An improved understanding of simulation learning concepts may also assist institutions to consider this learning technique. An examination of educational theory allows simulation learning to be better understood in terms of its role and usefulness for the learning process. Academic literature links simulation learning to the theoretical concepts of experiential learning. Issenberg et al. (2005) undertook a rigorous review of medical training and
Simulation learning. They observed that “Deliberate practice, not just time and experience in clinical practice is the key to medical clinical competence” (Issenberg et al., 2005, p13).

‘Deliberate practice’ is a learning concept defined by Ericsson (2004) who studied the attainment of expert practice. The basis of this concept is an individual focuses on improving their performance through problem solving and practicing. The key elements are receiving detailed immediate feedback, and being able to repeat the task. A simulated activity allows an individual to repeat the experience when clinical opportunity may not be available. Simulation facilitators, colleagues, and recording devices could all be available to observe and give detailed feedback within the simulated environment. Ericssons (2004) concept has similarities to other experiential frameworks such as Benners’ (2004) work based on the Dreyfus model of skill acquisition.

Benner, et al., (2010, p85) suggest simulation allows for development of ‘clinical imagination’ or the ability of the nurse to envision how they would approach a clinical situation. The opportunity for rehearsal and the stop/start flexibility of simulation allows for in depth discussion that is not always appropriate in the clinical setting. In Benner’s (1982) seminal work, expertise (and critical thinking) is thought to come from the opportunity to adapt and consider preconceived ideas and theories to the many different experiences encountered. Performed well, simulation therefore adds to this pool of experience.
Bradley (2006) also links simulation to experiential learning frameworks, citing Kolb’s seminal work on the experiential learning cycle. Kolb (D. M. Smith & Kolb, 1986) suggests there are four phases of learning any one of which could lead the process. There is acting and experiencing which then leads on to a process of reflection on the experience. This in turn allows for linking the experience to theory and developing abstract concepts. The individual can then plan for the next experience, building on past learning in a cycle or spiral of learning (Smith & Kolb, 1986). This suggests that in order for the simulation exercise to be effective, all components of the experiential learning cycle would need to be present. Figure 1 is a diagrammatic representation based on Kolb’s experiential learning framework.

![Figure 1: Kolb’s Experiential Learning Framework](image)

In further support of experiential learning frameworks is Banduras social cognitive theory, cited by Pike and O’Donnell (2010) in their study of self-efficacy and undergraduate nursing curricula. Self-efficacy or self-belief is proposed by Bandura to be the cornerstone upon which learning can begin, individuals must feel and believe in their own ability before they can achieve success “Efficacy beliefs are the product of a complex process of self- persuasion” (Bandura, 1989, p1179) and determines a person’s level of motivation.
"...the stronger their belief in their capabilities, the stronger and more persistent are their efforts" (Bandura, 1989, p1176).

There are several factors that influence self-efficacy; active experience, observation of others, verbal persuasion and an individual's emotional reality (Bandura, 1989). Firstly active experience, may either be negative or positive and would influence how an individual would perceive their performance should they repeat the scenario. A successful experience improves self-efficacy and an unsuccessful experience will do the opposite. Observing others allows an individual to rate and compare themselves to another's performance such as a student observing a clinical mentor in practice. Verbal persuasion is another concept introduced by Bandura (1989) and refers to the influence of another individual on a person's self-belief by simply telling them they can succeed. Verbal persuaders using positive language can improve a person's self-belief in being successful. Finally a person's level of anxiety or fear can affect their self-belief if they perceive the anxiety is a reflection or precursor to failure. Simulation learning could allow for all of Bandura's (1989) learning concepts. The following narrative explains in full how the simulation learning process can enhance learning.

1.2.4 Components of effective simulation

There is no one clear agreement to what parts of the simulation learning process ensure it is an effective learning experience. Measuring effectiveness is however a challenge for education researchers (Gaba et al., 2001). Measuring successful patient outcomes does not necessarily reflect practitioner competence nor the impact of simulation experience as too
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many other variables such as patient co-morbidities can confound the results (Gaba et al., 2001). Simulation experience along with guided debriefing however, seems to be able to develop an individual’s ability to self-assess their performance and this so far has been the most desirable method of assessing simulation effectiveness (Gaba et al., 2001; Issenberg et al., 2005).

There are several expert opinions based on extensive experience and development of simulation learning for medical and nursing education (Gaba et al., 2001; Issenberg et al., 2005; Jeffries, 2007). These experts have developed components to the simulation learning experience to ensure effective learning that is in line with experiential learning concepts such as that of Kolb (D. M. Smith & Kolb, 1986). The common components are preplanning, active involvement of the simulation participants, realism and debriefing/reflection (Gaba et al., 2001; Issenberg et al., 2005; Jeffries, 2007). The interrelationships between these components and the learning theories that support them are discussed below.

1.2.4.1 Preplanning

Preplanning consists of scenario development and simulation preparation (Jeffries, 2007). This can be a time consuming process for facilitators (Stefanski & Rossler, 2009). Recommendations have been made that thought needs to be given to how best to prepare the students (Jeffries, 2007). The simulation participants should be able to imagine themselves in the scenario (Benner, 2010) and have goals to achieve that can be personal and/or facilitator directed (Bandura, 1989). The preparation phase should provide an
opportunity for the participants to learn and understand theoretical components of the clinical scenario (D. M. Smith & Kolb, 1986).

The simulated clinical scenario should allow challenges for all levels of experience and be understood by all of the participants (Benner, 2004). However, if success comes too easily or the goal is too easily achieved then the individual will not be challenged enough to continue to progress. The concern is they do not then develop a strong sense of self-efficacy or self-belief and can easily be undermined by later failure or difficulty (Bandura, 1989). Facing challenges and setbacks allows the individual to develop a strong sense of self-efficacy which in turn motivates these students to set their own goals, achieve and perform well (Bandura, 1989).

Figure 2: Diagram representing how support and challenge can influence personal development (Transcribed from Daloz, 1986, p 214).

Daloz’s (1986) work on mentorship and adult learning supports Banduras (1989) point of view on degree of challenge. Daloz (1986) developed a model (see figure 2. above) which suggests that the mentor or educator can influence the learning experience of individuals by insuring optimal support and challenge to maximise self efficacy. Simulated learning
environments can allow the facilitator to support the individual and set the challenge at a level with which the individual can be challenged allowing for growth and development. The model above suggests that a low challenge with high support can lead to an individual having their self-concept confirmed however, there is limited personal growth. An individual with a high challenge but little support may retreat from the learning experience and not gain from the experience, which may be the case with real clinical situations and little mentorship. Without support and challenge an individual’s ability to grow and learn are left static.

1.2.4.2 Active experience

The simulation exercise allows an engaged learner an active experience and opportunity for experimentation (Benner, 2004; Ericsson, 2004; D. M. Smith & Kolb, 1986). A successful and positive experience allows an individual to gain confidence in their performance and increases their self-belief in achieving their goals (Bandura, 1989). Opportunity for observation (either in real time or recording devices) of others in the scenario allows participants to compare their own performance by providing modelling of positive and negative behaviour (Bandura, 1989; Benner, 2004). Called “vicarious experiences” by Bandura (1989), observing others is a powerful influence in learning.

By allowing nurses to participate in a simulation learning experience may also decrease their anxiety prior to the ‘real’ experience (Pike & O’Donnell, 2010). In order for an individual to have self-belief Bandura (1989) suggests that they will examine their feelings
of fear and anxiety and use this to gauge their success or failure at a task. It stands to reason therefore the less anxiety the greater likelihood of success being achieved.

Repetitions of performance, with small individual goal changes, are thought to assist with mastery (Ericsson, 2004). Real clinical environments do not always provide opportunity for repetition which simulation learning can provide. Simulation learning allows the participants to continue the scenario, and make mistakes without the educator needing to take over for patient safety sake (Pike & O’Donnell, 2010).

1.2.4.3 Reflective practice

The debrief phase is considered a crucial aspect of the simulation learning process (Gaba et al., 2001; Jeffries, 2007; Rudolph, Simon, Dufresne, & Raemer, 2006). Feedback and reflection should occur immediately after the simulation experience to allow simulation participants to receive verbal feedback and allow for personal reflection. This then allows an individual to set further goals and plans for improvement (Bandura, 1989; Benner, 2004; Ericsson, 2004; D. M. Smith & Kolb, 1986). Utilising a reflective cycle allows an individual to examine their performance and the performance of others in a structured and meaningful way. Schon (1983) suggests that during the active experience an individual can self-evaluate their performance by recognising the familiar with the not so familiar and apply their previous knowledge, this is termed ‘reflection-in-action’. After the active experience the conscious evaluation of performance can be made in order to develop new understandings and apply to new situations known as ‘reflection-on-action’ (Schon, 1983).
Rudolph et al. (2006) developed a reflective cycle for use with simulation learning, which is based on Schon’s (1983) seminal work on the ‘reflective practitioner’. Rudolph (2006) proposes that individuals and educators have beliefs, emotions and a self-concept that is not apparent to others. This internal reality is considered a ‘frame’ by which an individual makes decisions.

In the debriefing process the educator should acknowledge this ‘frame’ and ensure questions are designed to elicit the experience of the individual rather than statements or questions designed to intimidate or make individuals defensive (Rudolph et al., 2006). An example of a good question includes a component of advocacy or a statement from the educators ‘frame’ that clearly states the educators point of view combined with an enquiry that seeks the individuals’ point of view. This is an example from Rudolph et al. (2006)

So, Damon, I noticed that you stepped away from the patient to find the bag-mask apparatus as the vital signs were deteriorating. I was thinking there possibly were alternative means to oxygenate the patient (advocacy). So I’m curious: how were you seeing the situation at that time? (inquiry). (Rudolph et al., 2006, p53).

Rudolph et al. (2006) suggests educators should be careful with how they lead the ‘reflection on action’ and debriefing phases of simulation learning. Educators should use positive language to create a safe and non-judgmental environment during and after simulation experiences in order to allow student development.
1.2.4.4 Replication of real life experiences

While not directly supported by theoretical concepts, scenario realism is considered an important factor of simulation in the academic literature. Scenario realism is dependent on the goals of the learning experience. The literature suggests simulation learning experience can exist on a spectrum of high to low technicality focusing on an individual’s technical skills through to team and system testing (Gaba, 2004; Issenberg, 2003; Jeffries, 2007). There are a number of differing approaches to simulation realism which will be explored here.

Gaba (2004) and Issenberg (2005) as researchers and leaders in the use of simulation in medical education, endorse the construction of realistic scenarios and environments to allow the participants an experience that is as real as possible. Fully replicated clinical environments that require full immersion and participation are considered “high fidelity” and focus on creating a very realistic and possibly emotional clinical situation that requires a realistic team response (Jeffries, 2007; Gaba, 2004). An example of high fidelity simulation is the cardiac bypass scenario run for anaesthesiologists prior to beginning cardiac anaesthetic rotations (Hassan & Sloan, 2006). This manikin is able to respond to both physiological and pharmacological interventions. It has palpable pulses and is able to simulate spontaneous breathing, carbon dioxide monitoring, haemodynamic monitoring including internal cardiac pressures and urine output. A computer interface controls all these variables and can produce physiological responses to bar-coded ‘drugs’ delivered to the manikin. The manikin is set in a laboratory that has real ventilators and monitoring devices that the simulation participants would be expecting to use (Hassan & Sloan, 2006).
The aim of the cardiac bypass simulation series was to evaluate trainee residence performance in an objective structured clinical examination (OSCE) setting and to allow training of anaesthetic residents in cardiac bypass anaesthesia (Hassan & Sloan 2006). The advantage of assessing competence using simulation according to these authors was that there was less variability in scores as each participant was given the same scenario. The authors note that coronary artery bypass surgery has become less common due to the success of interventional cardiology techniques. Therefore simulation allows student exposure to the complex needs of coronary bypass patients. The authors report that students found the simulation experience challenging.

The leading disadvantage of high fidelity simulation is cost. The simulation exercise by Hassan and Sloan (2006) was noted by the authors to be costly with initial manikin purchase, and the need for a designated space for the simulation lab. One can imagine consumable use, and facilitator time would also be costly.

Less realistic simulation scenarios considered medium to low fidelity include part task simulation focusing on individual technical skill (Pugh & Youngblood, 2002) and computerised clinical situations requiring complex decision making (Davis, 2008). Pugh and Youngblood's (2002) study profiled the successful utilisation of an "E-pelvic simulator" in the training of health professionals in pelvic examination. Prior to the pelvic simulator the students trained on real women, the assessment of the practitioner's competence was very subjective and the women potentially exposed to multiple
examinations for training purposes. The pelvic examination simulator was designed to replicate a woman's pelvic anatomy and linked to a computer that could record digital stimulation of certain points in the pelvis including recording digital pressure. The advantage of the computerised tracking system provided feedback to the student regarding whether they were examining the right areas and with sufficient pressure. During assessment of competence the assessors had the computerised tracking report which during the assessment the student was blind to, allowing for a more objective assessment process (Pugh & Youngblood, 2002).

There has been an emergence of computer based learning in nursing education (Smith & Reed, 2008). Nurse availability is hampered by the chance of 'release' from their clinical environment to attend training. This is an issue that is frequently discussed in the literature as a hurdle to nurse participation in simulation exercises (Smith & Reed, 2008). Computer based learning allows the nurse flexibility to access learning at a time that suits the nurse and is considered more cost effective. There are generally two types of computer based learning one is computer assisted where the student accesses the programme in order to learn theory and concepts (Beckley, Stenhouse, & Greene, 2000; Davis, 2008). The other is computer simulation in the form of a game.

An example in the literature of computer simulation is a computer game that allows triage nurses in emergency departments to practice the complex task of disaster triage decisions ("Computer game improves triage skills following major incidents," 2008). This modality of simulation learning allows nurses to practice a skill that is an extremely rare occurrence.
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for most triage nurses. Running a full disaster simulation scenario would be costly and the
numbers of nurses exposed to the triage process limited. While not entirely realistic and
lacking the emotional and interpersonal issues that a real scenario would provide, a
computer game potentially provides a useful learning adjunct and insight for large
numbers of triage nurses.

Contrasting to the computer game disaster simulation is a publication regarding student
nurses at an undergraduate school. They practiced a public health disaster scenario
applying principles of disaster triage and treatment and practiced under a simulated
situation their prioritising, leadership and communication skills (Morrison & Catanzaro,
2010). The students played either responder roles or patient roles. The setting was a high
school where a sudden and overwhelming number of unwell patients started presenting to
the school nurse. The ‘responders’ had roles from school nurse through to more senior
roles who needed to identify, contain and prevent further spread of the disease. The
‘patients’ had a variety of issues including complex chronic disease and/or acute disease
presentations. However, more technical skills were not able to be practiced and specific
patient physiological responses limited.

