Virtual patients, non-technical skills and undergraduate health professionals

Monica Peddle

Grad Dip Nurse Education, MEd.

A thesis submitted for the degree of Doctor of Philosophy

Faculty of Medicine, Nursing and Health Sciences

Monash University

March 2019
Copyright notice

© Monica Peddle 2019
Abstract

‘Non-technical skills’ are essential requirements for health professional graduates for safe and competent practice. Technology-enhanced simulation, including virtual patients, offer flexible, reproducible, and accessible learning experiences for students to develop non-technical skills. The Virtual Simulated Patient Resource (www.vspr.net.au) is a web-based resource that uses branching, narrative virtual patients to develop knowledge, attitudes and practice of all non-technical skills categories in undergraduate health professional students. However, little is known about what or how non-technical skill knowledge, skills and practice can be developed in undergraduate nursing students through interactions with virtual patients.

This study design adhered to the principles of case study methodology. Phase one of the case study used integrative review methods to synthesize empirical and theoretical literature to provide a comprehensive understanding of virtual patients in curricula relative to non-technical skills. Document analysis established the need for education related to non-technical skills in undergraduate health professional curriculum and provided critical information to develop the conceptual framework to guide the case study. In phase one twenty-eight articles were included in the integrative review with eleven health professional competency standards documents in the document analysis.

Phase two of the case study investigated integration of virtual patients to develop non-technical skills in undergraduate nursing education. A purposive convenience sample was used with qualitative data obtained via interview and focus groups. Units of analysis were individual first- and third-year nursing students and faculty involved in facilitating learning across two education facilities in Victoria leading to registration as Registered Nurses. In phase two 45 first-year and 31 third-year students consented to participate, with twelve individual interviews and one focus group conducted with faculty. Data analysis used framework analysis that was supported by the conceptual framework guiding the case study and accepted constructs in clinical practice.
Interactions with virtual patients across the curriculum may assist undergraduate nursing students and some faculty in developing knowledge, skill and practice of non-technical skill categories including communication, situation awareness, teamwork, leadership, decision-making skills and professional skills of duty, advocacy and empathy. Additionally, interactions with virtual patients influence learning knowledge, attitudes and practice of non-technical skills in undergraduate nursing students via authenticity in the virtual patient interaction, socialisation to the professional role, vicarious learning and learning by making mistakes. Potential limitations to learning from virtual patient interactions include fear, overconfidence, groupthink and confusion. To manage limitations to student learning non-technical skills through virtual patient interactions, facilitation approaches, opportunities for reflection, constructive feedback and debriefing may be key.

This study demonstrates making learning non-technical skills explicit via interactions with virtual patients can change the way students perceive practice, with learning transferable to the clinical setting to support safe and competent patient care. The educational design of the simulation experience, sequencing learning activities surrounding the virtual patient, and authenticity of the virtual patient interaction are identified as important factors for consideration. Moreover, faculty report observing learning transfer to different contexts of care, evidenced by student self-reported practice change following interactions with the virtual patient, supporting patient safety.
## Publications during enrolment

<table>
<thead>
<tr>
<th>Thesis chapter</th>
<th>Publication</th>
<th>Publication status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Five</td>
<td>Peddle, M., Bearman, M., McKenna, L., &amp; Nestel D. Getting it wrong to get it right: Faculty perspectives of learning non-technical skills through virtual patient interactions. <em>Nurse Education Today</em>. (Under review)</td>
<td>Under review</td>
</tr>
</tbody>
</table>
Thesis including published works declaration

I hereby declare that this thesis contains no material which has been accepted for the award of any other degree or diploma at any university or equivalent institution and that, to the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

This thesis includes four original papers published in peer reviewed journals and one submitted for publication. The core theme of the thesis is application of virtual patients to develop non-technical skills in undergraduate nursing students. The ideas, development and writing up of all papers in the thesis were my principal responsibility as the student, working within the Faculty of Medicine, Nursing and Health Sciences under the supervision of Professor Debra Nestel.

The inclusion of co-authors reflects the fact that the work came from active collaboration between researchers and acknowledges input into team-based research.

In the case of Chapters Two, Four and Five my contribution to the work involved the following:

<table>
<thead>
<tr>
<th>Thesis Chapter</th>
<th>Publication Title</th>
<th>Status (published, in press, accepted or returned for revision, submitted)</th>
<th>Nature and % of student contribution</th>
<th>Co-author name(s) Nature and % of Co-author’s contribution*</th>
<th>Co-author(s) Y/N*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two</td>
<td>Virtual patients and non-technical skills in undergraduate health professional education: An integrative review.</td>
<td>Published. <em>Clinical Simulation in Nursing</em>, 12(9), pp. 400-410.</td>
<td>70% - Concept development, key ideas, drafting, editing and submission</td>
<td>Bearman, M 15% - Concept development, key idea, drafting and editing. Nestel, D 15% - Concept development, key idea, drafting, editing</td>
<td>No</td>
</tr>
<tr>
<td>Four</td>
<td>What non-technical skills competencies are addressed by Australian standards documents for health professionals who work in secondary and tertiary clinical settings? A qualitative comparative analysis.</td>
<td>Published. <em>BMJ Open</em>, 8(8), e020799. doi: 10.1136/bmjopen-2017-020799</td>
<td>70% - Concept development, key ideas, drafting, editing and submission</td>
<td>Bearman, M - 10% - Concept development, key idea, drafting and editing. Radomski, N - 5% - Concept development, key idea and drafting. McKenna, L - 5% - Drafting and editing. Nestel D - 10% - Concept development, key idea, drafting and editing.</td>
<td>No</td>
</tr>
<tr>
<td>Thesis Chapter</td>
<td>Publication Title</td>
<td>Status (published, in press, accepted or returned for revision, submitted)</td>
<td>Nature and % of student contribution</td>
<td>Co-author name(s) Nature and % of Co-author’s contribution*</td>
<td>Co-author(s), Monash student Y/N*</td>
</tr>
<tr>
<td>---------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>-------------------------------------</td>
<td>-----------------------------------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>Five</td>
<td>Development of non-technical skills through virtual patients for undergraduate nursing students: An exploratory study.</td>
<td>Published. <em>Nurse Education Today</em> 73, 94-101. doi: <a href="https://doi.org/10.1016/j.nedt.2018.11.008">https://doi.org/10.1016/j.nedt.2018.11.008</a>.</td>
<td>80% - Concept development, key ideas, drafting, editing and submission</td>
<td>McKenna, L - 10% Concept development, key idea, drafting and editing. Bearman, M - 5% - Concept development, key idea, drafting and editing. Nestel D - 5% - Concept development, key idea, drafting and editing.</td>
<td>No</td>
</tr>
<tr>
<td>Five</td>
<td>Exploring undergraduate nursing student interactions with virtual patients to develop ‘non-technical skills’ through case study methodology.</td>
<td>Published <em>Advances in Simulation</em>, 4(1), 1. 2. doi: 10.1186/s41077-019-0088-7</td>
<td>80% - Concept development, key ideas, drafting, editing and submission</td>
<td>Bearman, M - 10% Concept development, key idea, drafting and editing. McKenna, L - 5% - Concept development, key idea, drafting and editing. Nestel D - 5% - Concept development, key idea, drafting and editing.</td>
<td>No</td>
</tr>
<tr>
<td>Five</td>
<td>Getting it wrong to get it right: Faculty perspectives of learning non-technical skills through virtual patient interactions.</td>
<td>Under review. <em>Nurse Education Today</em></td>
<td>80% - Concept development, key ideas, drafting, editing and submission</td>
<td>Nestel D - 10% Concept development, key idea, drafting and editing. McKenna, L - 5% - Concept development, key idea, drafting and editing. Bearman, M - 5% - Concept development, key idea, drafting and editing.</td>
<td></td>
</tr>
</tbody>
</table>
I have not renumbered sections of submitted or published papers in order to generate a consistent presentation within the thesis.
Acknowledgements

I am extremely grateful to my employer, La Trobe University, School of Nursing and Midwifery, for supporting my candidature and approving six months study leave to complete this study.

I thank the generosity, patience and inspiration of my supervisors, Professor Debra Nestel, Associate Professor Margaret Bearman, Professor Lisa McKenna and Dr Natalie Radomski. I appreciate their intellectual capacity, perseverance and guidance.

I recognise the valuable support of my work colleagues who covered and enabled my absences to focus on my thesis.

I acknowledge the participation of the undergraduate nursing students and educators in this study for their generosity and time.

I acknowledge the assistance of professional editor, Dr Diane Brown, who corrected grammar, syntax, punctuation, spelling and typos, identifying layout or formatting issues, and checking and line editing references for completeness and consistency of reference style in accordance with the Australian Standards for Editing Practice (2013).

I acknowledge my wonderful family for their tolerance, understanding and acceptance of my study pre-occupation.

Finally, I dedicate this thesis to my father, Lindsay and my late mother, Patricia. To the memory of a life well spent.
Contents

List of tables.................................................................................................................... xiii
List of images.................................................................................................................. xiii
List of figures................................................................................................................ xiii
Glossary and abbreviations ........................................................................................... xiv

Chapter 1 Introduction..................................................................................................... 1
  1.0 Introduction..................................................................................................... 1
  1.1 Statement of the research problem ................................................................. 2
  1.2 Virtual Simulated Patient Resource ................................................................. 3
     1.2.1 Theoretical modules................................................................................ 4
     1.2.2 Virtual patient simulations ................................................................. 7
  1.3 Aim of the research ....................................................................................... 15
  1.4 Research questions ...................................................................................... 15
  1.5 Significance of the research .......................................................................... 15
  1.6 Thesis outline ................................................................................................ 16
  1.7 Summary ...................................................................................................... 18

Chapter 2 Undergraduate Health Professionals, Non-technical Skills and
            Virtual Patients.................................................................................................... 19
  2.0 Introduction................................................................................................... 19
  2.0 Error and adverse events in healthcare ......................................................... 19
  2.1 Patient safety .............................................................................................. 20
  2.2 Human factors ............................................................................................. 21
  2.3 Evolution of non-technical skills taxonomy ................................................... 22
  2.4 Non-technical skills in healthcare ................................................................ 22
  2.5 Non-technical skills ....................................................................................... 25
  2.6 Health professional graduates .................................................................... 26
  2.7 Registration of practising health professionals in Australia ....................... 28
5.5 Faculty perspective of developing non-technical skills using virtual patients 134
5.5.1 Publication five ................................................................. 135
5.6 Synthesis of case study findings ............................................. 162
5.6.1 What students learnt – other professional skills .................. 163
5.6.2 How students learnt .......................................................... 164
5.7 Implications ............................................................................. 168
5.8 Summary .................................................................................. 168

Chapter 6 Discussion ..................................................................... 169
6.0 Introduction ................................................................................ 169
6.1 Summary of key findings ......................................................... 170
6.2 Competency standards and non-technical skills in Australian health professional practice ............................................. 171
6.3 Non-technical skills categories and elements .......................... 172
6.3.1 Communication ................................................................... 173
6.3.2 Situation awareness ............................................................ 174
6.3.3 Teamwork ............................................................................. 174
6.3.4 Decision-making ................................................................. 174
6.3.5 Leadership ............................................................................ 175
6.3.6 Managing stress and coping with fatigue ............................ 175
6.3.7 Professional traits ................................................................. 176
6.4 Implications for learning non-technical skills in undergraduate nursing education ......................................................... 176
6.5 Learning non-technical skills .................................................... 179
6.5.1 Learning through mistakes – Getting it wrong to get it right ...... 179
6.5.2 Groupthink .......................................................................... 182
6.5.3 Authenticity – imperfect reality ............................................ 183
6.5.4 Clinical practice ................................................................. 184
6.5.5 Faculty embodiment of non-technical skills in education .......... 185
6.6 Variation across units of analysis .............................................. 186
6.7 Reflexivity ................................................................................ 187
List of tables

Table 1.1. Outline of virtual patient scenarios in VSPR. .................................................... 8
Table 2.1: Categories and elements of non-technical skills ............................................... 23
Table 2.2: Integrative review update ................................................................................. 49
Table 2.3: Themes from integrative review update ............................................................ 60
Table 3.1: Paradigm for this thesis .................................................................................... 71
Table 3.2: Framework underpinning analysis. ................................................................. 82
Table 3.3: Methods in this thesis ..................................................................................... 88
Table 3.4: Ethical considerations ...................................................................................... 92
Table 5.1: What students learnt – specific non-technical skills ....................................... 162
Table 5.2: What students learnt – other professional skills .............................................. 163
Table 5.3: How the students learnt .................................................................................. 164

List of images

Image 1 VSPR welcome page ............................................................................................. 4
Image 2 Certificate of Achievement .................................................................................. 5
Image 3 VSPR Modules ..................................................................................................... 7
Image 4 VSPR Scenarios ................................................................................................ 10
Image 5 Pre-briefing information .................................................................................... 11
Image 6 Final screen in the virtual patient simulation following a poor patient outcome. 14

List of figures

Figure 1.1 Decision tree Blood Product scenario ............................................................ 12
Glossary and abbreviations

Glossary
Non-technical skills – the cognitive, social and interpersonal skills that complement technical skills for safe and competent patient care (Flin, O’Connor, & Crichton, 2013).

Virtual patients – an interactive computer simulation of real-life clinical scenarios for the purpose of healthcare and medical training, education or assessment (Ellaway, Candler, Greene, & Smothers, 2006)

Abbreviations
AHPRA – Australian Health Professional Registration Agency
ANMAC – Australian Nursing and Midwifery Accreditation Council
EN – Enrolled Nurse
RN – Registered Nurse
VSPR – Virtual Simulated Patient Resource
Chapter 1  Introduction

1.0  Introduction

"As many as 1 in 10 patients are harmed whilst receiving health care"


The World Healthcare Organisation (WHO) defines patient safety as “the absence of preventable harm to a patient during the process of health care and reduction of risk of unnecessary harm associated with health care to an acceptable minimum” (WHO., 2018). Patient safety is at the forefront and an internationally recognised tenet of healthcare (Mathews, Sutcliffe, Garrett, Pronovost, & Paine, 2018). It has become a priority for the delivery of healthcare, a significant research area and a recognised element of high reliable healthcare organisations (Mathews et al., 2018) and is an important principle in practice for health professionals, managers, organisations, patients and families.

Important components of patient safety are the cognitive, social and interpersonal skills that complement technical skills for safe and competent patient care, so called non-technical skills (Flin, O’Connor & Crichton, 2013). There is no argument over the type of cognitive, social and interpersonal skills that are required to support patient safety such as communication, teamwork, situations awareness, leadership, decision-making, coping with fatigue and managing stress (Nestel, Walker, Simon, Aggarwal, & Andreatta, 2011). Technical skills are often associated with “psychomotor, and dexterity skills associated with physical examinations, clinical procedures, surgery, specialized medical equipment, and medicines” (Nestel, Walker, Simon, Aggarwal, & Andreatta, 2011). However, debate has arisen over the term used to describe these skills. It has been suggested the term, “non-technical skills”, indicates these skills are of lesser value and undergraduate health professionals do not need training (Nestel et al., 2011). The term may inaccurately represent critical aspects of professional clinical practice (Nestel et al., 2011), as some of these skills, for example communication, can be considered highly technical (Glavin, 2011; Nestel et al., 2011). Additionally, the distinction between technical and non-technical skills across disciplines and contexts of care is not the same (Gaba, 2011; Reedy, Lavelle, Simpson, & Anderson, 2017). Moreover, referring to what they are not, may misrepresent the importance of these skills in
safe and competent care (Nestel et al., 2011). Conversely, other arguments identify that the
term “non-technical skills” is accepted in practice across many professional contexts and
entrenched in the literature (Gaba, 2011). It is claimed that healthcare practitioners have a
shared understanding that technical skills refer to psychomotor tasks (Gaba, 2011). All skills,
including psychomotor, cognitive, social and interpersonal, are important for safe and efficient
performance of a range of activities and tasks in high-risk industries. In this thesis, the term
“non-technical skills” is used whilst acknowledging its limitations.

There is a lack of information on the development of non-technical skills in undergraduate
health professionals (Nicolaides et al., 2018) as historically these skills were often left to be
developed through on-the-job learning in clinical placement. Moreover, research surrounding
the development of non-technical skills in undergraduate health professionals as a
competency standard requirement for registration, or the implementation of strategies aimed
at developing non-technical skills in undergraduate health professionals, is lacking
(Nicolaides et al., 2018). It is imperative that new health professional graduates are prepared
and equipped with these fundamental skills prior to entering clinical practice.

The purpose of this chapter is to orientate the reader to the context of the research and
provide a statement of the problem to be investigated. A detailed description of the Virtual
Simulated Patient Resource (VSPR) is provided. The aim of the research, the research
questions and the overall significance of the study are discussed. The chapter concludes with
an outline of the thesis.