This public health simulation exercise concluded with a reflection process allowing for
students to discuss and consolidate their learning. While probably not considered high
fidelity as the simulated patients were actors rather than computerised manikins, the
realism for the students was high. They experienced the emotional responses and practiced
the interpersonal skills and decision making required for the roles they were allocated, and found the experience useful (Morrison & Catanzaro, 2010).

The other end of the simulation fidelity spectrum involves little active participation by the students and consists of role plays or observed practice. For example role play was used as the simulation modality for experienced critical care nurses to learn end of life care conversations (Shannon, Long-Sutehall, & Coombs, 2011). The participants at a critical care conference attended the lecture which involved first theatre style demonstrations of techniques for end of life care conversations followed by role playing in pairs. The responses of the participants suggested many found the role playing to be very insightful and potentially helpful to their clinical practice (Shannon et al., 2011). Low fidelity simulation is possibly more accessible for all institutions as the costs involved would be relatively low with no expensive technical equipment and larger groups of participants able to be catered for. The focus of Shannon et al.’s (2011) education session was on the non-technical aspects of communication of which the realism of the situation had to come from believable conversation and human interaction.

Communication, human interaction and simulation learning realism.

The reality of many clinical situations is not only the technical skill and tasks but also the interpersonal and emotional issues that arise (Jefferies, 2007). The unpredictability of ‘non-technical’ skills in the real clinical situation is a challenge to recreate in the simulated scenario (Pike & O’Donnell, 2010). Pike and O’Donnell’s (2010) study suggested that the students felt underprepared for communication and the emotional problems they had faced
in the clinical situation. One example was concern about a student having to deal with a dying patient. The student felt that given the sensitive nature of the situation there was a pressure to perform which did not allow for mistakes to occur. The student wished she had had a simulated opportunity to practice what to say in this situation (Pike & O’Donnell, 2010). Students in this study found interpersonal skills and communication the most difficult to learn and felt a lot of anxiety around seemingly simple requests from relatives enquiring after patients (Pike & O’Donnell, 2010).

However, Pike and O’Donnell (2010) also found that their students struggled to perceive a manikin as ‘real’. While a simulated cardiac arrest seemed to improve the students perceived self-efficacy, when faced with the real situation after the simulated experience the same student felt overwhelmed and ineffective (Pike & O’Donnell, 2010). The authors concluded from their study, that more research was needed to determine the best approach for teaching and learning interpersonal and communication skills.

In a study by Pye, Kane and Jones (2010), nurses felt their communication skills were improved by the presence of actors or lay people, representing family members in simulated paediatric resuscitation scenarios. Each actor was prepared regarding emotions and expected reactions and schooled to escalate their behaviour should staff not respond in a certain way. This study involved a group of experienced nurses from a paediatric ICU. The simulation intervention was designed to assist transition nurses to expecting and anticipating parental presence during a child’s resuscitation to ensure a supportive environment for all involved (Pye et al., 2010).
Recreating realistic human interactions within the simulation environment can be challenging for nurse educators and it is not clear from the literature how successful this is compared to real clinical experience. Anecdotally the literature suggests nurses find practising communication skills outside of their clinical environment to be useful to their clinical practice (Morrison & Catanzaro, 2010; Pike & O'Donnell, 2010; Pye et al., 2010; Shannon et al., 2011).

There are many applications for simulation learning from new practitioner to experienced clinicians training. Simulated learning environments allows for assessment of competency for individuals and teams (Issenberg et al., 2005; Pugh & Youngblood, 2002). Research and the evaluation of organisational systems and practices can be evaluated and tested through simulated scenarios (Gaba, 2004; Issenberg et al., 2005). As Gaba states “Simulation . . . is best suited . . . for activities that are hazardous, involve uncommon or rare situations, or when experiential learning is of greatest value” (Gaba, 2004, p6).

1.2.5 Summary

Simulated learning is a popular and internationally endorsed method of learning for undergraduate nurses (Benner, et al., 2010; Nursing and Midwifery Council, 2007; Rudd, et al., 2010; Wilford & Doyle, 2006). The call for lecturers to up skill in utilising simulation to ensure its maximum efficacy has been made (Benner, et al., 2010; Nursing and Midwifery Council, 2007; Rudd, et al., 2010). While simulation fits into experiential
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learning theory, there is concern it lacks solid evidence to support its use and to convince educational stakeholders to invest time and money (Bradley, 2006; Rudd, et al., 2010).

As discussed at the beginning of this chapter, anaesthesiology has been the leader of simulated learning in health training with ‘crew/crisis resource training’ (Gaba et al., 2001). Gaba et al. (2001) observed that that traditional medical training did not adequately prepare clinicians to deal with the anaesthetics role in patient care which can be dynamic and unpredictable. Critical care nursing, involves the care of the complex and critically unwell patient, where the margin of error is low (Cato & Murray, 2010). Like anaesthesiology the critical care environment can also be dynamic and unpredictable. The critical care nurse must learn teamwork within a multidisciplinary framework, care of anxious families and the highly technical and complex care needs of their patients (Cato & Murray, 2010; Pye et al., 2010; Stefanski & Rossler, 2009).

This integrative review will focus on the critical care nursing environment of emergency departments and intensive care units, where the patient population is high risk, and the care complex and challenging for nurses to learn and maintain competence (Cato & Murray, 2010; Stefanski & Rossler, 2009). The author wanted to better explore and understand how simulation learning may enhance clinical skill acquisition for the critical care nurse. The following chapters discuss the methods, findings and results of this research into simulation learning.
Chapter 2 Methods

The aim of this research project was to undertake an integrated literature review to gain a greater understanding of simulation as a learning tool and its role in nursing education. In particular, there was a desire for increased knowledge about the role of simulation learning in supporting and integrating nurses into critical care areas. By exploring a range of literature including a variety of methodologies, integrative reviews are thought to better inform nursing evidence based practice and can lead to further direction for nursing research (Polit & Beck, 2004; Whittemore & Knafl, 2005).

The integrative review follows a systematic framework (Polit & Beck, 2004; Whittemore & Knafl, 2005). This framework is based on research methods and allows for an analysis of the research that occurs from a variety of methodologies. There were several phases to this framework; the first phase involved establishing a question or topic of interest. Next was a literature search which included a search of academic journal databases and cited studies. The studies were assessed and evaluated for quality and relevance to the topic or question. A database was established and a coding system to extract themes or categories from the studies that related to the research question. These themes were synthesised and a report written with a discussion of the findings (Polit & Beck, 2004 Whittemore & Knafl, 2005). Each of these phases is explored and discussed in more detail in this chapter.
2.1 Establishing the question.

The author's background in critical care nursing and clinical education, established the initial interest in simulation learning as a tool for clinical teaching. New or uncommon experiences which nurses are expected to have the necessary skills and knowledge to deal with in the critical care environment are difficult to teach and learn when confronted with the stress and urgency of acute care areas (Stefanski & Rossler, 2009). The author questioned whether simulation learning would potentially provide a useful adjunct to clinical learning that could occur outside of the clinical environment. Hence, a desire to learn and understand more about simulation learning motivated the author to undertake this review.

Formation of the initial research question began with a reflection on the authors' experiences of simulation learning and conversations with fellow nurse educators. Early experience for the author in facilitating simulated clinical scenarios in an emergency department suggested some nurses were very nervous and reticent about being 'on the spot' and under scrutiny.

Anecdotal feedback to the author from fellow nurse educators regarding simulation learning suggested a lack of understanding from the educators of how simulation learning could be applied. Some of the comments from educators were "nothing beats real clinical experience", and "the nurses get too self-conscious and embarrassed". There were also concerns regarding the lack of funding for resources such as consumables, physical space to run the scenarios and access to manikins. A desire to understand and perhaps dissipate
these feelings prompted an interest in the experience of students, nurses and educators with regard to simulation learning.

Accessing literature reviews in December 2011 on simulation learning indicated a strong interest in simulation effectiveness (Cant & Cooper, 2010; Lamb, 2007; Lapkin et al., 2010). The reviews highlighted the challenge of measuring simulation effectiveness and suggested more robust studies needed to occur. Other simulation learning reviews highlighted concerns around an unfamiliar environment, increased student anxiety and inconsistency of the standards within simulation education (Cannon-Diehl, 2009; Cato & Murray, 2010).

There were no systematic reviews found on the initial search which focused on the critical care nursing environment. However on completion of the integrated review and written report, an article was published which focused on post registration critical care nursing (Jansson, Kääriäinen & Kyngäs, 2012). The authors were aiming to assess the published literature regarding the effectiveness of simulation learning on continuing education for post registration critical care nurses. The authors found only one article meeting their inclusion criteria. This highlights the paucity of published research into simulation learning for post graduate nursing groups. As with earlier literature reviews this group were interested in determining whether simulation learning was more effective than other learning modality's for post graduate nursing groups. They conclude that more robust, multicentre studies need to occur.
An initial database search of simulation learning and nursing prior to commencing the review in January 2012 encountered 997 articles in CINAHL alone. The high volume of simulation articles influenced the scope of the review and the decision made that it be narrowed to elicit more manageable numbers. By focusing on critical care nursing environments and a five year time frame a more focused parameter set was established for this review.

The aim of the integrative review was to gain a greater understanding of simulation as a learning tool and its role in nursing education. To accomplish these aims the objectives were to:

- Identify what evidence exists that demonstrates simulation is an effective learning tool for nurses who are involved in critical care.
- Explore the experiences of both nurses and educators utilising simulation learning to prepare for critical care nursing.

2.2 Searching literature

The articles for review were obtained through accessing academic journal databases. A simplified flowchart of the search process is presented below in figure three. CINAHL was searched using keywords: simulation, or simulation learning, or patient simulation, these were then combined with nursing, and nursing education. Initial results indicated 997 articles. Further searching was limited to the keywords; ‘critical care’ or ‘emergency nursing’ eliciting 59 articles. Medline(R) 1996 to present with updates and Embase all
years with updates were searched using key words ‘simulation and education’, ‘learning methods and experiential learning’ this was combined with ‘nursing’. The time frame was restricted to the last five years 2007 to April 2012 eliciting 555 results. These results were converged with the keywords ‘critical care and emergenc*’ with no further keywords used, eliciting 102 results. Altogether 161 articles were obtained.

Figure 3: Flow diagram of literature selection process.

The titles and abstracts of the 161 articles were then screened by the author for congruence with the review objectives. The initial inclusion criteria included primary research studies of nurses either undergraduate or postgraduate, and educators who have participated in simulation learning to prepare for critical care environments. The research team also agreed to include review articles, expert opinions and programme reports. Reference lists were analysed for potentially useful studies. Twenty-three studies were then downloaded for more detailed review.
2.3 Quality evaluation and selection criteria

Establishing the quality of the studies is an important aspect of the selection phase and a consistent and robust system for this was required (Pluye, Gagnon, Griffiths, & Johnson-Lafleur, 2009; Polit & Beck, 2004; Whittemore & Knafl, 2005). The Joanna Briggs Institute (JBI) quality appraisal tools were utilised to provide a systematic approach to quality assessment.

The literature collected involved research from quantitative, qualitative and mixed method research. The analysis of the different methodologies required differing approaches. The JBI (2008) system for unified management, assessment and review of information (SUMARI) was utilised accessing hardcopies of the quality assessment tools which are presented in Appendix A.

To gain an understanding of whether simulation learning is an effective form of learning, an analysis of studies that focused on the 'cause and effect' relationship of the intervention was required. Quantitative research elicits data in a numerical form that can then be analysed statistically to describe phenomena or understand relationships. The randomised controlled trial (RCT) is the gold standard for good quantitative research and promotes the concept of cause and effect, the results can help to guide practice (Polit & Beck, 2004). The quantitative research studies were reviewed for quality and validity using the standardised JBI checklists for meta-analysis of statistics assessment and review (MAStARI). There was variability in methodologies and study designs with controlled trials (Carrico, Coty, Goss, & LaJoie, 2007; Nunnink, Welsh, Abbey, & Buschel, 2009), a
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descriptive trial (Messmer, 2008) and mixed method studies (Barbosa & Marin, 2009; Kane, Pye, & Jones, 2011; Leflore & Anderson, 2008; Mould, White, & Gallagher, 2011; Pye et al., 2010; Stefanski & Rossler, 2009; van Schaik, Plant, Diane, Tsang, & O'Sullivan, 2011). Therefore a meta-analysis of the quantitative data was unable to be undertaken, however the textual data was used and synthesised with textual data extracted from other studies from the qualitative and narrative opinion perspectives.

Qualitative research is the investigation of phenomena where narrative is collected and analysed (Polit & Beck, 2004). The JBI qualitative assessment and review instrument (QARI) was used to assist in the critical appraisal of the qualitative research. The QARI approach allows for a meta-aggregation of the results or a pooling of the themes, which can then add an understanding or meaningfulness to the experience of simulation for nurses and nursing educators.

The articles discussing expert opinion were analysed using narrative opinion and text assessment and review (NOTaRI) instrument from JBI. The focus of this analysis was the strength and validity of the opinion or non research report, from the perspective of the ‘experts’ influence and other cultural perspectives.

The quality of the studies were assessed by three reviewers using the appropriate JBI quality assessment tools and consensus reached with regard to relevance and appropriate quality for inclusion in the review. These quality assessment tables are presented on page 38 (descriptive case study designs) and Appendix B (expert opinion, qualitative designs...
and controlled trials). Further refinement of the inclusion and exclusion criteria was established to allow for greater strength of the collected data, therefore it was agreed to include studies where the nurses results had not been separated from the other health professionals. At this point the search was not rerun as a manageable number of articles had been retrieved for this review process.

Exclusions were made of studies that focused on non critical care themes. These exclusions were a computer based learning platform for recognising child abuse in the emergency department (Smeekens et al., 2011), a “think aloud” method of role play for emergency nurses dealing with mental health patients (McAllister, Billett, Moyle, & Zimmer-Gembeck, 2009), and a malpractice law suit simulation (Jenkins & Lemak, 2009).

Following the quality evaluation it was agreed between the reviewers to include quality scores no less than six out of a possible score of nine. Further discussion of quality and rigor of the study articles will occur in the discussion chapter (page 83).

2.4 Data analysis and extraction

The fifteen simulation articles included for synthesis had differing clinical settings, methods, participant profiles and simulation structures therefore a thematic analysis was applied to all studies rather than a direct comparison. By focusing on the narrative data of all the studies when extracting themes a qualitative approach can be used in order to find common themes and compare and contrast results (Polit & Beck, 2004).
The central questions of the review have already established the initial themes. That is, studies were grouped into those that established and discussed the effectiveness of simulation learning. Secondly, studies were collated which discussed the experiences of nurses, students, and teachers as they utilise or initiate simulation learning.

A thematic analysis requires a systematic approach and repetitive reading of the literature to think about and record potential themes, dependent on the central question (Braun & Clarke, 2006). Narrative data from the studies can then be coded and grouped into themes that should then answer the central questions.

A database was developed with all fifteen included studies to provide a systematic and complete extraction of data from the articles. The JBI extraction tools and notes on data extraction from Polit and Beck (2004) were utilised to provide consistency with the extraction method. Data was collated on research method, participants/sample, setting, data quality score, country, main argument of article, intervention, control/comparison, author conclusion and reviewer conclusion. Appendix C presents the data extraction phase in table form.

Three main themes emerged namely: reasons for simulation learning, influences to effective simulation and simulation experiences. These themes and associated sub themes will be discussed in full in the following results and discussion chapters.
Chapter 3 Findings

The results of the review are presented here in a narrative form, due to the differing methodologies meta analysis of the quantitative results was not possible. There were fifteen articles that met the inclusion criteria for the review. These studies were appraised against specific criteria and the data extracted and synthesised into themes. The main emergent themes were: reasons for simulation learning, influences to effective simulation and simulation experiences. Figure four (page 44) gives an overview of the themes. A description of the studies including data quality, study populations, and study methods will also be included in this chapter.

3.1 Characteristics of the studies.

All the selected articles were from peer reviewed journals. The majority of the studies were from the United States of America (USA) \((n=12)\) while two were from Australia and one was from the United Kingdom (UK). The study populations were all from convenience samples with volunteer participants. The sample sizes ranged from ten (Kaddoura, 2010), to 219 (Mould et al., 2011). Two of the eleven research studies were undergraduate nursing groups (Elfrink, Nininger, Rohig, & Lee, 2009; Mould et al., 2011). The majority \((n=9)\) of the study cohorts consisted of post registration nurses (Baid, 2011; Carrico et al., 2007; Kaddoura, 2010; Kane et al., 2011; Leflore & Anderson, 2008; Messmer, 2008; Morris et al., 2007; Nunnink et al., 2009; van Schaik et al., 2011). Of these nine studies, four consisted of multidisciplinary teams that included doctors, nurses, paramedics and/or technicians (Leflore & Anderson, 2008; Messmer, 2008; Nunnink et al.,
2009; van Schaik et al., 2011). The results of any nurses’ response to the intervention was not separated out in three of the studies (Leflore & Anderson, 2008; Messmer, 2008; Nunnink et al., 2009). The four expert opinion articles focused on simulation learning within post registration critical care nursing (Day, 2007; Gant, 2007; Gomez, 2009; Roche, 2010). Table one is an example of the quality assessment of the descriptive study designs. In the appendix is the quality assessment of all the articles’ (Appendix B).
Table 1: Quality assessment of descriptive case series designs. Table structure transcribed from Joanna Briggs Institute, (2008).

<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
<td>Was the study based on a random or pseudo random sample?</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Were the criteria for inclusion in the sample clearly defined?</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Were the confounding factors identified and strategies to deal with them stated?</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Were outcomes assessed using objective criteria?</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Yes</td>
<td>Unclear</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>If comparisons were being made was there sufficient descriptions of the groups?</td>
<td>N/A</td>
<td>N/A</td>
<td>Y</td>
<td>Y</td>
<td>N/A</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Was follow up carried out over a sufficient time period?</td>
<td>Y 6month followup</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Were the outcomes of the people who withdrew described and included in the analysis?</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Were the outcomes measured in a reliable way?</td>
<td>Unclear</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Unclear</td>
</tr>
<tr>
<td>Was appropriate statistical analysis used?</td>
<td>N</td>
<td>Y</td>
<td>No stats</td>
<td>Y</td>
<td>Y Chi sq</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Comments: Include?</td>
<td>No 4/9 Provides narrative data regarding teacher experience.</td>
<td>No 5/9 Simulation experience not assessed</td>
<td>Yes 6/9 Effectiveness measured by self-efficacy and confidence</td>
<td>No 4/9 No conclusion re improvement of CPR skills,</td>
<td>Yes 6/9 self-reported confidence and competence</td>
<td>Yes 7/9 Results do not have nurses separate from EMTs and paramedics</td>
<td>Yes 7/9 Self-reported confidence and competence scale</td>
<td></td>
</tr>
</tbody>
</table>
Of the fifteen studies nine were primary research, two were programme reviews and four were expert opinions. The study designs were varied; two controlled trials (Carrico et al., 2007; Nunnink et al., 2009), five descriptive/mixed methods studies (Kane et al., 2011; Leflore & Anderson, 2008; Messmer, 2008; Mould et al., 2011; van Schaik et al., 2011), two qualitative studies (Elfrink et al., 2009; Kaddoura, 2010), two education programme reviews (Baid, 2011; Morris et al., 2007) and four opinion articles (Day, 2007; Gant, 2007; Gomez, 2009; Roche, 2010). The studies ranked from levels two to six on the hierarchy of study evidence (Polit & Beck, 2004). Table 2 below, summarises the variety of methods used.

Table 2: Summary of study methodologies

<table>
<thead>
<tr>
<th>Research Method</th>
<th>Design</th>
<th>N</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantitative</td>
<td>Controlled trials</td>
<td>2</td>
<td>Carrico et al., 2007; Nunnink et al., 2009</td>
</tr>
<tr>
<td>Quantitative</td>
<td>Descriptive trials</td>
<td>1</td>
<td>Messmer, 2008</td>
</tr>
<tr>
<td>Mixed methods</td>
<td>Descriptive trial plus free text comments</td>
<td>4</td>
<td>Kane et al., 2011; Leflore &amp; Anderson, 2008; Mould et al., 2011; van Schaik et al., 2011.</td>
</tr>
<tr>
<td>Qualitative</td>
<td>Qualitative focus groups</td>
<td>2</td>
<td>Elfrink et al., 2009; Kaddoura, 2010</td>
</tr>
<tr>
<td>Opinion</td>
<td>Programme review</td>
<td>2</td>
<td>Baid, 2011; Morris et al., 2007</td>
</tr>
</tbody>
</table>

Control groups provide a ‘normal’ baseline to compare the intervention group and assess the difference (Polit & Beck, 2004). Carrico et al.'s (2007) control group had classroom teaching minus the simulation manikin demonstrating cough. The assessors were blind to who received the intervention and who did not. The study of twenty participants suggested...
the group exposed to the intervention had an improvement in personal protective equipment use compared to the control (Carrico et al., 2007).

Nunnick et al.’s (2009) control group had the ICU’s standard teaching of chest reopening procedure which consisted of classroom teaching plus watching a video of the procedure. The intervention group had an active simulated experience of emergency chest reopening in the ICU. The results of the control group was compared to the simulation intervention group by the use of self-evaluation surveys and multiple choice questionnaires testing recall of facts associated with the chest reopening procedure. This study of forty nurses and nine doctors found that confidence and knowledge improved following simulation learning however, the control group had an equivalent improvement in these areas (Nunnink et al., 2009).

The majority (n=5) of the selected studies were quantitative studies of a descriptive case study design. Descriptive studies sit at level four of the evidence hierarchy (Polit and Beck, 2004). These studies aim to analyse and describe a particular group’s response to an intervention as it naturally occurs rather than endeavouring to understand causal sequence of reactions. Four of the studies within this review were mixed methods, utilising the quantitative descriptive design with a small qualitative component (Kane et al., 2011; Leflore & Anderson, 2008; Mould et al., 2011; van Schaik et al., 2011) and one purely descriptive (Messmer, 2008).
The qualitative component of the mixed method study designs is able to provide knowledge around the participants' experience of simulation. A pre-test, post test evaluation design was used in three of the studies along with open ended questions (Kane et al., 2011; Leflore & Anderson, 2008; Mould et al., 2011). A post test survey evaluation combined with independent observer assessment was used for simulation evaluation with Messmer (2008) and post test survey and open ended question was used by van Schaik et al. (2011). The researchers were focusing on self-perceived evaluations of confidence (Kane et al., 2011; Mould et al., 2011; Nunnink et al., 2009; van Schaik et al., 2011), competence (Mould et al., 2011; van Schaik et al., 2011), teamwork (Messmer, 2008) and retention of confidence or comfort (Kane et al., 2011). There were improvements in all these areas.

Effectiveness of simulation learning was also assessed using independent assessors who utilised standardised tools to evaluate competence. A validated assessment tool for evaluating nurse-physician collaboration was used by Messmer (2008). This study according to the observers did indicate that collaboration between the nurse-physician groups did improve over the three scenarios (Messmer, 2008). The other three studies used independent observers to assess the simulation participants for clinical or technical competence according to a set format (Baid, 2011; Carrico et al., 2007; Leflore & Anderson, 2008).

There was a variety of learning aims and simulation learning interventions in this group of studies. Kane et al. (2011) and Mould et al. (2011) aimed to establish the effectiveness of
simulation learning within their critical care education programmes. They both used simulation suites providing high fidelity emergency scenarios for groups to actively participate in. Other simulation interventions in this descriptive study group included the use of simulation to role model expert practice (Leflore & Anderson, 2008) and to evaluate training methods (Baid, 2011; Elfrink et al., 2009; Kaddoura, 2010; Leflore & Anderson, 2008) and the development of team communication and cohesion in critical scenarios (Messmer, 2008; van Schaik et al., 2011).

Qualitative research sits at level four in the evidence hierarchy and contributes understanding and meaning to a phenomenon. The two qualitative studies in this review, focused on capturing the experience of the simulation learning participants (Elfrink et al., 2009; Kaddoura, 2010). Elfrink et al. (2009), through open ended questionnaires and focus groups asked for a formative and summative evaluation of the simulation learning component of the undergraduate students critical care programme. The theoretical underpinnings were that the students' simulation reality was tied to emotions and self-awareness (Elfrink et al., 2009). Kaddoura (2010) used focus groups to gain an understanding of new graduate nurses' experience and perceptions of simulation training in their critical care course.

The final set of studies consisting of the two education programme reviews (Baid, 2011; Morris et al., 2007) and four opinion articles (Day, 2007; Gant, 2007; Gomez, 2009; Roche, 2010) sit at levels five and six respectively of the evidence hierarchy. Baid (2011), presents a reflective analysis of introducing simulation into a critical care training
programme to assess competence of students. Morris (2007) has introduced simulation learning into a critical care programme aiming to promote critical thinking and control clinical experiences for students. The four opinion articles all endorse simulation learning for critical care and emergency nurses. All the authors were professors from universities in the USA who held positions within various nursing education departments. The quality reviews of these articles are in Appendix B.

The overall quality of all the studies in this review sits low on the evidence hierarchy with only two articles directly comparing the simulation intervention with their current learning practice (Carrico et al., 2007; Nunnink et al., 2009). The mixed methods and qualitative methods used by many of the researchers in this review (Elfrink et al., 2009; Kaddoura, 2010; Kane et al., 2011; Leflore & Anderson, 2008; Mould et al., 2011; van Schaik et al., 2011) will assist with understanding the experiences of simulation participants. A thematic analysis was utilised to extract and group themes from all of the articles, thus providing a basis for discussion and critique.

3.2 Themes

The research questions focused on identifying the existing evidence that demonstrates simulation is an effective learning tool and the exploration of the experience of students and teachers utilising simulation learning. These questions provided the focus for the thematic analysis in the data synthesis phase of this review. Figure 4 below summarises the themes.
To understand and interpret the various researchers choice of research design and their conclusions, data was also extracted regarding the reasons for simulation learning intervention, the components of simulation utilised by the authors and the settings which the simulation intervention took place. An overview of the emergent themes will be presented here with further interpretation and analysis in the discussion chapter.

### 3.2.1 Theme 1.0 Rationale for using simulation learning.

All of the authors rationalised their decision to alter their current educational programmes. The authors felt current training methods could be improved utilising the principles of simulation learning to improve patient safety and quality care (Leflore & Anderson, 2008;
Nunnink et al., 2009) develop teamwork and communication strategies (Elfrink et al., 2009; Kaddoura, 2010; Messmer, 2008), and ensure confidence and competence of health workers (Baid, 2011; Carrico et al., 2007; Leflore & Anderson, 2008; Morris et al., 2007; Mould et al., 2011; Nunnink et al., 2009; van Schaik et al., 2011). These three issues form the following subthemes; patient safety and quality care, improvement in training standards, and student development.

3.2.1 Subtheme 1.1. Patient safety and quality care

The reasons for initiating simulation learning were varied. The most common concern was to improve patient safety and quality care in ten of the fifteen articles (Carrico et al., 2007; Kaddoura, 2010; Kane et al., 2011; Leflore & Anderson, 2008; Messmer, 2008; Morris et al., 2007; Mould et al., 2011; Nunnink et al., 2009; Roche, 2010; van Schaik et al., 2011). The concerns related to the high patient acuity (high risk, low margin of error) in critical care situations (Kane et al., 2011; Leflore & Anderson, 2008; Mould et al., 2011). Given these concerns it was suggested that simulation learning could assist new nurses to develop skills around error management (Roche, 2010). Also that, in situ 'mock code' simulation learning could allow for an evaluation of systems, where equipment, communication networks and protocol testing can occur (Nunnink et al., 2009; van Schaik et al., 2011).

Concerns were also raised about how to adequately prepare newly qualified nurses to deal with this acute environment (Kane et al., 2011; Morris et al., 2007; Roche, 2010). Moreover, Mould et al. (2011) raises the question of whether it is ethically sound for critically ill patients to be cared for by inexperienced nurses.
Team collaboration and cohesion were thought of as important critical care skills (Roche, 2010) that improve patient outcomes (Messmer, 2008). Simulation scenarios were used by two studies to assess and develop teamwork (Messmer, 2008; van Schaik et al., 2011). Messmer (2008) studied eighteen teams of nurses and physicians and found that communication, respect for roles and collaboration improved over three subsequent simulated scenarios. Van Schaik et al. (2011) used in situ simulation scenarios of resuscitation, while surveying self-efficacy of simulation participants. These results discovered that there was an improved understanding of roles and changes in culture as senior physicians began to become involved in the simulations.