1.1 Statement of the research problem

Adverse events in healthcare are identified as the third leading cause of death in developed
countries with significant patient morbidity, financial costs, distress and suffering arising from
medical errors (Makary & Daniel, 2016). A significant component of adverse events and
medical errors are non-technical skills (Flin et al., 2013). A proliferation of literature
investigates the importance of effective non-technical skills in preventing error (Bleetman,
Sanusi, Dale, & Brace, 2012; Catchpole, Mishra, Handa, & McCulloch, 2008; Flin & Maran,
2015; Flin et al., 2013; Uramatsu et al., 2017; White, Lowes, & Hormis, 2015), with many
published research papers describing and exploring the effect of various training
interventions in mitigating risk from poor non-technical skills (Bamford, Langdon, Rodd,
Eastaugh-Waring, & Coulston, 2018; Dedy, Bonrath, Ahmed, & Grantcharov, 2016; Gordon,
Darbyshire, & Baker, 2012; Yule et al., 2015). Additionally, there are a number of papers
reporting development of taxonomies and frameworks used to support practitioner
recognition and assessment of non-technical skills in practice including Anaesthetists’ Non-
technical Skills (ANTS) (Fletcher, McGeorge, Flin, Glavin, & Maran, 2002); Surgeons’ Non-
technical Skills (NOTSS) (Yule et al., 2008); Scrub Practitioner Non-Technical Skills
(SPLINTS) (Mitchell et al., 2013); and Anaesthetic Non-Technical Skills for Anaesthetic

However, much of the published literature related to developing health professional non-
technical skills, focuses on specialist groups or teams, addressing health professionals who
have graduated. There is limited exploration of the impact of virtual learning activities on
developing non-technical skills in undergraduate health professionals. Additionally, there is
minimal reporting of how these virtual may influence learning. Moreover, there is paucity of
evidence describing non-technical skills required for competent health professional practice
in Australia. Gaps thus exist in literature around the identification, exploration and description
of the development and practice of non-technical skills in undergraduate health professionals’.

This thesis will begin by focusing on undergraduate health professional students and
culminate in focusing on undergraduate nursing students. If the problems with patient safety
are to be addressed, the clinical practice competencies of newly graduating registered nurses
need to be optimised to ensure quality patient outcomes. The student researcher as a
Registered Nurse believes the investigation of the level of understanding and practice of non-
technical skills in the clinical setting by undergraduate nursing students, and identifying the
effective strategies that develop non-technical skills, will not only provide insights about
suitable teaching and learning approaches and inform curriculum development, but also
benefit the nursing profession by minimising deficits in practice supporting patient safety
moving forward (Murray, Sundin, & Cope, 2018). Nurses make up over 50% of the world’s
health workforce, therefore if undergraduate nursing students are educated regarding non-
technical skills there is the potential to make a significant contribution to patient safety and

1.2 Virtual Simulated Patient Resource

An innovative resource designed to develop non-technical skills in undergraduate health
professionals is the VSPR (www.vspr.net.au). The VSPR is a secure web-based resource
comprising nine theoretical interactive online learning modules and seven virtual patient
simulations (Image 1). The aim of the resource is to develop all categories of non-technical
skills in undergraduate health professionals. It was funded by Health Workforce Australia in
2013, with recurrent funding in 2015 and 2016. A steering committee, comprising simulation,
online learning and clinical experts, provided initial expert advice regarding resource
development. The student researcher led the design, development, authorship and implementation of the resource. The exploration of the influence of virtual patient simulations in VSPR on undergraduate nursing students non-technical skills is the focus of this thesis.

Constructivist learning theory and active online learning principles provided the foundation for the resource’s design. Learning was designed to be active and student-centred, aiming to engage the learner in the situation with opportunities for reflection. This approach supports an individual’s reconstruction of knowledge and meaning, developed through prior experiences, based on new learning experiences (Grapczynski, Schuurman, Booth, Bambini, & Beel-Bates, 2015). The resource was designed to address multiple professions’ perspectives and present a multidisciplinary approach to non-technical skills learning.

Image 1: VSPR welcome page

1.2.1 Theoretical modules

The theoretical modules within VSPR provide the theoretical and foundational knowledge, skills and attitudes regarding non-technical skills in healthcare. As the aim of the VSPR is to develop knowledge, skills, attitudes and practice of all non-technical skills categories and elements in undergraduate health professionals, the categories and elements of non-technical skills developed by Flin et al. (2013) provided a framework for the modules. The eight modules were designed using active online learning principles and they are presented in the learning management system, Moodle. Each module in the resource, except the
introductory module, commences with a pre-test and concludes with a post-test, which when submitted, generates a certificate of completion (Image 2).

![Image 2: Certificate of Achievement](image2.png)

Modules include:

1. **Introduction to non-technical skills**

   This module offers an introduction to non-technical skills for undergraduate students. The module defines and explores the history of non-technical skills. It enables students to explore the role of non-technical skills in healthcare and medical error and recognise different non-technical skills and their behavioural components.

2. **Teamwork**

   This module enables students to explore different teams in healthcare environments. Students identify factors that are a part of an effective team as well as the barriers to effective teamwork in the clinical setting. Students are introduced to strategies that will assist them to participate in and be a productive member of healthcare teams.

3. **Communication**

   This module enables students to appreciate the role of effective communication in healthcare and healthcare teams. It identifies the barriers and enablers to effective communication. A range of communication strategies to be used in the clinical setting is introduced.
4. Leadership

This module will explore leadership as a critical component of effective team performance, influencing team effectiveness by facilitating team action and making sure that teams have all the necessary resources and processes for optimal performance. The different types of leaders and the characteristics that make an effective leader and strategies that can be employed in the clinical setting to promote leadership and followership will also be examined.

5. Situation awareness

This module reviews the definition of situation awareness and examines its role in safe patient care. The elements of situation awareness and how that can be applied to situations in healthcare are reviewed along with opportunities to enhance situation awareness skills.

6. Decision-making

This module introduces the concept of making a decision as an individual and as part of team, and explores the factors that can influence decision-making. The module presents tools and strategies to enhance decision-making skills for novice health professionals.

7. Stress and fatigue

In this module, students explore different types of stress experienced by health professionals and various approaches to managing stress. Additionally, sources of fatigue are identified and the potential impact of fatigue on performance is investigated. Strategies to manage fatigue are introduced.

8. Task management

In this module, students explore the impact of prioritisation and planning, including correctly scheduling tasks and activities according to importance and being able to allocate attention accordingly. Students investigate the importance of supporting safety and quality standards by adhering to guidelines and protocols. Students also identify the essential staff needed and available requirements for completion of a task and how to use those resources to complete a task with minimum stress or workload.
The topics addressed in the virtual patient simulations in VSPR were informed by reported sentinel events in Victoria, Australia, common Medical Emergency Team scenarios from major metropolitan hospitals in Melbourne, Australia, and the lived experiences of the steering committee members as reported on the website (www.vspr.net.au). Rather than presenting emergency situations, the virtual patient simulations in VSPR present common patient care situations in acute and primary care contexts. Each virtual patient simulation contains varying levels of complexity to address the developing competence of the learners. As with the VSPR online learning modules, a certificate is available upon completion of the simulation.

The virtual patient scenarios address clinical concepts including:

1. Falls (Commencing year)
2. Administering blood products (Intermediary year)
3. Caring for an aggressive patient (Commencing or intermediary year)
4. Participating in an interprofessional ward round (Intermediary year)
5. Providing safe post-operative care (Final Year)
6. Caring for a woman in labour with an epidural (Intermediary year)
7. Monitoring warfarin therapy in the community (Intermediary or final year).

Table 1.1. Outline of virtual patient scenarios in VSPR.


<table>
<thead>
<tr>
<th>Virtual Patient title</th>
<th>Virtual patient topic</th>
<th>Positive patient outcomes</th>
<th>Negative patient outcomes</th>
<th>Target learner audience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Falls</td>
<td>Preventing patient falls in the clinical practice setting</td>
<td>Patient assisted to toilet. Patient discharged two days later.</td>
<td>Patient falls when toileting independently. Sustains laceration to forehead, fractured right neck of femur and head injury. Patient remained in hospital for several weeks for treatment and rehabilitation.</td>
<td>Novice learner</td>
</tr>
<tr>
<td>Ward round</td>
<td>Interprofessional teamwork including patient as a member of the team.</td>
<td>Correct diagnosis made and patient commenced on appropriate medication. Patient discharged three days later.</td>
<td>Incorrect diagnosis. Patient experiences Acute Pulmonary Oedema and requires emergency medical team intervention. Patient admitted to High Dependency Unit and follow up rehabilitation for several weeks.</td>
<td>Advanced beginner.</td>
</tr>
<tr>
<td>Aggressive patients</td>
<td>Recognising and responding to aggression</td>
<td>Patient frustration and agitation correctly identified and managed resulting in de-escalation of the situation.</td>
<td>Patient frustration and agitation is not recognised. Patient behaviour escalates into aggressive violent outburst. Security measures are required to manage patient situation.</td>
<td>Advanced beginner.</td>
</tr>
<tr>
<td>Community</td>
<td>Managing warfarin therapy in the community post coronary artery bypass grafts</td>
<td>Patient receiving warfarin therapy has high International Normalised Ratio</td>
<td>High International Normalised Ratio not identified. Patient sent home from clinic with no emergency treatment. Patient experiences large cerebral</td>
<td>Advanced beginner.</td>
</tr>
<tr>
<td>Virtual Patient title</td>
<td>Virtual patient topic</td>
<td>Positive patient outcomes</td>
<td>Negative patient outcomes.</td>
<td>Target learner audience</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-----------------------</td>
<td>---------------------------</td>
<td>-----------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>Post-operative</td>
<td>Recognising and responding to patient deterioration in the immediate post-operative period.</td>
<td>Patterns and trends are recognised early with appropriate treatment implemented. Normal fluid balance returned in post-operative phase.</td>
<td>Patterns and trends are not recognised and no treatment implemented. Patient experiences Acute Kidney Injury post-operatively.</td>
<td>Competent</td>
</tr>
<tr>
<td>Midwifery</td>
<td>Woman with epidural analgesia in labour experiences episode of low blood pressure</td>
<td>A pathological fetal heart rate pattern is detected following episode of hypotension. Fluid resuscitation is initiated and a change to maternal position. Normal vaginal birth.</td>
<td>There is a delay in recognising, reporting and responding to a pathological fetal heart rate pattern. Fetal compromise ensues resulting in emergency caesarean section and neonate resuscitation.</td>
<td>Competent</td>
</tr>
</tbody>
</table>
A ‘Choose Your Own Adventure’ game approach was used to develop the virtual patient simulations. A decision tree with branching algorithm and supporting scripts, was created to govern the progress and outcome of each simulation. Developed scenarios and algorithms were peer reviewed for clinical authenticity, and scripts were revised for continuity and language. Video vignettes were produced to depict realistic clinical situations in genuine clinical environments, such as an acute hospital ward, birth suite and primary healthcare clinic. To cater for a variable audience, a storytelling approach was used to produce the video vignettes (Saldes, 2005). A storytelling approach enables individuals to interpret the video from their own perspective (Saldes, 2005). Professional actors portray the health professionals and patients. The video vignettes contain limited technical or procedural skills, or clinical interventions. A virtual patient scenario can contain a minimum of 10, and up to a maximum of 19 vignettes in the simulation (Figure 1.1).