3.2.1 Subtheme 1.2 To improve training standards

The improvement of training standards was the dominant concern (n=11) for the articles in the review (Baid, 2011; Gant, 2007; Gomez, 2009; Kaddoura, 2010; Kane et al., 2011; Leflore & Anderson, 2008; Morris et al., 2007; Mould et al, 2011; Nunnink et al., 2009; Roche, 2010; van Schaik et al, 2011). Simulated learning was thought of as important to provide consistency in training and make up for discrepancies around adequate clinical supervision (Baid, 2011, Gomez, 2009; Morris et al., 2007; Mould et al, 2011). Controlling the clinical experience allows for assessing the competence of individuals, teams and adequacy of training (Baid, 2011; Gant, 2007; Gomez, 2009; Leflore & Anderson, 2008; Morris et al., 2007). The simulated experience also allows for development of critical thinking (Kaddoura, 2010; Morris et al., 2007).
Simulated scenarios are able to provide a range of experiences (Kaddoura, 2010; van Schaik et al., 2011) and ensure uncommon and rare experiences could be provided for (Kaddoura, 2011; Leflore & Anderson, 2008; Mould et al., 2011; Nunnink et al., 2009; Roche, 2010). For example neonatal transport teams were given self-directed learning packages, observed neonatal expert role modelling then assessed for their knowledge and skills using simulation (Leflore & Anderson, 2008). The physical environment of the air transport vehicle and the high acuity of the patients on board provide a unique situation making emergency training drills and expert role modelling difficult to achieve without the aid of simulation (Leflore & Anderson, 2008). Nunnink et al.’s (2009), study was based on the issue of the need for emergency chest reopening being very rare and few staff ever getting to be involved in one. Should the situation occur, staff needed to be confident and aware of the process and requirements within a short time frame in order to give the patient the best possible outcome.

The development of critical thinking was a concern for Kaddoura (2010) and Morris et al. (2008), both felt that critical thinking could be developed by simulation learning and facilitators challenging students to fully assess and plan care decisions. Kaddoura (2010) explored critical thinking in student focus groups, students perceived themselves to have developed critical thinking through the simulation programme through the effect of realism and facilitation by educators.
3.2.1 Subtheme 1.3 Student development

Studies were aiming to develop or assess student confidence (Kaddoura, 2010; Kane et al., 2011; Mould et al., 2011; Nunnink et al., 2009; van Schaik et al., 2011) and alleviate anxiety (Elfrink et al., 2009; Kaddoura, 2010; Mould et al., 2011; van Schaik et al., 2011). The studies were exploring whether the simulation scenario helped participant confidence once back in the clinical environment. Self-perceived confidence being assessed through the pre-test post-test evaluation process (Kane et al., 2011; Mould et al., 2011; Nunnink et al., 2009; van Schaik et al., 2011), or through focus groups (Kaddoura, 2010).

Mould et al. (2011) writes of concerns from students of the anxiety they experienced prior to critical care clinical practice. By allowing students to rehearse the different experiences they may encounter in a protected environment, Mould et al. (2011) hoped that anxiety might be lessened.

3.2.2 Theme 2.0 Influences on effective simulation learning

All the review research studies were concerned with the effectiveness of their simulation intervention. As discussed in the background chapter (page 13) effective simulation experience should comprise of four components to maximise the learning process (Issenberg et al., 2005; Jefferies, 2007). Six studies discussed simulation learning principles and an intention to include these principles in their intervention (Elfrink et al., 2009; Kane et al., 2011; Leflore & Anderson, 2009; Messmer, 2011; Mould et al., 2011; van Schaik et al., 2011). Simulation principles have been discussed in the background chapter and consist of a preparation phase, active participation, realism and
debrie/reflection. In addition to these four phases, there were other aspects namely repetition of the simulation experience and role modelling or observing. These six principles are the subthemes for the influences on simulation learning.

3.2.2 Theme 2.1 Preparation

There was a range in student preparation prior to the simulation experience reported in the studies. There were formalised classroom teaching sessions (Carrico et al., 2007; Nunnink et al., 2008), scenario introduction and orientation to manikin capabilities (Kane et al., 2011; Leflore & Anderson, 2008; Mould et al., 2011; van Schaik, 2011) and a formalised process of planning within the group (Elfrink et al., 2009). Leflore and Anderson (2008) also provided a self-modulated learning package and expert role modelling prior to the team beginning the active simulation component. Preparation was unclear or not fully articulated for four of the studies (Kaddoura, 2010; Messmer, 2008; Morris et al., 2007 Nunnink et al., 2008). Nunnink et al.'s (2008) study had clear preparation articulated for the control group but not for the simulation group.

3.2.2 Theme 2.2 Fidelity/Realism

Simulation fidelity as discussed in the background chapter (page 18) ranges from fully replicated environments with physiologically responsive manikins considered high fidelity through to observations, role plays and part task training considered low fidelity. Fidelity can also refer to the environment (van Schaik et al., 2011) and to the psychological or emotional reality (Pike & O'Donnell, 2010). Six of the studies used high fidelity simulation (Kaddoura, 2010; Kane et al., 2011; Leflore & Anderson, 2008; Morris et al.,
2007; Mould et al., 2011; Nunnink et al., 2009), except for Nunnink et al. (2009) and van Schaik et al. (2011), all utilised simulation suites. Nunnink et al. (2009) and van Schaik et al. (2011) utilised the real clinical environment for the simulation exercise. Van Schaik et al.’s (2011) study focused on simulating arrest codes within different areas of the hospital. The manikins were medium fidelity which were able to simulate part tasks such as intubation, and vascular access and can simulate heart rhythms but were unable to simulate breathing or other real time physiological responses (van Schaik et al., 2011). The low fidelity study was Carricos et al. (2007) coughing/sneezing manikin which study participants observed but did not actively engage with. Nunnink et al.’s (2009) control group watched an instructional video following classroom teaching. Video is considered a form of low fidelity simulation although not discussed as such in their study (Nunnink et al., 2009).

The settings of the studies were either in situ within the simulation participants’ usual clinical environment (Nunnick et al., 2009; van Schaik et al., 2011) or in a simulation suite (Carrico et al., 2007; Elfrink et al., 2009; Kaddoura, 2010; Kane et al., 2008; Leflore & Anderson, 2008; Messmer, 2008; Mould et al., 2011). For Nunnink et al. (2009) and van Schaik et al. (2011) in situ simulation training was an important part of the simulation process. Simulation scenarios within the real clinical setting can provide environmental realism and allows for system testing. The interdisciplinary teams that would normally respond within the units were able to work together easily under simulated conditions (van Schaik et al., 2011). Van Schaik et al. (2011) also noted the change in culture over time as senior physicians began to get involved in the mock scenarios.
In three of the studies the extent of realism was unclear (Baid, 2011; Elfrink et al., 2009; Messmer, 2008). Messmer (2008) did utilise a simulation suite, however, the degree of realism that the manikin provided is not reported. Baid (2011) and Elfrink et al. (2009) made no statements regarding the setting or the degree of realism of their simulation learning interventions.

3.2.2 Theme 2.3 Debriefing and guided reflection

The debriefing and guided reflection component of simulation learning was a feature of eight of the studies (Elfrink et al., 2009; Kaddoura, 2010; Kane et al. 2011; Leflore & Anderson, 2008; Messmer, 2008; Morris et al., 2007; Mould et al., 2011; van Schaik et al., 2011). Audio visual recording of the simulated scenario for debriefing purposes occurred in six of the studies (Elfrink et al., 2009; Kaddoura, 2010; Leflore & Anderson, 2008; Messmer, 2008; Morris et al., 2007; Mould et al., 2011). Nunnink et al. (2009), utilised a ‘pause and discuss’ technique during the simulated scenario not a formal debrief. Baid (2011) discussed a personal reflection as an instructor but not one for students. Carrico et al. (2007) did not discuss a debriefing process for the simulation intervention participants.

3.2.2 Theme 2.4 Role modelling and observing

Simulation participants in Leflore and Anderson’s (2008) study observed ‘experts’ performing emergency procedures live in simulated scenarios as a technique to role model expected behaviour in neonatal emergencies. Nunnink et al. (2009) utilised video for a similar reason, to role model the procedure of emergency chest reopening in ICU. Another three studies divided groups of simulation participants into ‘active’ and ‘observer’ roles.
(Kaddoura, 2010; Mould et al, 2011; van Schaik et al., 2011) giving participants the opportunity to learn from both points of view.

3.2.2 Theme 2.5 Repetition

One study which focused on nurse physician collaboration, allowed teams to work together in simulated critical situations a total of three times and found an improvement in the collaboration after each session (Messmer, 2008). Elfrink et al. (2009) wrote of repeating simulated scenarios for students but this was not considered useful by the students and it was unclear in the narrative whether this was done. None of the other studies discussed allowing repeated attempts at the same simulation scenario as a component to their simulation learning.

3.2.2 Theme 2.6 Limitations to simulation learning

The research studies discussed little about limitations to simulation learning. The majority of issues were raised by the opinion articles with concerns around cost, research, and interpersonal relationships.

3.2.2 Theme 2.6.1 Cost

Two research studies observed that the time simulator educators and facilitators took to organise scenarios and settings was very high (Baid, 2011; Nunnink et al., 2009). The number of staff who can be accommodated in simulation exercises was low (25 staff in groups of three to four for 30 minute blocks of time) compared to numbers who could be
taught didactically and through video observation (24 staff for 30 minutes) (Nunnink et al., 2009). Limited resources and funds appear to make it difficult to create realism for the students participating in simulation experiences (Baid, 2011; Gant, 2007).

Another issue raised was the ability of educators to design scenarios and facilitate debriefings (Baid, 2011; Gant, 2007). The question was raised by Gant (2007) of institutions who may fund the equipment but then find the operators are not sufficiently trained to use them and more funding is then required to provide this training.

3.2.2 Theme 2.6.2 Interpersonal relationships

Concerns that simulation learning lacks humanism and fails to develop interpersonal relationships were broached by two of the opinion articles (Day, 2007; Gant, 2007). Day (2007) believes simulation learning is limited by the educators’ imagination and does not allow for the unpredictable. Day (2007) also expresses concern that the value of the experienced nurse and student relationship is lost if replaced by simulation experiences.

3.2.3 Theme 3.0 Experiences

The participant experiences data was obtained from the qualitative components of the research data. Researchers utilising a mixed methods research design asked for free text feedback from simulation participants. Elfrink et al. (2009) and Kaddoura (2010) utilised focus groups to elicit narrative from students regarding their perceptions of simulation learning.
3.2.3 Subtheme 3.1 Student experiences

The students/participants from Elfrink et al., (2009), Kaddoura, (2010) and van Schaik et al. (2011) perceived simulated scenarios as contributing to improvements in their anxiety levels when confronted with critical care situations. This was evidenced by statements from individuals that suggested being able to practice critical scenarios, in the protected environment of simulation, reduced their feelings of anxiety when faced with the real scenario.

There were also reports that simulation can cause undue stress and anxiety (Elfrink et al., 2009; Mould et al., 2011). Elfrink et al.’s (2009) qualitative study asked students what they found to be helpful or unhelpful with regard to simulation training and arranged focus groups to gather more information from students. The results of this formative phase of the study uncovered the issues students found stressful. The causes of anxiety for these students were identified as not understanding the environment and their role, and the videotaping of the scenario. The main solution, as requested by the students, was to have a planning session prior to commencing the scenario where the students could plan as a team.

Kaddoura (2010), utilised semi structured interviews of focus groups of ten nurses to elicit their experiences of simulation learning. Kaddoura’s focus was on whether simulation learning could enhance learning, critical thinking and confidence for these nurses. The author recorded and analysed the narrative of these focus groups to develop three themes; “just-in-time learning of cognitive and psychomotor skills”, “fostering critical thinking
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and leadership skills through feedback on simulation”, “safety in a non-threatening learning environment” (Kaddoura, 2010, p510). Students were quoted in the narrative stating they believed they had improvements in confidence and they believed their critical thinking skills were improved by the realism of scenarios and facilitators questioning their decisions.

3.2.3 Subtheme 3.2 Teamwork

Development of teamwork and insight into role delineation and leadership was a strong theme in the qualitative data (Elfrink et al., 2009; Kaddoura, 2010, van Schaik et al., 2011). Elfrink et al.'s study asked what students found most helpful regarding the simulation experience and proposed that “delegation and working as a team” (Elfrink et al., 2009, p85) was a key aspect. Elfrink et al. (2009) introduced group planning at the beginning of the simulation experience and the students felt that this helped them to work together and not feel singled out. One participant from van Schaik et al.’s (2011) study felt they gained an understanding of the differing roles each person contributed during the resuscitation scenario, and that this helped their overall understanding of the resuscitation process. Participants from Kaddoura’s (2010) study felt that simulation scenarios helped the students get to know each other and learn from each other through working together or through observation via recording.

Van Schaik et al. (2011) observed through an in situ resuscitation training programme that a change in culture was occurring as a result of their programme. Senior medical clinicians were beginning to get involved in the training that had previously been perceived as only
3.2.3 Subtheme 3.3 Educator experiences of simulation learning.

There was a paucity of educator experiences of simulation learning in the research. One study provided a reflective analysis of an educator's experience of using simulation to assess student competency (Baid, 2011). Several issues were highlighted by Baid (2011) as learning issues for educators. The simulation scenarios were time intensive with preparation of clinical stories, lab results and creating adequate realism both environmental and 'patients' (Baid, 2011). Simulation facilitators also required training in order to learn how to adequately create scenarios, set up manikins, and facilitate the scenarios. This was also supported by Kane et al. (2011), who also ensured educators received training prior to beginning the simulation learning intervention with students.

Elfrink et al. (2009) reported the importance of educators requesting early formative feedback from students participating in clinical simulation scenarios. They believed that students engaged better with simulation learning when given the opportunity to feedback to the educators. The educators were prepared to change aspects of the simulation learning process to incorporate the students concerns. Elfrink et al. (2009) believed this improved the student/teacher relationship.
3.3 Summary

The studies were predominately based in the USA with post registration nursing and multidisciplinary groups. There was variability in study design and methods, with a focus on descriptive and qualitative data methods. These research methods allow for an exploration of the simulation participants reactions and attitudes towards simulation learning. A thematic analysis was chosen to group the concepts that emerged from data extraction and synthesis of the literature. The main themes from this were; the reasons for simulation learning being initiated, influences to effective simulation learning and experiences of simulation. Further discussion and critique of the study validity and themes will occur in the discussion chapter.
Chapter 4 Discussion

Within this chapter a discussion relating to the findings and wider literature is presented. The two specific objectives for this systematic review were firstly to identify what evidence exists that demonstrates simulation is an effective learning tool for nurses who are involved in critical care. Secondly, it was hoped to explore the experiences of both nurses and educators utilising simulation learning to prepare for critical care nursing.

Effective learning is not easy to define, as discussed earlier in Chapter 1 Section 1.2.4 on page 13. The synthesis of the articles reviewed establishes the criteria for which they each defined as effective learning. These perspectives on ‘effective learning’ will be debated and discussed later in this chapter.