Accompanying each simulation are briefing documents that provide the evidence base relevant to the topic of the virtual patient and a written summary of the patient history and status (Image 5). The first video vignette provides an introduction and sets the scene for the clinical situation. Each vignette presents a series of non-technical skills cues and information
with escalation of the cues and information presented as the simulation progresses. As each video vignette concludes, two choices appear on the screen. To advance the simulation, participants select one of the two choices available. Each choice made by participants in the simulation impacts future options (Friedman, 1995). The branching algorithm governs the next video vignette displayed as part of the simulation. Each decision made culminates in either a positive (Image 6) or a negative patient outcome (Image 7).

Image 5: Pre-briefing information
Figure 1.1 Decision tree Blood Product scenario

1. Introduction.
   RMO orders blood. No time for administration noted on order.

2. RN reviews the order and notes time not written down and gets RMO to review.

3. Blood taken for cross match. ID band not checked and sample taken from wrong patient. Blood Bank rings and queries the blood sample taken from patient as the blood samples are different than on record. They request the patient to be re-bled.

4. Checks completed at the patient bedside and blood administration completed correctly.

5. Checks not completed at the patient bedside and blood administered to the wrong patient.

7. RN does not review order and the time for administration is not noted on the prescription order.

8. Blood taken for cross match. Pt ID band checked and correct label used.

9. Blood Bank do not advise ward blood is ready for transfusion. Patient complex of chest pain at 2030 reviewed by RMO who orders blood to commence. ASAP.

10. No handover to next shift for blood transfusion. Blood arrives onto the ward from blood bank. RN not aware of patient to receive blood transfusion. Commence check the bag at the desk to save time.

11. Checks at the patient bedside correctly completed and blood administered safely.

12. Checks not completed at the patient bedside and blood given to wrong patient.
Scenario 1 - Falls

This scenario deals with an elderly patient and falls risks.

Falls
Patient story

Feedback
We are interested in your opinions of the scenario. Please provide some feedback on this scenario.

You have successfully prevented a patient fall in hospital.

Play again  Restart scenario

We are interested in your opinions of the scenario. Please provide some feedback on this scenario.

Image 6: Final screen in the virtual patient simulation following a good patient outcome
Participants engage in the simulations as themselves. Interaction with the virtual patient can be undertaken in small groups or as self-directed learning activities. Intrinsic feedback is provided by the consequences of decisions made and the final patient outcome. In small group activities, peer discussion, facilitated by an instructor, occurs at the conclusion of each vignette. Discussion focuses on the significant non-technical skills cues and information detected in the vignettes, which informs the group members’ debate regarding the options available. Discussion may also revolve around errors made and the concluding adverse event, depending on the patient outcome. When the interaction with the virtual patient is undertaken in small group activities, the session is concluded with a final debriefing.
The virtual patients in VSPR were tested for functionality with a pilot group of users prior to publication of the resource. Issues with sequencing of video vignettes and usability of the resource were addressed. Errors in displaying certificates of completion were rectified.

1.3 Aim of the research

The central premise of this research is that effective non-technical skills are fundamental to competent and safe clinical practice for all health professionals. This research aims to develop the body of knowledge surrounding virtual patient with the intent to understand and improve how undergraduate nursing students learn non-technical skills, particularly through virtual patients.

1.4 Research questions

Detailed questions include:

1. What is the use of virtual patients to develop non-technical skills in undergraduate health professional education? What are the non-technical skills developed in undergraduate health professionals through interactions with virtual patients?

2. How do standards utilised by the Australian Health Professional Registration Agency (AHPRA) to govern registration for practice address non-technical skills required by health professionals in patient care situations in acute secondary and tertiary healthcare?

3. What specific non-technical skills do undergraduate nursing students learn following interaction with the virtual patient?

4. How do interactions with virtual patient influence learning non-technical skills in undergraduate nursing students?

5. How do faculty perceive interactions with virtual patients support student learning and practise of non-technical skills?

1.5 Significance of the research

This research enabled a systematic investigation into the specific non-technical skills categories and elements that are required for safe and competent practice in Australia, and identified the relevance of non-technical skill education in undergraduate health professional
curricula. The research explored the development of knowledge, skill, attitudes and practise of non-technical skills in undergraduate nursing students, following interactions with a series of virtual patients aimed at developing all categories of non-technical skills. The findings of the research add to the body of knowledge regarding virtual patients to enable a deeper understanding of the factors contributing to the development of knowledge, skills, attitudes and practice of non-technical skills in undergraduate nursing students. Recommendations identify important factors to be considered in the development of future undergraduate nursing curricula, and the integration of virtual patients to promote safe and competent undergraduate health professionals.

1.6 Thesis outline

This chapter (Chapter One) has introduced the research and provided a statement of the research problem, the aim of the research and the research questions. A description of the VSPR is provided together with an outline of thesis chapters.

Chapter Two explores the patient safety movement in healthcare and the role of human factors with a specific focus on the evolution of non-technical skills in healthcare. It outlines the role of simulation-based learning in developing non-technical skills and positions virtual patients as one potentially valuable resource in developing non-technical skills in undergraduate health professionals. This chapter includes a peer reviewed publication, (Peddle, M, Bearman M., & Nestel, D. (2016). Virtual patients and non-technical skills in undergraduate health professional education: An integrative review. Clinical Simulation in Nursing, 12(9), 400-410) describing the application of virtual patients to develop non-technical skills in undergraduate health professional education programs. The integrative review identifies the learning outcomes achieved related to non-technical skills via interactions with virtual patients, important factors that contribute to learning and explores the learner experience interacting with a virtual patient.

Chapter Three outlines the conceptual framework underpinning this research with justification of the paradigm selected drawing on relevant literature. It outlines the student researcher’s worldview in relation to the research and describes approaches taken to ensure research quality. It describes the research methodology and methods used in the research including study design, sample and population, settings, data collection and data analysis. Additionally, the foundations for rigour in this study, including trustworthiness and credibility are discussed. Ethical considerations of the research are outlined and measures taken to adhere to ethical requirements are described.
Chapter Four positions this research in the current healthcare context in Australia to demonstrate relevance to health professional practice and education. The chapter describes the findings of a published, peer reviewed, qualitative comparative analysis, (Peddle, M., Bearman, M., Radomski, N., McKenna, L., & Nestel, D. (2018). What non-technical skills competencies are addressed by Australian standards documents for health professionals who work in secondary and tertiary clinical settings? A qualitative comparative analysis. BMJ Open, 8(8), e020799,) examining competency standards, standards of practice for registration with the Australian Health Professional Registration Agency (AHPRA), for reference to non-technical skills. The chapter concludes by extrapolating the study findings regarding requirements for teaching and learning of non-technical skills in undergraduate health professional education in Australia.

Chapter Five details the findings of the exploratory, intrinsic case study employed in this study. Three peer-reviewed publications are included in this chapter. They include: Peddle, M., McKenna, L., Bearman, M., and Nestel, D. (2019). Development of non-technical skills through virtual patients for undergraduate nursing students: An exploratory study. Nurse Education Today, 73, 94-101), which describes the specific non-technical skills developed by undergraduate nursing students via interaction with virtual patients; Peddle, M., Bearman, M., McKenna, L., and Nestel, D. (2019). Exploring undergraduate nursing student interactions with virtual patients to develop 'non-technical skills' through case study methodology. Advances in Simulation, 4(1), 2, which outlines how the experiences of interacting with virtual patients influenced non-technical skills knowledge, skill and practice in undergraduate nursing students; and finally Peddle, M., Bearman, M., McKenna, L., and Nestel, D. “Getting it wrong to get it right”: Faculty perspectives of learning non-technical skills via virtual patient interactions. Nurse Education Today. (Under review), which examines facilitator perceptions of the role of virtual patients in developing non-technical skills and their perceived impact on professional practice in undergraduate health professionals.

Chapter Six draws together the findings of the studies undertaken in this research, to present the resulting evidence base regarding the development and implementation of virtual simulated patient simulations to develop knowledge, skill, attitudes and practice of non-technical skills in undergraduate health professional students. The findings are considered in relation to existing literature and position this study within that, highlighting the new knowledge generated.

The final recommendations and factors for consideration from the research are presented in Chapter Seven which also presents the strengths and limitations of the current research.
1.7 Summary

Chapter One has presented the context of the research and outlined the role of non-technical skills in the provision of safe and competent patient care in healthcare. It defined the gap in undergraduate health professional curriculum in relation to non-technical skills and described the development of the VSPR, which aims to develop non-technical skills of undergraduate health professionals. The aim of the study, to add to the body of knowledge regarding virtual patients, non-technical skills and undergraduate health professionals to improve how undergraduate student learn non-technical skills, was explained and the research questions stated. The next chapter describes the background to the research and situates this research within current literature.
Chapter 2  Undergraduate Health Professionals, Non-technical Skills and Virtual Patients

2.0  Introduction

In this chapter, the background to the patient safety movement and the evolution of non-technical skills in healthcare are outlined. Specific attention is paid to the education of non-technical skills and application of virtual patient methodology in undergraduate nursing curricula. The results of a peer-reviewed, published integrative review are presented. This review provides a summary of significant findings from the literature and enabled framing of this research. An update is also provided to the integrative review using literature published since 2016.

2.0  Error and adverse events in healthcare

Adverse events and medical errors continue to be ever-present factors of the healthcare landscape. A recent systematic review investigating inpatients with reported preventable adverse events identified that up to 887 of 88,428 (10%) patients experienced escalation of care, with 92 patients’ escalation calls attributed to medical error (Bhise et al., 2018). A current study investigating nurses’ experiences in Turkey identified that up to 19.4% had made a medical error, whilst 40.1% had witnessed a medical error (Kiymaz & Koç, 2018). Additionally, a survey of physicians in the United States identified that of the 6,695 who responded, 691 (10.5%) reported a perceived medical error in the previous three months (Tawfik et al., 2018). In the emergency departments in France, medical error rates are similarly reported, occurring in 10% of patients treated (Freund et al., 2018).

Originally, a study conducted in 1964 identified that 20% of admitted patients in the United States experienced an adverse event, with 20% of those injuries serious or fatal (Schimmel, 1964). At a similar time in Australia, Wilson et al. (1995) reported that 16.6% of admissions into acute care hospitals were associated with an adverse event, with 51.2% of these events classified as highly preventable. Questions were asked about why the error rate in healthcare was so high. The health professionals working within the industry were highly trained and educated, and there was legislation, regulations and evidenced-based guidelines to inform practice. Leape (1994) suggested the reason for these high error rates not having raised
concern was the difficulties health professionals had in dealing with human error and the culture that was present in healthcare practice. In the 1980s, there was a distinct lack of research surrounding medical accidents and medical negligence (Vincent, 2011). Medical error was rarely acknowledged in relation to patients, with research on patient safety regarded as disreputable and seldom published in journals (Vincent, 2011). The practice of striving for perfection led health professionals to cover up mistakes or try to shift blame to other colleagues or the patient (Leape, 1994). The ensuing culture of shame and blame led practitioners to deny or hide errors (Hoffman & Kanzaria, 2014) and any learning that occurred as a result of an adverse event happened in a vacuum, with little or no sharing (Leape, 1994). Leape (1994) proposed that for any change to occur there needed to be a significant shift in the way health professionals thought about errors.

2.1 Patient safety

In the year 2000, the Institute of Medicine (IOM) released a report, *To Err is Human: Building a Safer Health System*, in which evidence is presented to demonstrate that healthcare was not as safe as it should be (Kohn, Corrigan, & Donaldson, 2000). The report identified that errors occurring in healthcare were “caused by faulty systems, processes and conditions that lead people to make mistakes or fail to prevent them” (Kohn et al., 2000, p2). Moreover, the report identified that many of these errors and accidents were preventable (Kohn et al., 2000). The report emphasised that the healthcare industry is a complex, high-risk industry that is prone to accidents and one of the greatest contributing factors to these accidents occurring was human error (Kohn et al., 2000). The report also highlighted the consequence of medical errors and the immense burden they place on the healthcare system, families and communities. Unfortunately, similar causes of preventable medical error are reported today, including human errors in communication, diagnostic errors, poor judgment, and inadequate skill (Makary & Daniel, 2016) with system errors also remaining a prevalent issue (Leveson, Samost, Dekker, Finkelstein, & Raman, 2016). Likewise, the outcomes of medical error for patients and their families remain, being significant morbidity, financial costs, distress and suffering (Shojania & Dixon-Woods, 2016).

A foundation arising from the publication of the IOM report was that a basic level of safety should be assured for all who use the health system (Stelfox, Palmisani, Scurlock, Orav, & Bates, 2006). The report continued to “lay out a national agenda for reducing errors in health care and improving patient safety” (Kohn et al., 2000, p. 5). The report triggered much investigation and discussion about patient safety issues, leading to a proliferation of research and literature around the concept of patient safety (Bates & Singh, 2018; Stelfox et al., 2006;
Tanon et al., 2010). Patient safety is defined as “the absence of preventable harm to a patient during the process of health care and reduction of risk of unnecessary harm associated with health care to an acceptable minimum” (WHO., 2018). Vincent (2011) also emphasises that safety resides in systems, as well as people, and that it needs to be actively pursued.

2.2 Human factors

In high-risk industries, such as aviation, oil, nuclear, and the military, errors and adverse events are often attributed to failures in human factors, rather than deficit in skills of the professionals involved (Flin et al., 2013). Analyses of incidents in these high-risk industries identify that up to 80% are related to errors in human factors (Flin et al., 2013). Human factors refer to “environmental, organizational and job factors, and human and individual characteristics which influence behaviour at work in a way which can affect health and safety” (WHO, 2015).

There are three fundamental elements to be considered in human factors: the job, the individual and the organisation. The job includes “areas such as the nature of the task, workload, the working environment, the design of displays and controls, and the role of procedures” (Health & Safety Executive, NA). The individual includes “his/her competence, skills, personality, attitude, and risk perception” (Health & Safety Executive, NA). The organisation includes “work patterns, the culture of the workplace, resources, communications, leadership and so on” (Health & Safety Executive, NA). Human factors are posited to be “the metaphorical glue that surrounds knowledge and skills” (Rosenorn-Lanng, 2014, p. 9).

Human error cannot be eliminated; however application of human factors thinking has provided improvements in safety in these high risk industries. Application of human factors thinking in healthcare has assisted with fine tuning medical device design and usability testing, and design of safer systems and processes (Carayon, 2012; Karsh, Holden, Alper, & Or, 2006). More than a decade ago Salas, Wilson, Burke, Wightman, and Howse (2006) implemented education programs based on human factors that led to positive reactions from participants and behaviour change with some learning transfer to simulated or real working environments. Similarly, researchers, educators and clinicians suggest application of human factors in healthcare will improve patient safety (Kohn et al., 2000). Current evidence indicates that training in human factors can improve teamwork, management, leadership and decision-making skills for emergency medicine teams (Truta et al., 2018). Additionally, research suggests that human factors training is transferrable to clinical care settings, such as improved non-technical skills in surgical teams in operating rooms (Gillespie et al., 2017),
improved leadership and team performance in rapid response teams in paediatrics (Siems, Cartron, Watson, McCarter, & Levin, 2017) and improved communication in the physician–nurse dyad in intensive care units (Turkelson, Aebersold, Redman, & Tschannen, 2017). It is proposed that application of the concepts, theories and methods of human factors will reduce medical errors and patient harm (Carayon, 2012).

2.3 Evolution of non-technical skills taxonomy

Non-technical skills are a subset of the individual element of human factors. The term ‘non-technical skills’ was first coined in aviation in the 1990s by the European Joint Aviation Authorities (Glavin, 2011). It was derived from Flight Crew Resource Management training (Helmreich, Merritt, & Wilhelm, 1999) and was used to describe airline pilots’ behaviour on the flight deck, to emphasise the cognitive and social skills required for safe and effective flight operations (Flin et al., 2003). Non-technical skills were initially defined as “the cognitive and social skills of flight crew members in the cockpit, not directly related to aircraft control, system management, and standard operating procedures” (Flin et al., 2003, p. 182).