The themes for discussion include the reasons why simulation learning was implemented, factors influencing the effectiveness of simulation learning and the experiences of the participants. Subthemes for discussion include the impact of simulation learning on; patient safety and quality care, training standards and student development. Other subthemes include the components of simulation learning utilised by the studies and the issues that limit the scope of simulation learning. Student and educator experiences will also be discussed. It was found that there were some correlations between the effectiveness and the experience of the simulation participants therefore effectiveness and experiences will be discussed together for support or contrast. This narrative will conclude
4.1 Patient safety and quality care

Patient safety and quality care are significant concepts throughout health care (Institute of Medicine, 2000) and unsurprisingly this was a concern identified in all the articles reviewed (Baid, 2011; Carrico et al., 2007; Day, 2007; Elfrink et al., 2009; Gant, 2007; Gomez, 2009; Kaddoura, 2010; Kane et al., 2011; Leflore & Anderson, 2008; Messmer, 2008; Morris et al., 2007; Mould et al., 2011; Nunnink et al., 2009; Roche, 2010; van Schaik et al., 2011). The issues raised regarding patient safety included concerns around the critical care environment having inexperienced nurses and high risk, high acuity patients (Kane et al., 2011; Leflore & Anderson, 2008; Morris et al., 2007; Mould et al., 2011; Roche, 2010) combined with a lack of quality mentors to support them (Kane et al., 2011; Morris et al., 2007; Mould et al., 2011). This issue is compounded by the need to improve the critical care team responses to rare and life threatening events through the opportunity to gain knowledge, familiarity with the specific emergency process and/or team collaboration (Leflore & Anderson, 2008; Messmer, 2008; Nunnink et al., 2009; van Schaik et al., 2011).

A collaborative team approach to patient care was considered paramount to ensure safe care. These concepts were identified and discussed in the background chapter (page 4), where scholars suggested that team cohesion is crucial to quality patient care (Gaba et al., 2001; Institute of Medicine, 2000). Teamwork is an aspect of simulation learning found to
be a positive outcome in the reviewed studies (Elfrink et al., 2009; Kaddoura, 2010; Messmer, 2008; Roche, 2010; van Schaik et al., 2011). For critical care nurses simulated learning environments can promote team collaboration especially if these teams work together over multiple scenarios (Messmer, 2008). The simulation experience also allowed an improved understanding of the differing roles each person had within a health care team (Kaddoura, 2010; van Schaik et al., 2011) and improved interdisciplinary communication and collaboration (Leflore & Anderson, 2008; Messmer, 2008; Nunnink et al., 2009; van Schaik et al., 2011).

Gaba et al. (2001) suggests promoting a greater understanding of role delineation and the perspective of all the different team members, allows the team to optimise their skills, knowledge and experience to ultimately improve patient safety as leadership and team support are improved. It is also important for the team to be able to function as themselves (in terms of their role and function with the health care team) in their natural teams and gain familiarity with the physical environment and equipment (Gaba et al., 2001). This may be difficult and costly to achieve in a simulated environment.

However setting up critical scenarios within the actual critical care environment such as the Intensive Care Unit can significantly reduce this cost. The other advantages of in situ simulation scenarios include equipment testing for usability and functional familiarity. Also the emergency response system of the health care organisation beyond the individuals and teams can be tested (Nunnink et al., 2009; van Schaik et al., 2011). The success of in situ simulation learning is dependent on the team members being available for the duration...
of the training as they can easily be drawn away to attend to real patient care needs within the critical care unit (Kane et al., 2011; van Schaik et al., 2011). There is also the issue of workload in the clinical environment on the training day; if it is too busy with clinical work there may not be the space to enable the teaching to be undertaken.

4.2 Improve training standards

Many of the review studies felt that being able to control the type of clinical situations that the attendees experienced was one of simulations most useful aspects (Baid, 2011; Kaddoura, 2010; Kane et al., 2011; Leflore & Anderson, 2008; Morris et al., 2007; Mould et al., 2011; Nunnink et al., 2009; Roche, 2010; van Schaik et al., 2011). Controlling the clinical experience in the simulation exercise is thought to be desirable for several reasons, firstly, for the assessment of specific competencies of the simulation participants (Baid, 2011; Leflore & Anderson, 2008; Morris et al., 2007). Critical care environments such as in flight critical care transport teams do not necessarily allow for peer review and easy observation of performance (Leflore & Anderson, 2008). Learning new knowledge, techniques or processes may need an aspect of assessment which reassures educators that the key concepts of the learning experience have been learnt and the practitioner is then hopefully able to apply this competently to the real clinical environment. Simulated scenarios when used to assess competency, ensure a standardised patient which means all the participants can be assessed in a fair and standardised manner (Williams, Klamen, & McGaghie, 2003). The issue of competency assessment is a complex one and worthy of more discussion therefore will be explored later in this chapter.
Life threatening emergencies do not occur frequently, and therefore prohibits many individuals gaining mastery in the responses and care needed in these situations. An opportunity to gain experience of these rare events can be provided through simulation (Kane et al., 2011; Morris et al., 2007; Mould et al., 2011; Nunnink et al., 2009; van Schaik et al., 2011). For example, Van Schaik et al. (2011) noted in the study exploring self-efficacy of participants following interdisciplinary simulation training, that 39% of the study participants had not attended a cardiac arrest prior to attending the resuscitation training provided. Hence the participants surveyed naturally found that the simulation training experienced was valuable in terms of giving them an insight into paediatric resuscitation situations that they may experience in the clinical environment.

Given the rarity of life threatening events, having experienced nurses who had been exposed to these situations is equally rare, hence there were concerns that quality mentors were not necessarily available in the critical care clinical environment to ensure positive learning experiences for students and new staff (Kane et al., 2011; Morris et al., 2007; Mould et al., 2011). Simulation learning could allow students and new staff to have positive experiences by providing a risk free environment with a trained facilitator that avoids the potential safety and ethical hazard of poorly supervised, unskilled nurses ‘practicing’ skills on critically unwell patients (Morris et al., 2007; Mould et al., 2011). Potential clinical mentors could also be allowed access to simulation learning of these rare events creating a more robust workforce to support new nurses.
Furthermore, newly qualified nurses with limited clinical experience prior to entering the critical care environment, could be given an overview of the more routine critical care scenarios and tasks through simulation (Kaddoura, 2010; Morris et al., 2007). This would therefore allow for simulated practice of skills such as endotracheal suctioning and care of patients with intercostal chest drains (Kaddoura, 2010). The simulated environment was perceived by the students to be a safer method of learning and allowed them to gain experiences that they could later apply to the real clinical environment. Low fidelity simulation such as part task training allows the student to become familiar with the equipment and/or process of the task (Gaba, 2004; Pugh & Youngblood, 2002). Beginner practitioners can learn the tasks of their role outside of the clinical context. It is the challenge of educators and mentors to provide the clinical context through experiential learning. Initially this can be with simulated experiences then further context is provided in the clinical environment (Benner, 1982, 2004).

In Morris et al.’s (2007) report on a critical care training programme, students felt that prior to simulation learning being introduced, there was no correlation between classroom teaching and the clinical experiences they were encountering and it was difficult to gain exposure to the appropriate clinical experience. Control of the clinical experience by utilisation of simulation learning, also allows facilitators of critical care training programmes to ensure that classroom teaching and clinical experience correlate allowing for timely reinforcement of theoretical foundations to clinical practice (Morris et al., 2007). The guided reflection during or following simulated experience promotes the principles of critical thinking so that they can apply theory to practice (Rudolph et al., ...)
2006; Schon, 1983). The student can then start imagining themselves within real clinical experiences and how they might respond (Benner et al., 2010).

Critical thinking was defined in this review as the ability of the nurse to make clinical judgments based on the whole assessment of the patient combined with previous knowledge and experience (Kaddoura, 2010; Morris et al., 2007). Simulation learning experiences allows for a guided experience through taking opportunities to reflect on practice and provide feedback both during and after the experience (Kaddoura, 2010; Morris et al., 2007). Participants themselves felt that their critical thinking skills were enhanced by the realism of the scenario and the facilitator questioning their decision making (Kaddoura, 2010). Participants would learn these techniques of reflection within the simulation learning environment that could then be applied when they are exposed to these situations in clinical practice.

Jefferies (2007) endorses simulation learning as a means of developing critical thinking in nurses but also warns there is little validating evidence that this is actually achieved. This review did little to add to validating the evidence, although it does suggest that the participants felt their critical thinking skills were enhanced (Kaddoura, 2010). A systematic review by Lapkin et al. (2010) into the effectiveness of simulation to teach clinical reasoning skills, suggests that high fidelity simulation can improve the critical thinking abilities of undergraduate nurses, however the results were mixed and the authors felt that further research was needed. Certainly critical thinking is not just the remit of undergraduate nurses therefore any future research should include all levels of nurses.
However, there are concerns that students may not engage well with a simulated environment (this issue is discussed in detail later in the chapter) (Pike & O'Donnell, 2010) therefore they may not think as critically as they might when in the clinical environment. The clinical environment, however, may not allow time or opportunity for clinical mentors or participants to reflect on their practice which is an important aspect of simulation training (Gaba et al., 2001). A lengthy discussion between students and educators is not always appropriate within the clinical environment (Benner et al., 2010) and the ability to pause the scenario to discuss specific aspects an advantage of simulated learning (Nunnink et al., 2009).

4.3 Student personal development

As discussed earlier in this chapter, critical care nurses must provide safe and competent care to high risk and high acuity patients, within environments that don’t necessarily provide adequate mentorship or support for the beginner practitioner. Nurses faced with personally challenging experiences but with inadequate support are at risk of experiencing more negative emotional states which can impact on their clinical judgement, behaviours and compromising their learning experience (Daloz, 1986). This leads onto the theme of how simulation learning can assist with the more personal development of the student, in particular their confidence, anxiety and self-perception.

In this review simulated scenarios were aiming to help nurses feel more confident (Kaddoura, 2010; Kane et al., 2011; Mould et al., 2011; Nunnink et al., 2009; van Schaik...
et al., 2011) or less anxious (Elfrink et al., 2009; Kaddoura, 2010; Mould et al., 2011; van Schaik et al., 2011) with regard to critical care. Dealing with life threatening conditions is always a daunting prospect and those who have not had the opportunity, or even those who have experienced such situations, are often apprehensive of them occurring again (Mould et al., 2011; van Schaik et al., 2011).

Another interesting subtheme concerned the fact that many of the studies in the review relied on the ability of the simulation participants to self-assess their performance (Elfrink et al. 2009; Kaddoura, 2010; Kane et al., 2011; Mould et al., 2011; Nunnink et al., 2009; van Schaik et al., 2011). This raises the question of how reliable is self-assessment as a measure of performance. These issues of confidence, anxiety and the self-assessment of performance will be considered in the following narrative.

4.3.1 Developing confidence

Simulation learning provides an opportunity for nurses to practice and gain knowledge and skills outside of the clinical environment. In this review, the studies utilised self-perceived improvements in confidence to measure the effectiveness of the simulation intervention (Kane et al., 2011; Mould et al., 2011; Nunnink et al., 2009; van Schaik et al., 2011). The results demonstrated that participants felt more confident immediately following the simulation experience. The reasons for this were varied, with reports of participants feeling more comfortable with the resuscitation process (Kane et al., 2011; van Schaik et al., 2011), which was thought to be due to the opportunity to plan and deliver care through the
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simulation experience (Kaddoura, 2010; Mould et al., 2011), and greater familiarity with equipment and technical skills (Kaddoura, 2010; Kane et al., 2011; van Schaik et al., 2011).

The choice to measure the effectiveness of simulation learning based on confidence was only rationalised by one study (van Schaik et al., 2011). In this study the author linked confidence to self-efficacy or the belief in oneself to perform a task (van Schaik et al., 2011). To create confidence and improved self-efficacy all aspects of Bandura's (2003) social cognitive theory should be incorporated into clinical teaching. This is namely, the opportunity to acquire mastery, verbal persuasion, opportunity to observe others, and control or understanding of their feelings and emotions (Maibach, Schieber, & Carroll, 1996; Pike & O'Donnell, 2010). The supposition being if a simulated learning experience improves a student's confidence then they are more likely to apply themselves in a positive manner towards future experiences (Bandura & Locke, 2003; Maibach et al., 1996; Pike & O'Donnell, 2010). An engaged learner is more likely to seek self-improvement in their performance (Benner, 2004).

The simulated learning process allows the concepts of Bandura's (1989) social cognitive theory to be under the control of the educator. These components of the simulation experience were present in the review studies. With simulation the educator can provide a situation requiring active participation for the student (Carrico et al., 2007; Elfrink et al., 2009; Kaddoura, 2010; Kane et al., 2011; Leflore & Anderson, 2008; Messmer, 2008; Mould et al., 2011; Nunnink et al., 2009; van Schaik et al., 2011) and by use of positive language encourage the student and allow them to express their feelings and perspective.
(Elfrink et al., 2009; Kaddoura, 2010). The simulation participants can also be given the opportunity to observe how others work through collaborative teamwork and review their own performance through recorded simulation scenarios (Elfrink et al., 2009; Kaddoura, 2010; Leflore & Anderson, 2008).

However, confidence in a simulated environment does not necessarily translate into the clinical context for undergraduate nurses (Pike & O’Donnell, 2010). This is in contrast to experienced nurses, who suggested that the experience of simulation had a positive impact on their care/actions when faced with the real clinical situation. They felt more familiar with the resuscitation process and their own role within the resuscitation team (van Schaik et al., 2011). Simulation participants also directly attributed simulation experiences to improving their confidence within the intensive care unit as they felt safer and more competent (Kaddoura, 2010). The reason for this difference could be explained by Benner’s novice to expert theory of skill attainment (Benner, 1984). Novice nurses with no experience of a situation are taught basic and objective rules for completion of a task. For example they are taught the normal values of heart rate or blood pressure and what to do if these are not in normal ranges. However these rules do not always apply to the clinical situation. In order for this knowledge to be applied to other contexts the educator must guide the student to understand the variations in the clinical situation and relate their new knowledge to the bigger picture. The more experienced nurse will approach a new patient situation as a whole picture and be able to apply and relate new knowledge (perhaps learnt in simulation) within a context of multiple previous experiences (Benner, 1984). Hence, for experienced nurses the simulation experience adds to their pool of previous experiences and can be more easily applied to the clinical context and would not
necessarily need further support and guidance from educators in order to make this transition.