Traditionally, non-technical skills in the airline industry were tacit, taught inconsistently and informally from one pilot to the next (Flin et al., 2013). However, following a spate of puzzling airline disasters in the 1970s (Flin et al., 2013), research was commissioned to investigate key behaviours of pilots on the flight deck (Flin et al., 2003). These experiments enabled identification of core “cognitive and interpersonal skills needed to manage the flight within an organized aviation system” – so called ‘non-technical skills’ of air crew (Flin et al., 2013. p286). The generic categories of non-technical skills inherent in safe and competent practice across high-risk industries were identified to include situation awareness, decision-making, communication, teamwork, leadership, managing stress and coping with fatigue (Flin et al., 2013). Identification of core non-technical skills enabled the development of training programs to increase the awareness of these skills in all aircrew (Flin et al., 2013). Human factors experts suggested this approach would establish a set of constructs and common vocabulary for discussion and learning about important behaviours that impact efficient and safe performance (Flin et al., 2013).

2.4 Non-technical skills in healthcare

Evidence indicates that failures in non-technical skills in healthcare, including communication breakdowns and poor decision-making, directly impact on patient safety, resulting in patient harm and death (Makary & Daniel, 2016). It is reported that 70 to 80 percent of healthcare
errors are attributed to breakdowns in communication, teamwork and decision-making (Flin et al., 2013). A revised definition of non-technical skills now describes them as “the cognitive, social and personal resource skills that complement technical skills and contribute to safe and efficient task performance” (Flin et al., 2013, P 1). There is little discrepancy as to what researchers and clinicians identify as non-technical skills (Gaba, 2011; Nestel et al., 2011) including situation awareness, decision-making, communication, team working, leadership, managing stress and coping with fatigue (Flin et al., 2013). Each non-technical skill category has particular elements (Table 2.1). These skills are highly technical and involve a complex set of knowledge, values and skills which are intricately linked to clinical practice (Glavin, 2011). Identifying the skill categories and elements provides “a set of established constructs and a common vocabulary for learning about the important behaviours that influence safe and efficient task execution” (Flin et al., 2013, p. 5).

Table 2.1: Categories and elements of non-technical skills

<table>
<thead>
<tr>
<th>Category</th>
<th>Definition</th>
<th>Elements</th>
</tr>
</thead>
</table>
| Situation awareness | “The perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future” (Flin et al., 2013, p. 17) | • Gathering information,  
• Interpreting information,  
• Anticipating future states.  
(Flin et al., 2013, p. 18) |
| decision-making   | “Decision-making can be defined as the process of reaching a judgement or choosing an option, sometimes called a course of action, to meet the needs of a given situation” (Flin et al., 2013, p. 41) | • Situation assessment-defining problem,  
• Generating and considering one or more response options,  
• Selecting and implementing an option,  
• Outcome review.  
(Flin et al., 2013, p. 41) |
| Communication     | “Communication is the exchange of information, feedback or response, ideas and feelings. It provides knowledge, institutes relationships, establishes predictable behaviour patterns, maintains attention to the task, and is a management tool” (Kanki & Palmer, 1993 in Flin et al., 2013, p. 69) | • Send information clearly and concisely,  
• Include context and intent during information exchange,  
• Receive information especially by listening,  
• Identify and address barriers to communication.  
(Flin et al., 2013, p. 69) |
<table>
<thead>
<tr>
<th>Category</th>
<th>Definition</th>
<th>Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teamwork</td>
<td>&quot;The definition of a team, according to Salas et al. (1992: p4), is: a distinguishable set of two or more people who interact, dynamically, interdependently, and adaptively toward a common and valued goal/objective/mission, who have each been assigned specific roles or functions to perform, and who have a limited life-span of membership&quot; (Flin et al., 2013, p. 94)</td>
<td>• Support others,&lt;br&gt;• Solve conflicts,&lt;br&gt;• Exchange information and&lt;br&gt;• Coordinate activities.&lt;br&gt;&lt;br&gt;Teamwork behaviour:&lt;br&gt;• Performance monitoring,&lt;br&gt;• Feedback,&lt;br&gt;• Closed loop communication&lt;br&gt;• Backing up behaviours.&lt;br&gt;&lt;br&gt;Team performance norms:&lt;br&gt;• Team self-awareness&lt;br&gt;• Fostering team interdependence&lt;br&gt;(Flin et al., 2013, p. 94)</td>
</tr>
<tr>
<td>Leadership</td>
<td>&quot;Team leadership is about directing and co-ordinating the activities of team members; encouraging them to work together; assessing performance; assigning tasks; developing team knowledge, skills and abilities; motivating; planning and organising; and establishing a positive team atmosphere&quot; (Salas et al., 2004 in Flin et al., 2013, p. 129)</td>
<td>• Use authority,&lt;br&gt;• Maintain standards,&lt;br&gt;• Plan and prioritise,&lt;br&gt;• Manage workload and resources&lt;br&gt;(Flin et al., 2013, p. 130)</td>
</tr>
<tr>
<td>Managing stress</td>
<td>“A particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her wellbeing” (Flin et al., 2013, p. 157)</td>
<td>• Identify causes,&lt;br&gt;• Recognise symptoms and effects,&lt;br&gt;• Implement coping strategies.&lt;br&gt;(Flin et al., 2013, p. 158)</td>
</tr>
<tr>
<td>Coping with fatigue</td>
<td>“The state of tiredness which is associated with long hours of work, prolonged periods without sleep, requirements to work at times which are 'out of sync' with the body's biological or Circadian rhythms” (Calwell &amp; Caldwell 2003 in Flin et al., 2013, p. 191)</td>
<td>• Identify causes of fatigue,&lt;br&gt;• Recognise effects of fatigue&lt;br&gt;• Implement coping strategies.&lt;br&gt;(Flin et al., 2013, p. 191)</td>
</tr>
</tbody>
</table>

Non-technical skills have now become an accepted construct in healthcare and several specific taxonomies have been developed using the established categories and elements of non-technical skills across different health specialties. Taxonomies include: Anaesthetists’ Non-technical Skills (ANTS) (Fletcher et al., 2002); Surgeons’ Non-technical Skills (NOTSS)
(Yule et al., 2008); Scrub Practitioner Non-Technical Skills (SPLINTS) (Mitchell et al., 2013); and Anaesthetic Non-Technical Skills for Anaesthetic Practitioners (ANTS-AP) (Rutherford et al., 2015). Other work to identify non-technical skills in paramedicine (Shields & Flin, 2012), acute medicine (Flin & Maran, 2004), intensive care (Reader, Flin, Lauche, & Cuthbertson, 2006) and pharmacy (Irwin & Weidmann, 2015) has recently been completed.

As evidenced by the taxonomies above, the categories and elements of non-technical skills required for competent and safe practice refine as practitioners begin to develop expertise in various specialties. Each practice environment has its own exclusive requirements for non-technical skills that are explicit to the requirements and features of that profession (Reader, Flin, Lauche & Cuthbertson, 2006). Therefore, it is important that the skills required in each context of care are carefully identified (Fletcher, McGeorge, Flin, Glavin & Maran, 2002).

Non-technical skills categories commonly reported in nursing literature identify situation awareness, teamwork, communication, decision-making, leadership (McClelland, 2019) coping with fatigue and managing stress (Mitchell, Flin, Yule, Mitchell, Coutts & Youngson, 2013). Additional areas identified are flexibility and adaptability (Hurley, Hutchinson, Kozlowski, Gadd & van Vorst, 2019), task management (Mitchell, Flin, Yule, Mitchell, Coutts & Youngson, 2012; Pearson & McLafferty, 2011) empathy (McCarthy, 2017) delegation (Medley & Home, 2005) and critical thinking (Thabet, Eman, Abood & Morsy, 2017). However, despite the refinement of the categories and elements of non-technical skills across practice contexts and professions, there is general agreement on the generic constructs of non-technical skills including situation awareness, decision making, leadership, teamwork, coping with stress and managing fatigue (Flin et al 2008; Wright, Segall, Hobbs, Phillips-Bute, Maynard & Taekman, 2013). It is imperative that foundational education received in relation to non-technical skills categories and elements have similarities across professions to support interprofessional practice. This concept is reinforced by the WHO Multi-professional Patient Safety Curriculum Guide (2018) which is inclusive of the “fields of dentistry, medicine, midwifery, nursing and pharmacy. It also supports the on-going training of all health care professionals.”

2.5 Non-technical skills

While non-technical skills have been established as critical for safe and competent patient care, many non-technical skills such as teamwork, communication skills and reporting of unsafe practice are yet to be fully integrated into current clinical practice (Mansour, Al
Shadafan, Abu-Sneineh, & AlAmer, 2018). Non-technical skills are poorly articulated and addressed in many undergraduate health professional education and training programs (Mansour et al., 2018; Pearson & McLafferty, 2011) with many countries reporting that non-technical skills education occurs in postgraduate and continuing education (Patient Safety and Quality Care Group of European Commission, 2014). However, the concepts of non-technical skills are yet to be fully integrated into curricula to ensure healthcare professionals are adequately educated (Mansour et al., 2018) with a substantial lack of guidance on implementing non-technical skills in curricula (Nicolaides et al., 2018). Skills required for competent practice in the clinical setting, such as teamwork, are left to be attained through ‘on-the-job’ learning experiences (Brennan et al., 2010; Foronda, Liu, & Bauman, 2013). Moreover, it is not clear how these skills are learnt in the clinical setting (Nicholls, Sweet, Muller, & Hyett, 2018). Additionally, embedding non-technical skills into undergraduate curricula that undergo professional accreditation procedures still face significant challenges (Mansour et al., 2018). It is suggested that key to embedding non-technical skills education in curricula may be transforming teaching and learning methods to better engage students in learning (Mansour et al., 2018).

It is suggested that early professional education in non-technical skills is beneficial for learners (Mansour et al., 2018). This early exposure may provide learners with: a basic understanding of the factors influencing human performance; a standard approach to clinical care; a common vocabulary to facilitate discussion of unsafe behaviours; improved team communication; and help to develop solutions for reducing risks to patients (Flin & Patey, 2009). The development of the Patient Safety Curriculum Guide by the World Health Organisation, which aimed to build the knowledge and skills of health professionals to better prepare them for safer practice, supports the importance of addressing these concepts in undergraduate health professional programs (Walton, 2011).

### 2.6 Health professional graduates

The landscape of contemporary healthcare systems has changed. Patients have more acute presentations, more complex health needs and shorter lengths of hospital stays (Rhodes & Curran, 2005). Knowledge and technology is developing exponentially alongside evolving and expanding roles of healthcare professionals (Wolff, Pesut, & Regan, 2010). Healthcare providers are calling for professional graduates to be adequately prepared for the reality of this fast-paced environment. Beginning practitioners must be competent to respond to diverse clinical situations, safely and in a timely fashion (Spunt, Foster, & Adams, 2004).
However, concern has been raised over the work readiness of health professional graduates to work in this contemporary clinical environment. “Graduate work readiness is the extent to which graduates are perceived to possess the skills and attributes that render them prepared for success in the workplace” (Walker & Campbell, 2013). In Australia, in the early 2000s reports from the Productivity Commission (2005), the Postgraduate Medical Council of Victoria (2003), Nurse Policy Branch, Victoria (2005) and the Victorian Government Department of Human Services (2007) stated that new medical and nursing graduates were not considered to be work ready. The reports indicated that new graduates did not have the necessary knowledge, skills or professional behaviours to function effectively in the clinical workplace. “New nurses need to have both the academic foundation and the appropriate level of practical skills and experience to prepare them to work in the real-world environment, across existing and emerging settings with changing health care needs” (Commonwealth of Australia, 2014, p. 2). A number of initiatives have been implemented to optimise new graduate performance across different disciplines (Berkow, Virkstis, Stewart, & Conway, 2009), and address these deficiencies (Frenk et al., 2010). Yet, the literature continues to highlight that education programs are producing unprepared graduates from stagnant, disjointed and out-dated curricula that are not keeping pace with health workforce changes (Frenk et al., 2010). There remains a mismatch between graduate nurse characteristics and workplace expectations (Commonwealth of Australia, 2014) with poor performance reported of new graduate nurses in critical thinking and problem solving, working independently and assessment procedures (Missen, McKenna, Beauchamp, & Larkins, 2016). Patterson, Curtis, and Reid (2008) identified the new graduate nurses’ skills of interacting with patients and conversing and working with members of the healthcare team effectively as areas deficient in practice. Gaps in the readiness of new health professional graduates also exist in time management, managing deteriorating patients and emergencies, and conflict and stress management (Merga, 2016). Furthermore, new graduates report that role conflict and poor confidence impact their ability to function effectively in the clinical setting (Walker & Campbell, 2013). Criticism has also been levelled at poor interpersonal relations and clinical decision-making skills of new graduate nurses that influences the student’s ability to successfully enter into the workforce (Cross, 2009).

This evidence indicates that lack of work readiness among health graduates extends beyond technical and/or clinical skills and competence (Eley, 2010). It suggests that lack of work readiness encompasses other non-technical skill competencies (Walker et al., 2013). The essential skills and competencies that have been identified as lacking in new health professional graduates align with non-technical skills categories and elements including teamwork, confidence, coping with demanding working conditions and managing the
increase in responsibility to make decisions in the clinical setting (Eley, 2010; Frenk et al., 2010). Improvement in non-technical skills amongst undergraduate health professionals is important if new graduates are to be deemed work ready at the point of qualification (Unsworth, Melling, Allan, Tucker, & Kelleher, 2014).

2.7 Registration of practising health professionals in Australia

In Australia, the Health Practitioner Regulation National Law Act (2009) governs health professional practice. Under this Act, the Australian Health Professional Registration Agency (AHPRA) registers practising health professionals. The mission of the AHPRA is “to protect the public by regulating health practitioners efficiently and effectively in the public interest to facilitate access to safer healthcare” (Australian Health Professional Registration Agency, 2015). One aspect of this mission is to ensure that “registered health professionals are suitably trained and qualified to practise in a competent and ethical manner” (Australian Health Professional Registration Agency, 2015). To manage this, each profession has a national board that is responsible for setting the national standards that practitioners must meet to be registered. There are currently 15 national boards in Australia, namely:

- Aboriginal and Torres Strait Islander Health Practice Board of Australia
- Chinese Medicine Board of Australia
- Chiropractic Board of Australia
- Dental Board of Australia
- Medical Board of Australia
- Medical Radiation Practice Board of Australia
- Nursing and Midwifery Board of Australia
- Occupational Therapy Board of Australia
- Optometry Board of Australia
- Osteopathy Board of Australia
- Paramedicine Board of Australia
- Pharmacy Board of Australia
- Physiotherapy Board of Australia
- Podiatry Board of Australia
- Psychology Board of Australia
Alongside the AHPRA and the national boards, there are also accreditation bodies whose role is to ensure that education programs, leading to registration with AHPRA, meet the education and practice standards. Examples of existing accreditation councils include the Australian Nursing and Midwifery Accreditation Council (ANMAC), the Australian Medical Council (AMC) and The Australian Pharmacy Council.

As non-technical skills have been demonstrated to be critical for the delivery of safe and competent patient care in various clinical contexts such as surgery, acute care, emergency departments and primary care (Agha, Fowler, & Sevdalis, 2015; Ahmed et al., 2014; Conroy, Feo, Boucaut, Alderman, & Kitson, 2017; Large & Aldridge, 2018), the categories and elements of non-technical skills should appear in the standards of practice for registration as a health practitioner in Australia. However, no evidence exists that details how non-technical skills categories and elements are addressed in the standards for practice for registration with AHPRA. Additionally, no evidence exists to indicate that the categories and elements of non-technical skills are inherent requirements for undergraduate health professional education curricula.

2.8 Non-technical skills education in undergraduate health professional students

Traditionally, undergraduate health professional education programs have focused on discipline and technical expertise, clinical reasoning and communication skills. The teaching of other competencies is then neglected (DeTata, 2015), not fully integrated in curricula (Hull et al., 2013), or poorly articulated during curriculum delivery and seldom measured (Youngson, 2011). Literature has highlighted that there is limited exposure of undergraduate health professional students to education content or activities specifically related to non-technical skills and limited guidance is available when integrating non-technical skills training in undergraduate curricula, such as medicine (Nicolaides et al., 2018). Additionally, there was no mandated requirement for coverage of patient safety content in curricula, such as nursing, addressing non-technical skills (Mansour et al., 2018). Other barriers identified to the integration of non-technical skills in curricula are having competent faculty to train and assess non-technical expertise (Hull et al., 2013), and feasible, reliable and valid assessment tools (Cooper et al., 2016). Furthermore, Glavin and Maran (2003) highlight that non-technical skills are often taught in an integrated format, which can lead to lack of clarity around the concepts being taught. Professional skills that are required for competent practice in the clinical setting, such as teamwork, task management, leadership, organisation and situation awareness are often left to be attained through ‘on-the-job’ learning experiences (Brennan et
al., 2010). However, the clinical learning environments that undergraduate learners are exposed to are opportunistic and learners experience considerable variation in the quality of the learning (Papastavrou, Lambrinou, Tsangari, Saarikoski, & Leino-Kilpi, 2010; Weller, Nestel, Marshall, Brooks, & Conn, 2012). This has resulted in new graduates who have limited awareness of the critical role non-technical skills play in quality and safe healthcare (Aboumatar et al., 2012) and have created gaps in the undergraduate health professional curriculum related to non-technical skills.