4.3.2 Alleviating anxiety

Feelings of anxiety can be detrimental to the learning process, if not dealt with in a positive way (Bandura, 1989; Maibach et al., 1996; Pike & O'Donnell, 2010). Anxiety can escalate into panic which does not allow for systematic thought and problem solving which can ultimately interfere with effective performance and decreased self-belief (Maibach et al., 1996; van Schaik et al., 2011). In this review two studies were primarily concerned about alleviating anxiety for their student populations and felt that simulation would assist with this (Elfrink et al., 2009; Mould et al., 2011). Adequate support for the students within a challenging environment is thought to decrease anxiety and potential avoidance behaviours and thereby facilitate personal development (Daloz, 1986). It is proposed that the simulated learning experience should have guided reflection both during and after the experience (Gaba, 2004; Rudolph et al., 2006). This reflection process should be a positive experience for the student that allows them to express their feelings and perspective allowing for greater engagement in the learning experience (Elfrink et al., 2009; Rudolph et al., 2006).

Enjoyment of the simulated experience positively correlated with improvements in confidence (Mould et al., 2011). This suggests that an enjoyable and positive simulation experience could diffuse a student's feelings of anxiety prior to the real clinical experience and promote their self-belief in success.
Following a simulated experience students reported feeling they were under too much scrutiny, unprepared and embarrassed (Elfrink et al., 2009). However, by allowing the students to express their feelings and introducing a group planning process before the simulated experience both students and educators felt the learning experience was enhanced (Elfrink et al., 2009).

The two studies by Mould et al. (2011) and Elfrink et al. (2009) were studies of preregistration nursing students who reported anxiety with the simulation experience. It is notable that there were no comments from studies with post registration nurses with regard to anxiety associated with simulation learning. In van Schaik et al.’s study they note that only 101 of the possible 319 nurses trained using simulation completed the survey, the responses were positive ones but 218 (68%) of the potential study population were left unsurveyed. The feelings and attitudes of experienced nurses towards simulation training was not a focus of any of the studies. Therefore there was no balance in the attitudes and perceptions of inexperienced and experienced critical care nurses towards simulation learning.

As Bandura (1989) suggests anxiety influences one’s self-belief and one’s ability to learn. Experienced practitioners could allow anxiety to influence their self-belief in a negative way and be unable to respond appropriately to emergency situations (Maibach et al., 1996). Avoidance behaviours and panic can all be negative responses to anxiety which
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experienced critical care nurses would also need to overcome in order to be effective care providers.

4.3.3 Self-awareness

Self-assessments of confidence, competence or satisfaction were the main method used by the researchers in this review to assess the effectiveness of simulation (Kane et al., 2011; Leflore & Anderson, 2008; Mould et al., 2011; Nunnink et al., 2009; van Schaik et al., 2011). However this relies on the simulation participant having a realistic self-concept. In the literature there is some debate whether self-assessment is a valid form of evaluation and some consider the objective structured clinical examination (OSCE) as a more effective measure of performance (Baxter & Norman, 2011). This debate will be explored in the following discussion.

Baxter and Norman (2011) found no correlation between self-perceived performance and observed performance. They also found that students with the least observed performance scores actually rated themselves much higher in self-perceived ability and vice versa (Baxter & Norman, 2011). This concept is also supported by Pike and O’Donnell (2010) who found that a student’s sense of self-efficacy in dealing with a simulated cardiac arrest failed to transfer into the real clinical environment, where the student felt unprepared. The authors were concerned that not having real experience of cardiac arrest can lead to an unrealistically high self-efficacy for students following a simulated scenario (Pike & O’Donnell, 2010).
These studies (Baxter & Norman, 2011; Pike & O'Donnell, 2010) only looked at undergraduate student nurse populations where the student ‘may not know what they don’t know’ and suggests that novice nurses have yet to develop the self-awareness required to self-evaluate their role and contribution to care. Benner (2004) suggests that nurses develop an awareness of their grasp of clinical situations based on past concrete experiences. For the beginner nurse this process has only just begun. The responsibility of the nurse educator is to guide novice nurses to understand the variances in clinical situations that may differ from theory or textbook based ideals (Benner, 2004). This suggests that for this group of nurses the transition from simulated experience to real life experience is one that needs guidance and support for the new nurse to ensure clinical application of new skills. The OSCE may be a more appropriate tool for novice nurse evaluation to ensure objectivity and provide a baseline for the new nurse to reflect on their own performance.

It has been argued, however, that observed assessments of clinicians within either simulated or clinical scenarios does not necessarily guarantee an unbiased and accurate assessment (Issenberg et al., 2005). Nor that the assessors’ perceived competence of the individual is able to be transferred into other clinical contexts (Williams et al., 2003). In a study of assessment bias, factors of “...rater attention, perspective, standards and mood...” (Williams et al., 2003, p274) can cause variability in assessment standards. It is proposed that in order to gain the least bias the observed assessment of competence needs to be structured, the assessors need to be trained and the students need to be assessed over many clinical encounters, simulated and real (Williams et al., 2003).
Self-evaluation of performance, however, is still considered a convenient and more reliable method of assessing performance (Issenberg et al., 2005). Some validated tools for student self-assessment have been developed in medical education (Millos et al., 2003; Pugh & Youngblood, 2002). However, as with observer assessment, self-assessment is not without its problems and nursing educators should perhaps be cautious about considering one assessment of a simulation experience evidence of competence or effective performance. Educators should allow for multiple opportunities and methods of assessment of which simulation can play its part in assessing student performance.

It appeared that simulation learning, for experienced staff, could transfer into the real environment and that skilled nurses were able to determine whether simulation learning was an effective method of learning for them. This is evidenced by statements from the simulation learning participants where they suggested that the simulation learning experience allowed for a reduction in stress once in the clinical environment and the skills and knowledge learnt in simulation were able to be applied directly to real experiences (Kaddoura, 2010; van Schaik et al., 2011). Experienced nurse-physician teams in the study of team collaboration, self-evaluated their performance and these were compared to independent observer scores (Messmer, 2008). The teams and the observers both indicated team collaboration had improved, suggesting that these experienced nurses could accurately self-evaluate their clinical performance.
4.4 Influences on effective simulation learning

The background chapter (page 13) discussed the components of simulation learning thought to be important to ensure an effective learning experience. In this review six of the studies discussed what they believed to be important aspects of simulation learning based on reviews of relevant literature (Elfrink et al., 2009; Kane et al., 2011; Leflore & Anderson, 2009; Messmer, 2008; Mould et al., 2011; van Schaik et al., 2011). These studies ensured these aspects were part of their simulation training programme. Only two of the review studies planned to validate any of the simulation learning components (Elfrink et al., 2009; Messmer, 2008). All of the review studies had participation but not necessarily preparation (Nunnink et al., 2008) or debriefing (Carrico et al., 2007). The common components were preparation, participation, debriefing, role modelling or observing, audio visual recording and repetition.

4.4.1 Preparation

Preparation for the simulation scenario ranged from a brief overview regarding programme objectives (van Schaik et al., 2011), orientation to the simulation suite and manikin capabilities (Kane et al., 2011), and theory based learning programmes (Carrico et al., 2007; Leflore & Anderson, 2009). Elfrink (2009) included a group planning phase after the simulation ‘patient handover’; this was considered by the students as the most valuable component to the learning experience. Prior to introducing this phase the students felt that they were unprepared and unsure of how to approach the scenario. Following the introduction of group planning the educators observed greater engagement of the students towards the scenario. The authors concluded that this group planning process demonstrated
that learning is influenced by the social practice of collaborative learning and mentor feedback (Elfrink et al., 2009). Collaborative learning is a concept supported by scholars as a leading benefit of simulation learning as discussed previously (pages 4 and 59).

The issues raised around the preparation of simulation training from the educators' perspective were difficulties around scenario development and obtaining adequate resources to enact these scenarios in order to provide adequate realism for the students (Baid, 2011). The simulated scenarios ranged from actors and role plays to low fidelity manikins set up in clinic rooms (Baid, 2011). Some high fidelity simulation centres provided training around the simulator computer software and manikin capabilities (Kane et al., 2011). It is important that educators are skilled in simulation learning techniques if they want to ensure that learning does in fact occur (Rudd et al., 2010).

Educators need to know more than the technical aspects of the simulation devices. They must also develop the skills and ability to guide the student in a non-judgemental manner to reflect on their practice and start to think critically with regard to their clinical decision making (Benner et al., 2010; Jeffries, 2007; Rudolph et al., 2006). Students should not feel too anxious or have negative emotions towards the simulation experience as this potentially can work against the learning process (Bandura & Locke, 2003). It is the responsibility of the simulation facilitator to ensure participants feel supported so that they develop confidence and improved self-efficacy (Daloz, 1986).
4.4.2 Participation and fidelity

The level of realism utilised in the studies reviewed ranged from high to low. The critical care training programmes all utilised high fidelity simulation suites and were aiming to recreate the critical care environments. The level of realism was thought to develop greater student engagement and therefore an ability to develop critical thinking (Kaddoura, 2010; Kane et al., 2011; Morris, 2007; Mould, 2011). High fidelity simulation was also utilised for team development (Messmer, 2008) and competency assessments (Leflore & Anderson, 2008). The scenarios were complex and the need for realism rationalised as a means to adequately assess competence under pressure. None of the review studies explicitly validated the impact of realism on student learning. However in the qualitative data, the participants’ perceived realism as an important factor in their experience, facilitating the development of critical thinking and applicability to practice (Kaddoura, 2010; Kane et al., 2011; Leflore & Anderson, 2008; Messmer, 2008; Mould et al., 2011).

There was no evidence in the studies to suggest the level of fidelity was an important factor for learning. The studies all demonstrated improvements in participant performance whether students participated in high fidelity (Kane et al., 2011; Messmer, 2008; Mould et al., 2011; Nunnink et al., 2008), medium fidelity (van Schaik et al., 2011) or low fidelity (Carrico et al., 2007, Nunnink et al., 2008). In fact Nunnink et al.’s (2008) study results showed no difference in the group that observed the video compared to the group that actively engaged in a simulation scenario. This result was consistent with a study by Levett-Jones, Lapkin, Hoffman, Arthur and Roche (2011) who demonstrated that student nurse knowledge retention was the same following high fidelity compared to medium fidelity simulation scenarios.
4.4.3 Debriefing

A guided debriefing process is considered paramount to ensure the simulation experience is effective (Gaba, 2004; Jefferies, 2007). As discussed in the background chapter (page 17) the debrief phase allows for immediate feedback and personal reflection on the experience. The opportunity to then develop critical thinking and clinical judgement can occur. In this review almost all of the studies reviewed had a debriefing stage, with the exception of Carrico et al., (2007). The effectiveness of debriefing and its role in simulation learning was not evaluated by any of the studies. However the anecdotal comments from the simulation participants valued the debriefing and reflection phase as an opportunity to identify areas to improve upon (Leflore & Anderson, 2009; van Schaik et al., 2011).

A learning concept utilised by educators to encourage personal reflection and alterations in behaviour was observational learning. Bandura (1989) suggests observational learning can be a powerful learning tool, particularly for those less familiar with the experience. Examples of observational learning included allowing groups to view their own performance through recording (Elfrink et al., 2009; Kaddoura, 2010; Leflore & Anderson, 2009; Messmer, 2008; Morris et al., 2007) and observation of other groups participating in simulation (Mould et al., 2011). The experience of the participants ranged from the audiovisual recording being a positive debriefing experience with participants gaining insight into their individual performance and highlighting areas of improvement (Kaddoura, 2010; Leflore & Anderson, 2009). In contrast to this, others found the recording of the session a distraction from the main focus of the session and a cause of significant anxiety (Elfrink et al., 2009). This negative response to recording in this study could have been related to the
low levels of engagement in simulation learning by students in the initial stages of the programme. The authors felt that introducing group planning prior to commencing the simulation scenario assisted with student engagement, and they observed in subsequent groups that recording of the simulation sessions were acceptable for students (Elfrink et al., 2009). This highlights the need to ensure students are feeling comfortable with the debriefing techniques utilised by educators.

4.4.4 Role modelling

Another technique utilising observational learning was the use of simulation to role model expected performance (Leflore & Anderson, 2008; Nunnink et al., 2009). Both of these studies allowed participants to observe clinical experts performing an emergency procedure. The effect of this intervention was assessed in both cases and found to have no statistical difference between their comparisons.

The study by Leflore and Anderson (2008) compared a self-directed learning package to expert role modelling and used simulated scenarios to assess participant performance. Both the participant groups in these studies were experienced critical care practitioners (Leflore & Anderson, 2008; Nunnink’s et al., 2009). The studies revealed that role modelling was an effective tool for teaching but lacked statistically significant results when compared to other methods. This result may differ for less experienced nurses as the benefit of observational learning is thought to be greater for those who are less familiar with the experience (Bandura, 1989).
4.4.5 Repetition

The issue of knowledge or confidence decaying over time is not one that the research in this review has identified as a key concept. However, the opportunity to repeat situations and scenarios contributes to mastery and improved self-efficacy (Bandura, 1989; Ericsson, 2004). There is evidence that team cohesion improves with teams continuing to work together through scenarios (Messmer, 2011). However, there is little evidence that knowledge or skill development is improved with neither subsequent attempts nor what the timeframe should be between opportunities to practice. One study surveyed confidence levels of participants after one year but it was not statistically significant as there was a much lower response rate (Kane et al., 2011). Van Schaik et al. (2011) notes that less than half of the nurses surveyed had attended a life threatening emergency and that some experienced nurses of three to five years duration, had never attended one either, strengthening the argument that simulation training is required. The question is raised, however, regarding what is the acceptable timeframe between experiences (either real or simulated) to preserve knowledge and confidence.

4.4.6 Limitations to successful simulation training.

While simulation learning has been positively endorsed by the studies in this review there has been emergence of some negative aspects. These are issues of anxiety (Elfrink et al., 2009), cost (Baid, 2011; Gant, 2007; Nunnink et al., 2009; Roche, 2010; van Schaik et al., 2011) and a lack of humanism (Day, 2007; Gant, 2007). Anxiety, as discussed earlier, can perhaps be alleviated by simulation training. Yet the opposite can be true too in that simulation can cause anxiety (Elfrink et al., 2009). It is unclear from this review whether
anxiety is an issue preventing simulation being a positive learning adjunct for experienced nurses.

While none of the review studies published costs, some made comments regarding the expenses both in time and equipment (Baid, 2011; Nunnink et al., 2009). It is also noted that additional finance is required for simulation facilitators to be trained and ensure they are familiar with the equipment and simulation learning process (Baid, 2011; Gant, 2007; Kane et al., 2011; Roche, 2010). The overall cost of high fidelity simulation learning could be prohibitive for some areas such as individual units and rural or small hospitals (Gant, 2007).

The time necessary to organise and facilitate a simulation scenario was described as lengthy (Baid, 2011; Nunnink et al., 2009). Nunnink et al. observed that the groups who went through the simulation scenario were small with only three to four staff every half hour. This compared to their usual training practice of classroom and video for 30 minutes and up to 25 members of staff. To undertake the session the manikin was physically altered in order to practice the psychomotor aspects of the scenario and programmed for physiological responses. The overall result of the interactive simulated learning intervention, however, was found to be no more effective than their traditional less expensive option (Nunnink et al., 2009). As mentioned earlier they noted that an added benefit was that the system and equipment testing also occurred as a result of the in situ simulation environment. If quality of patient care and improved safety were the goals then
ensuring a robust communication system and safe equipment usage would perhaps be improved with an in situ interactive simulation scenario.

In van Schaik et al.'s (2011) study, portable medium fidelity manikins and in situ mock code training were utilised to keep costs down. The medium fidelity manikins could simulate heart rhythms and could allow advanced airway management interventions and vascular access but lacked real time physiological responses. The resuscitation training occurred in various departments and wards allowing staff to utilise existing equipment and resources normally available to them in their natural clinical environment. As noted by Nunnink et al. (2009), the additional benefits of the in situ simulation environment allowed for testing of the emergency system, equipment testing and development of the 'first responder' team (van Schaik et al., 2011).

It is unclear from this review whether high fidelity training is really worth the costs involved. In a study by Buckley and Gordon (2011) high fidelity simulation learning of advanced life support skills, was noted to improve student nurses skills at recognising the deteriorating patient. It is thought that early detection and reporting of patient deterioration has favourable outcomes for the patient (Buckley & Gordon, 2011). Again there is no evidence in this review of the cost effectiveness of simulation learning directly. However, the benefits of improved patient safety through the testing of the clinical environment, is notable and surely worth the financial burden.
Another issue that concerned academics is the ability of students to develop relationships with expert mentors or patients and essential communication skills when involved in simulation learning which is accused of lacking humanism by some (Day, 2007; Gant, 2007). It was suggested that simulation learning removes the important aspect of context from the scenario and outcomes become predictable. This creates an unrealistic situation for students as they plan care and make decisions in simulation without being able to access support and guidance from experienced nurses who would normally be available in the real environment. Simulation learning it was proposed also lacks the opportunity for students to learn to care and be concerned for their patients and family members (Day, 2007). The unpredictable nature of the real clinical context also allows the teacher/mentor and student to solve problems together and the student to learn from this process (Day, 2007). Other studies have observed that students do find it difficult to see a manikin as a real person (Pike & O'Donnell, 2010) and simulation of the non-technical aspects of nursing care such as communication is a challenge for educators as discussed in detail in the background chapter (page 23). However students also felt being able to practice difficult conversations within a simulated scenario utilising role play was of benefit in order to feel more confident when in the clinical situation (Pye et al., 2010).

Gant (2007) and Day’s (2007) concerns do stand to remind educators that a balance of simulation to real clinical learning is required. Educators are also reminded of their role in ensuring that learning in simulation situations has the opportunity to be applied to the clinical context and that variation in the clinical situation is given meaning for the student. Benners (2004) work on skill acquisition in nursing suggests that learning requires the application of knowledge to experience. Simulated learning experiences can contribute to
this process as with guidance the students assess, plan and deliver care to a simulated patient however it still remains the role of the educator to assist new nurses to apply new knowledge to the real clinical context.

4.5 Quality and study limitations.

All the studies in this integrative review recommended simulation learning as a tool in critical care nursing education and demonstrated that simulation learning was useful to develop participant confidence, knowledge retention and critical thinking. The studies focused on a descriptive analysis of the participants’ response to simulation learning rather than eliciting the specific effectiveness of the intervention with comparisons to other modalities and situations.

Randomised controlled trials (RCTs) and meta-analysis of RCTs are considered to be strong evidence when assessing effectiveness of an intervention. However, out of the fifteen studies only two were controlled trials (Carrico et al., 2007; Nunnink et al., 2009), unfortunately both were lacking in rigor in terms of methods such as the sample, (22 nurses and 40 nurses and nine doctors respectively) and the process used to assess effectiveness (Nunnink et al., 2009). The two controlled trials (Carrico et al., 2007; Nunnick et al., 2009) had very different aims and methodologies (as detailed on pages 39 and 40), and therefore were unsuitable to undertake a meta-analysis. This makes it difficult to know with confidence that simulation learning is better than other teaching modalities such as real clinical experience.
Kaddoura’s (2010) qualitative study had only positive comments from the students regarding their simulation experience. The author did not disclose details of the questions used in the interviews to collect the data. It is unclear how the author in this study adjusted for bias as there is no mention of co-researchers or the relationship of the researcher to the students. Disclosure of the authors potential bias and how this was addressed would have made this qualitative work more robust and allow for greater confidence in the study results.

The lack of scientific rigor in the simulation learning research is a finding consistent with other systematic reviews of simulation learning in nursing education (Cant & Cooper, 2010; Lapkin et al., 2010) and suggests that more robust, multicentre research needs to occur.

The second research question looked to capture the experiences of educators and students utilising simulation learning. Unfortunately there was little data capturing experiences that elicited a broad range of perspectives from differing ages, genders and levels of experience. The responses from critical care nurses in this review were largely positive and suggest a bias that fails to represent all simulation learning participants’ perspectives.

4.6 Summary of findings

The studies in this review had undergraduate nurses, post registration nurses and interdisciplinary critical care teams. They focused on developing confidence, competence
Simulation learning was thought to be helpful in improving patient safety with responses to life threatening events, emergency system testing and the development of cohesive teams. Control of the clinical scenario allowed improvements in training standards, and student personal development. Furthermore, participants felt that simulation learning helped their anxiety and confidence associated with emergency situations and prepared them for critical care nursing.

The more negative aspects of simulation learning include the cost of high fidelity simulation suites and it appears from this review that the realism of the simulated scenario has little impact on the degree of learning raising the question of whether simulation suites are really necessary. Another issue that emerged included simulation learning provoking anxiety as participants felt embarrassed or under scrutiny. Experts warn that simulation learning should not replace clinical experience where valuable insights are gained from expert nurse mentors and when patient to nurse relationships are fostered.
Chapter 5 Implications for future research and practice

The review study has highlighted the need for more robust research studies from both paradigms, namely quantitative and qualitative. It appears that simulation learning is not easy to research or gain an understanding of the impact of simulation on participant learning. While this review indicates that simulation learning is seen as positive from the participant's perspective, there are questions still left unanswered. For example how well an individual's confidence and skill, acquired from a simulated scenario, transfer into the real environment? A study design that surveys simulation participants' months to years after simulation training could provide insights into how often such training should be repeated to ensure the maintenance of skills and knowledge? This type of research could also help to understand the degree to which knowledge or confidence might reduce over time.

Furthermore, research comparing the learning needs of inexperienced versus experienced nurses would also be useful to ensure simulation learning has value for all levels of nursing competence. Knowing what the best technique for teaching a particular learning need is would be very useful for educators. For example an undergraduate may need to communicate with patients in a more empathetic manner, role plays could assist with this but perhaps this skill is best acquired in the clinical environment. Likewise, a unit may have acquired a new dialysis machine, which an experienced nurse will be able to apply to the clinical context after gaining familiarity with the equipments physical layout. Yet, in
contrast, an inexperienced nurse may also need to actually understand the patient interaction with the equipment and the psychosocial issues that are associated with it.

It is also notable that the simulation participant surveys did not uncover many negative responses to simulation learning. It would be surprising if all participants were totally at ease with role playing and acting out scenarios. The experience of this author is that some nurses have felt exposed and under too much scrutiny, particularly experienced nurses in simulated training, who were observed to become very anxious during a simulation exercises or tended to avoid such sessions. In order for simulation learning to be useful the confounding issues would need to be understood by educators. Again study designs aiming to uncover these issues would provide valuable insights.

*Personal reflection*

The author of this work initially aimed to gain a greater understanding of the simulation learning process in order to better utilise this modality to support the clinical learning of critical care nurses. Through following the integrative review process this dissertation provided an overview of the theoretical foundations of simulation learning within the critical care environment and suggested gaps in knowledge that could lead to further research. Unfortunately a change of country and work position did not allow the author to apply this learning to the education environment. However in the new role of a student, the author had the opportunity to reflect on how simulation learning may have supported the learning offered through classroom teaching. The author observed that the opportunity to gain practical experience in a timely manner following the theoretical content was very
challenging due to the infrequency of the situation and the availability of mentors to support the experience. The other issue was variability in the skill of the educator or mentor to support new experiences for students in a manner that allowed for feelings of confidence and empowerment to make clinical decisions. This highlighted the common concerns concluded in this dissertation that simulation learning principles along with educators skilled in providing support could have better supported student learning and growth.

There was a scarcity of data around critical care nurse educator experiences and attitudes to simulation learning and issues of student engagement. In particular the author would have liked to explore the issue of student engagement in simulation learning namely the influences of age, gender and previous experience. The author, however, must acknowledge the limitations of this dissertation in terms of the initial research questions and the confines of time. Yet, this opportunity, however limited, has set a platform for further investigation.
Chapter 6 Conclusion

Simulation learning is more than simply the replication of an experience but a teaching technique designed around the principles of experiential learning (Gaba, 2004). The experiential learning framework conceptualised by Kolb (D. M. Smith & Kolb, 1986) is a cycle of active experience, reflection on experience to understand emotions and feelings, application of abstract ideas and theories to practice and planning for new experience. Skill acquisition and expert practice is thought to result from multiple experiences combined also with the personal desire to improve (Benner, 2004). The reflective process can occur during simulated experiences with guidance from facilitators and afterwards during debriefing (Rudolph et al., 2006). This allows for the participant to apply theory to practice which then develops critical thinking (Lapkin et al., 2010).

For critical care nurses simulation learning can assist with skill attainment, both technical and non-technical within a safe environment away from the acute care arena. The simulation participant can assess, plan and deliver care to a simulated critical patient under the non-judgemental oversight of a skilled educator. The leading advantage of simulation experiences is its flexibility to be stopped, restarted, repeated and allows for prolonged discussion, all of which are not appropriate or possible in the real clinical setting. Educators can manipulate the simulated environment and experiences to meet the learning or competency assessment needs of the participants.
Simulation learning has been utilised in other high risk environments such as the aviation industry to develop competent individuals and more importantly competent teams. Modern healthcare organisations have a responsibility to provide safe and quality care to the public. Good team collaboration and cohesion is considered vital to creating safe healthcare practices (Gaba et al., 2001; Institute of Medicine, 2000). Simulation learning principles can allow multidisciplinary teams to work together outside of the high risk clinical area to develop collaboration and communication (Gaba et al., 2001; Messmer, 2008).

In exploring effectiveness and participant experiences of the simulation learning interventions, an examination of article quality was first considered. Further analysis included an examination of the expected outcomes of simulation learning from the perspective of each study and the results grouped into themes for discussion and critique. The findings chapter presented these themes within predefined themes of effectiveness and experience of simulation learning.

This integrative review demonstrated that simulation learning within the critical care environment had been initiated for several reasons. To improve patient safety and quality care by allowing for team development, competency assessment and experience of rare life threatening events. Improvements in training standards with simulation include timely reinforcement of theoretical foundations to clinical practice, and development of critical thinking. Development of the student was also a concern with simulation interventions
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aiming to improve confidence, and alleviate anxiety. The self-assessment of performance was relied upon by researchers to assess simulation intervention outcomes.

Further clarity into how well simulation learning transfers into the clinical context would be useful with longitudinal multicentre controlled research designs. In addition research that elicited the attitudes and perceptions of nurses that represented the diversity of gender, age and experience would assist nurse educators to better understand the influences to student engagement with the simulation learning technique. This would enable educators to anticipate any variability in personal approach to simulation experiences and ensures targeted learning.
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Appendix A

Quality Assessment Tools from Joanna Briggs Institute (2008).^1

## Qualitative Assessment Form

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Yes</th>
<th>No</th>
<th>Unclear</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) There is congruity between the stated philosophical perspective and the research methodology.</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>2) There is congruity between the research methodology and the research question or objectives.</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>3) There is congruity between the research methodology and the methods used to collect data.</td>
<td>c</td>
<td>c</td>
<td>c</td>
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<tr>
<td>4) There is congruity between the research methodology and the representation and analysis of data.</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>5) There is congruity between the research methodology and the interpretation of results.</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>6) There is a statement locating the researcher culturally or theoretically.</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>7) The influence of the researcher on the research, and vice-versa, is addressed.</td>
<td>c</td>
<td>c</td>
<td>c</td>
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<tr>
<td>8) Participants, and their voices, are adequately represented.</td>
<td>c</td>
<td>c</td>
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</tr>
<tr>
<td>9) The research is ethical according to current criteria or, for recent studies, there is evidence of ethical approval by an appropriate body.</td>
<td>c</td>
<td>c</td>
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</tr>
<tr>
<td>10) Conclusions drawn in the research report do appear to flow from the analysis, or interpretation, of the data.</td>
<td>c</td>
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</table>

Include

Reason

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### Quantitative Assessment Form: Descriptive/Case Series Studies

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<tr>
<th>Criteria</th>
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</thead>
<tbody>
<tr>
<td>1) Was study based on a random or pseudo-random sample?</td>
<td>c</td>
<td>c</td>
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</tr>
<tr>
<td>2) Were the criteria for inclusion in the sample clearly defined?</td>
<td>c</td>
<td>c</td>
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</tr>
<tr>
<td>3) Were confounding factors identified and strategies to deal with them stated?</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>4) Were outcomes assessed using objective criteria?</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>5) If comparisons are being made, was there sufficient descriptions of the groups?</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>6) Was follow up carried out over a sufficient time period?</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>7) Were the outcomes of people who withdrew described and included in the analysis?</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>8) Were outcomes measured in a reliable way?</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>9) Was appropriate statistical analysis used?</td>
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### Quantitative Assessment Form: Randomised Controlled Trial/Pseudo-randomised Controlled Trial

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<tr>
<td>1) Was the assignment to treatment groups truly random?</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>2) Were participants blinded to treatment allocation?</td>
<td>c</td>
<td>c</td>
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<tr>
<td>3) Was allocation to treatment groups concealed from the allocator?</td>
<td>c</td>
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<tr>
<td>4) Were the outcomes of people who withdrew described and included in the analysis?</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>5) Were those assessing outcomes blind to the treatment allocation?</td>
<td>c</td>
<td>c</td>
<td>c</td>
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<tr>
<td>6) Were the control and treatment groups comparable at entry?</td>
<td>c</td>
<td>c</td>
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</tr>
<tr>
<td>7) Were groups treated identically other than for the named interventions?</td>
<td>c</td>
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</tr>
<tr>
<td>8) Were outcomes measured in the same way for all groups?</td>
<td>c</td>
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<tr>
<td>9) Were outcomes measured in a reliable way?</td>
<td>c</td>
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<tr>
<td>10) Was appropriate statistical analysis used?</td>
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Narrative opinion and text assessment and review

Criteria

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</table>

1) Is the source of the opinion clearly identified?
2) Does the source of the opinion have standing in the field of expertise?
3) Are the interests of patients/clients the central focus of the opinion?
4) Is the opinion's basis in logic/experience clearly argued?
5) Is the argument developed analytically?
6) Is there reference to the extant literature?
7) Is the opinion supported by peers?

Comments: Include?
Appendix B.


Qualitative assessment table.

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<td>1. Is there congruity between the stated philosophical perspective and the research methodology?</td>
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<td>2. Is there congruity between the research methodology and the research question or objectives?</td>
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<tr>
<td>3. Is there congruity between the research methodology and the methods used to collect data?</td>
<td>Y</td>
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<tr>
<td>4. Is there congruity between the research methodology and the representation and analysis of data?</td>
<td>Y</td>
<td>Y</td>
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<tr>
<td>5. Is there congruity between the research methodology and the interpretation of results?</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>6. Is there a statement locating the researcher culturally or theoretically?</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>7. Is the influence of the researcher on the research, and viceversa, addressed?</td>
<td>N</td>
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</tr>
<tr>
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<td>Y</td>
<td>Y</td>
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<tr>
<td>9. Is the research ethical according to current criteria or, for recent studies, and is there evidence of ethical approval by an appropriate body?</td>
<td>Y</td>
<td>Y</td>
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<tr>
<td>10. Do the conclusions drawn in the research report flow from the analysis, or interpretation, of the data?</td>
<td>Y</td>
<td>Y</td>
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<tr>
<td>Comments. Include?</td>
<td>Y 8/10</td>
<td>Y 8/10</td>
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Narrative opinion and text assessment and review quality assessment table (JBI, 2008).

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<tr>
<td>Does the source of the opinion have standing in the field of expertise?</td>
<td>? CNE, member of ENA</td>
<td>?</td>
<td>Y Assoc prof of learning</td>
<td>Y Assoc prof and CNS</td>
<td>Y Assoc Prof</td>
<td>Y Srn lecturer, ICU pathway leader</td>
<td>Y Assitant prof and CNS</td>
</tr>
<tr>
<td>Are the interests of patients/clients the central focus of the opinion?</td>
<td>Y</td>
<td>N educator assessment of new Emergency nurses</td>
<td>N</td>
<td>Y sim avoids pt safety issues</td>
<td>Y patient/client nurse relationship</td>
<td>N a reflective analysis of educator experience</td>
<td>N</td>
</tr>
<tr>
<td>Is the opinion’s basis in logic/experience clearly argued?</td>
<td>Y</td>
<td>Y Opinion based on experience</td>
<td>Y</td>
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<td>Y</td>
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<tr>
<td>Is the argument developed analytically?</td>
<td>Yes predominately experience based. Some literature.</td>
<td>Not really, discussion of scenario outcome.</td>
<td>Y</td>
<td>Y experience and literature</td>
<td>Y experientially</td>
<td>Y</td>
<td>Y experience</td>
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<tr>
<td>Is there reference to the extant literature?</td>
<td>Minimal use of literature.</td>
<td>No</td>
<td>Y</td>
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<tr>
<td>Is the opinion supported by peers?</td>
<td>Y</td>
<td>N</td>
<td>Y Simulation lacks ‘humanist’ learning.</td>
<td>Y</td>
<td>Y</td>
<td>Authors personal experience</td>
<td>Y</td>
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<tr>
<td>Comments: Include?</td>
<td>Yes 6/7 Use of simulation to assess competency.</td>
<td>No 2/7 Superficial report on a sim scenario.</td>
<td>Yes 6/7</td>
<td>Yes 7/7 Overview of the benefits of sim</td>
<td>Yes 7/7 Simulation limitations.</td>
<td>Yes 6/7 Educator experience of simulation</td>
<td>Yes 6/7</td>
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</tbody>
</table>

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<td>Y</td>
<td>Y</td>
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<td>Include?</td>
<td>Yes 7/10</td>
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<td>Comments.</td>
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</table>
## Appendix C

**Data extraction table showing**: Sample/location, Methods, Intervention, Authors conclusions, Reviewer comments (JBI, 2008).

<table>
<thead>
<tr>
<th>Author, Sample/Location</th>
<th>Sample/Location</th>
<th>Methods</th>
<th>Intervention</th>
<th>Authors conclusions</th>
<th>Reviewer comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kane, Pye &amp; Jones, 2011. Effectiveness of a simulation based educational programme in a pediatric cardiac intensive care unit.</td>
<td>65 cardiac ICU nurses Volunteers Simulation suite USA</td>
<td>Mixed methods, three surveys pre/post test +1 yr, self reported confidence and competence scale + responses and comments by nurses, retention of knowledge.</td>
<td>Structured Simulation programme</td>
<td>Sim effective, multi disciplinary scenarios thought to improve realism, unknown whether frequency of sim training needs to be addressed i.e. more often. Poor response to 1 year follow up</td>
<td>Reasons for introducing simulation training Infrequency of training, inconsistency in training requirements, time constraints on nursing staff. Global concerns regarding quality and safety of patient care, increased patient acuity, less experienced nurses in the workforce.</td>
</tr>
<tr>
<td>Leflore &amp; Anderson 2008. Effectiveness of 2 methods to teach and evaluate new content to neonatal transport personnel using high-fidelity simulation.</td>
<td>24 RNs, 24 RTs, 24 EMTs (24 NICU transport teams). One hospital transport service. Simulation suite USA</td>
<td>Mixed methods, pre/post test surveys, observation tool, videotaped.</td>
<td>Self learning versus expert role modelling Simulation used to assess participant competence</td>
<td>Role modelling an effective form of learning. Simulation an effective form of learning and evaluation as evidenced by positive crew responses and observational study.</td>
<td>Scope of paediatric transport team broadened to include neonates, acuity of neonates demanded an enhanced learning and evaluation process that improved patient outcome, had access to a simulation suite.</td>
</tr>
<tr>
<td>Messmer, 2008. Enhancing nurse-physician collaboration using pediatric simulation.</td>
<td>105 participants One childrens hospital, 50 volunteer nurses and 55 pediatric residents, comprising 18 teams. range of nurses from CICU, PICU, NICU, ED, med-surg, ambulatory. USA</td>
<td>Descriptive study, 3 mock codes videotaped and tapes reviewed independently by 3 observers according to the Kramer and Schmalenberg Nurse Physician Scale. Participants completed demographic surveys and Collaboration &amp; Satisfaction with Patient Care Decisions and Clinical Group Cohesion.</td>
<td>Each team attended 3 mock codes using human patient simulator</td>
<td>The three mock codes demonstrated improved nurse physician communication over the 3 code scenarios in teams who did not know each other prior. Improved communication can lead to improved patient outcomes.</td>
<td>Patient safety, advancing technology allowing hifidelity experiences, &quot;allows for rare or emergent conditions&quot; to be practiced, allows for multidisciplinary teams to get to know each other thus enhancing management of crisis situations.</td>
</tr>
<tr>
<td>Author, Sample/Location</td>
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<tr>
<td>Mould, White &amp; Gallagher, 2011. Evaluation of a critical care simulation series for undergraduate nursing students.</td>
<td>219 Undergraduate nurses out of 252. One centre, volunteers Australia</td>
<td>Mixed methods, pretest post test design, self reported</td>
<td>High fidelity simulation scenarios based on emergency critical care situations, 4 teams each week rotated to observer group each week.</td>
<td>Students express anxiety associated with critical practicums. Limited exposure to clinical experiences particularly emergencies, demand for good supervisors important in critical care areas. Ethical and safety issues around students involved in the seriously ill patient care. The simulation scenarios were time consuming from a facilitator point of view but felt that simulation developed confidence and competence for students.</td>
<td></td>
</tr>
<tr>
<td>van Schaik et al., 2011. Interprofessional team training in pediatric resuscitation: A low cost, in-situ simulation program that enhances self-efficacy among participants</td>
<td>Drs and nurses from acute care and ICU 101 nurses responded out of 319 surveyed One centre USA</td>
<td>Mixed methods, cross sectional observational study. Post programme survey of self efficacy rating scale, performance and confidence. Open question asking for comments.</td>
<td>Mock code training in clinical environment using principles of effective SL design. Interprofessional team training serves patient safety and training requirements.</td>
<td>Medium fidelity initiated due to high cost of a simulation suite. In situ training allows for system, procedure and protocol testing and alerts latent environmental threats to safety</td>
<td></td>
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<tr>
<td>Nunnink, Welsh, Abbey &amp; Buschsel, 2009. In situ simulation-based team training for post-cardiac surgical emergency chest reopen in the ICU</td>
<td>Convenience sample 40 nurses 9 drs Australia</td>
<td>Controlled trial. Control group using usual training practice (video + lecture). Pre test post questionnaire regarding confidence and competence.</td>
<td>In situ simulation based training using a modified manikin.</td>
<td>Simulation improved confidence but not more so than video training. The added advantage with sim was system testing. Sim testing considerably more expensive due to staff time. Emergency chest reopening procedure an infrequent, complex and time sensitive process requiring practice and skill. 'pause and discuss' during scenario no formal debrief.</td>
<td></td>
</tr>
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<tr>
<td>Carrico et al., 2007. Changing health care worker behaviour in relation to respiratory disease transmission with a novel approach that uses biosimulation.</td>
<td>Controlled trial, Random selection into intervention or control group.</td>
<td>Classroom teaching plus Patient biosimulator</td>
<td>Improved use of PPE observed in intervention group. Both groups had improved post test scores indicating didactic teaching effective in knowledge but not necessarily in behaviour.</td>
<td>Small sample size, unknown long term benefits of intervention.</td>
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</tr>
<tr>
<td>Elfrink, Nininger, Rohig and Lee, 2009. The case for group planning in human patient simulation.</td>
<td>Programme evaluation - qualitative using focus groups and open questions and quantitative questions on a scale 0 to 2.</td>
<td>Formative assessment after first round of simulation.</td>
<td>Formative assessment can assist to target simulation learning and ensure a collaborative learning process. Findings suggest simulation learning is grounded in social practice not fidelity of the clinical encounter. Group planning was thought to be the catalyst for student learning - not currently supported in the literature as an essential element of simulation.</td>
<td>A formative evaluation can be used to guide simulation and capture the students emotional and self awareness issues thus improving the student/teacher interaction as further simulation learning can be changed. When group planning was added to the simulation experience the students reported greater ownership and less anxiety.</td>
<td></td>
</tr>
<tr>
<td>Kaddoura, 2010. New graduate nurses perceptions of the effects of clinical simulation on their critical thinking, learning and confidence.</td>
<td>Qualitative descriptive design, semi structured interviews to explore student perceptions and experiences of sim during critical care training.</td>
<td>Taught using aim for one 8hr day every 3 weeks total of 8 simulation days in the course.</td>
<td>Sim is effective for nurses to gain confidence in their critical thinking skills, teamwork and leadership.</td>
<td>Only positive responses from students. Researcher bias not clear. Can new nurses effectively self evaluate their skills at critical thinking/clinical judgement?</td>
<td></td>
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<tr>
<td>Author, Location</td>
<td>Methods</td>
<td>Authors conclusions</td>
<td>Reviewer comments</td>
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<tr>
<td>Baid, 2011. The OSCE within intensive care nursing education. UK</td>
<td>Reflective analysis of authors experience as a teacher introducing OSCE to ICU programme</td>
<td>OSCE provides a standardised approach to assessing clinical skills for the university teacher. There is a need for research into this field of using simulation to assess clinical skills in ICU nursing.</td>
<td>Useful insights into one educator's experience of using simulation to assess ICU student competency. Issues raised included potential examiner bias, examiner training/preparation, time and resources needed for OSCE day, student preparation, improved collaboration with ICU and tertiary institution, improved standardisation of clinical assessment, recommendation that more research required for simulation as an assessment tool in ICU.</td>
<td></td>
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<tr>
<td>Morris et al. 2007. Designing a comprehensive model for critical care orientation. USA</td>
<td>Critical care orientation programme review.</td>
<td>Success of the critical care orientation programme has meant greater uptake in the rest of the hospital and support from managers. It allows orientation of nurses with a variety of experience levels and improved preceptor ability to implement the programme and understand their role.</td>
<td>Simulation initiated in order to correlate theoretical learning and practical experience, and to develop critical thinking.</td>
<td></td>
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</tr>
<tr>
<td>Gant, 2007. Human simulation in Emergency Nursing education: current status USA</td>
<td>Review and opinion</td>
<td>Simulation useful to prevent adverse outcomes and improve patient safety however has poor research support and costly in time, money.</td>
<td>Raises some useful points regarding ensuring humanist learning is not missed by simulation learning.</td>
<td></td>
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<tr>
<td>Day, 2007. Simulation and the teaching and learning of practice in critical care units USA</td>
<td>Opinion article regarding ethical issues of simulation learning.</td>
<td>USA nursing shortage has meant new relatively inexperienced critical care nurses have the responsibility of teaching new graduate nurses. New graduate nurses are expected to learn critical care alongside basic nursing care. Simulation has been introduced to allow teaching within low risk safe environment of simulation. However it should not replace real clinical experience.</td>
<td>Time spent on simulation instead of clinical practice could slow down the process of new nurses learning. Effort to teach nurses to teach and better guidance for new nurses to deal with the complexities of the patient/family relationship. The learning loses its context within simulation and learning becomes predictable and replicable. &quot;...teaching and nursing are relational practices in which meaning is created in the interactions that take place between and among participants&quot; Day 2007, p505.</td>
<td></td>
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</tr>
<tr>
<td>Author, Location</td>
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<tr>
<td>Gomez, 2009. Assessing competency with the use of human patient simulation in the emergency department. USA</td>
<td>Opinion review</td>
<td>Simulation ideal for assessing competency in the ED.</td>
<td>Competency assessment defined by author as the ability to assess someone across all skill domains – knowledge, psychomotor, communication. Simulation ideal as removed from clinical distractions.</td>
<td></td>
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<tr>
<td>Roche, 2010. Human patient simulation in critical care. USA</td>
<td>Review article.</td>
<td>Supportive of simulation training. The need for stronger research, replicating existing studies.</td>
<td>Simulation useful in 4 contexts, &quot;...crisis management...high risk low volume conditions...Error management...communication...&quot; Roche 2010, p18 &quot;ineffective communication is the most frequently cited category of causes of sentinel events&quot; Roche, 2010, p19. Role play may be helpful and familiarity with drug dosages and calculations, to develop safety habits.</td>
<td></td>
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</tbody>
</table>