Non-technical skills can be attained through structured education programs and are similar to technical skills in that they can be learnt (Paige, 2010). Vincent (2011) elaborates that anyone can learn non-technical skills. Youngson (2011, p. S36) suggests that “induction, development and feedback through debriefing enhances” non-technical skills in undergraduate learners. Likewise, the World Health Organisation Patient Safety Curriculum Guide released in 2011 supports the training of all healthcare professionals in patient safety concepts including non-technical skills (WHO., 2011).

Many authors suggest that the introduction of concepts, such as non-technical skills, early in professional training empowers the learner with the tools to advance their thinking and gives them an opportunity to practise and master this way of working (Aboumatar et al., 2012; Robertson et al., 2010; Wolff et al., 2010). Such early introduction of non-technical skills in curricula should be explicit and enable the development and practise of non-technical skills to enable mastery of the concepts associated with clinical performance. Additionally, it is proposed that early exposure of students to interprofessional collaboration as part of the educational process will develop knowledge and awareness of non-technical skills, and contribute significantly to the development and practise of effective skills (De Souza, Dias Da Silva, & De Carvalho, 2010). Further, early integration of non-technical skills education would support development of these skills before professional attitudes are fully developed (Mansour et al., 2018). It is critical that undergraduate health professionals experience a curriculum in which discipline specific, technical and non-technical skills are equally prominent.

However, a literature review by Robson, Clark, Pinnock, White, and Baxendale (2013), aiming to identify the teaching of patient safety focusing on human factors in undergraduate nursing curricula, returned only two articles from the database search. The findings of the review indicated that whilst limited concepts of patient safety were included in undergraduate teaching programs they were implicit, with minimal focus on non-technical skills as these were not yet part of the undergraduate nursing landscape (Attree, 2006). Additionally, Mansour (2012) identified that patient safety education had not been integrated or included
in the undergraduate system. It was also highlighted that many nursing academics lacked understanding of the patient safety agenda and the role of human factors (Mansour, 2012). More recent publications continue to indicate that undergraduate nursing education is yet to fully integrate non-technical skills in curricula (Piresa et al., 2016). Whilst some categories of non-technical skills may be taught, such as working in teams and communication, the confidence of students in these skills areas declines as students’ progress through the course and are exposed to clinical practice (Lukewich et al., 2015). In fact, Piresa et al. (2016) call for consideration to integrate non-technical skills training in all undergraduate nursing curricula. Further publications are now beginning to emerge that are addressing the integration of non-technical skills education in undergraduate nursing (Fukuta & Litsuka, 2018; Mansour et al., 2018) specifically through using simulation-based education.

### 2.9 Learning through simulation

Learning through simulation is “a technique that uses a situation or environment created, to allow persons to experience a representation of a real event for the purpose of practice, learning, evaluation, testing, or to gain understanding of systems or human actions” (ASSH HWA Data Dictionary, 2012). Simulation in health professional education, with the recent development and refinement of its methodology, is suggested to provide a robust and effective strategy to successfully develop non-technical skills in learners (Fernandez et al., 2008; Kneebone, 2010; Unsworth et al., 2014). Education programs focused on the development of non-technical skills indicate that simulation strategies enable the undergraduate student to focus on development or improvement of communication, decision-making, leadership and teamwork skills (Berkow et al., 2009; Lambton, O’Neill, & Dudum, 2008; Pearson & McLafferty, 2011; Takayesu et al., 2006; Unsworth, McKeever, & Kelleher, 2012; Walshe, O’Brien, Murphy, & Hartigan, 2011). Learning through simulation also provides an opportunity for students to practise leadership and teamwork skills, critical to the development of competent undergraduate learners (Berkow et al., 2009; Pearson & McLafferty, 2011).

The simulation approaches used to generate these outcomes related to non-technical skills rely predominantly on traditional immersive, face-to-face delivery methods. These traditional forms of learning through simulation can include modalities such as case studies, computer programs, simulated patients, task trainers, high technology mannequins or a combination (Cannon-Diehl, 2009). However, there are challenges in implementing simulations using traditional face-to-face approaches in undergraduate education including cost, time and the difficulty in replicating across large, geographically diverse student cohorts. They are
resource intensive, can present timetabling challenges and offer limited opportunity for repetition of the learning experience approach (Andreatta et al., 2010; Lempicki & Holland, 2018). Further, the training contexts may change depending on the preparation and expertise of the facilitators, which ultimately leads to learning activities that are not standard and performance levels and debriefing that vary (Andreatta et al., 2010).

The application of innovative forms of technology-enhanced simulation, in the form of virtual patients, is a relatively new addition to the learning through simulation toolbox (Botezatu, Hult, Tessma, & Fors, 2010). Virtual simulation resources, such as virtual patient simulations, can provide a sustainable simulation approach for large student numbers. Virtual simulation resources permit access of undergraduate learners to essential, but at times unavailable, clinical situations for practice and learning (Posel, Fleiszer, & Shore, 2009). Additionally, virtual simulation resources can lessen the burden on training resources including faculty, equipment and patients (McGee, 2012). Whilst the standardisation and reproducability of the technical aspects of the scenario and equipment is improving, challenges remain with the consistency of the facilitation and debriefing experiences due to staff education and experience (Liaw, Zhou, Lau, Siau, & Chan, 2014). Further, there is often little opportunity for repetitive practice to enable students to develop appropriate knowledge, skills and attitudes (Liaw, Chan, Chen, Hooi, & Siau, 2014).

2.10 Virtual patients

Virtual patients offer a very useful way to address outcomes related to non-technical skills. Virtual patients are defined as “an interactive computer simulation of real-life clinical scenarios for the purpose of healthcare and medical training, education or assessment” (Ellaway et al., 2006.p2 ). Whilst virtual patients are time and resource intensive to produce, they are associated with significantly higher learning outcomes related to knowledge and clinical reasoning (Cook, Erwin, & Triola, 2010; Huang, Reynolds, & Candler, 2007). Virtual patients are also able to transcend logistical barriers (Cook, Hatala, Brydges, & et al., 2011) and support repetitive practice on realistic, meaningful but rare clinical situations (Huang et al., 2007; Lok et al., 2006). Virtual patients can provide a cost-effective alternative to face-to-face simulation (Andreatta et al., 2010; Lok et al., 2006), especially in large undergraduate student cohorts, such as in nursing. Feedback mechanisms present in virtual patients also promote learning (Lok et al., 2006), with the platform conducive to enabling objective assessments (Andreatta et al., 2010; Liaw, Chan, et al., 2014). The ability of the virtual patient to promote application of knowledge to clinical situations promotes deep learning and supports mastery learning (Berman, Durning, Fischer, Huwendiek, & Triola, 2016).
Whilst empirical evidence regarding the design, integration and outcomes from utilising virtual patients in health professional curricula is beginning to develop; there is limited evidence on the feasibility and effectiveness of virtual patients to develop non-technical skills in undergraduate health professional learners, specifically undergraduate nursing students. Missing from the literature are reports of the specific non-technical skills that are developed through interactions with virtual patients and how this experience influences learning and practice of non-technical skills in undergraduate nursing students. Finally, there is a dearth of research reporting how faculty perceive learning and practice of non-technical skills following interaction with virtual patients in undergraduate nursing students.

The virtual patient depicts a patient in a realistic clinical situation and setting, with which the learner engages in the role of a health professional, to make diagnostic and therapeutic decisions (Cook & Triola, 2009). They can assist learners to acquire and improve skills and enable practice in applying skills in realistic clinical situations to maintain skills over time (Andreatta et al., 2010). The virtual patient enables learning conditions to be standardised and performance to be monitored and recorded, supporting use as a means of assessing student performance (Kilmon, Brown, Ghosh, & Mikitiuk, 2010).

Benefits of virtual patient learning include cost effectiveness (Cook & Triola, 2009), no requirements for clinical laboratory space or dedicated technical staff to run the equipment (Kleinheksel, 2017). Additionally, virtual patients are consistent with no deviation from the prescribed simulation pathway (Kleinheksel, 2017). Virtual patients can be distributed across large student cohorts to support repetition and review of knowledge, skills and attitudes at times when the learner requires it (Kleinheksel, 2017). Virtual patients can create high-fidelity, immersive simulations with a high level of interactivity (Liaw, Chan, et al., 2014). The scenarios can cover a wide range of clinical topics, using authentic clinical settings and situations (Liaw, Chan, et al., 2014). As such, virtual patients are flexible, reproducible, and can be disseminated across large undergraduate student numbers (Posel, Fleischer, & Shore, 2009).

Literature supports the compelling educational capabilities (Posel et al., 2009) of virtual patients, which utilise authentic clinical situations to develop mental schemata in the learner. Virtual patients have been associated with improved learning outcomes in the domains of knowledge, skills, and behaviours (Cook et al., 2011). Such virtual patients traditionally present ‘case-based’ opportunities for problem-based inquiry learning (McGee, 2012; Posel et al., 2009) and are traditionally aimed at developing diagnostic and clinical reasoning (Cook & Triola, 2009). Other outcomes from virtual patients include assessment skills (Botezatu et
al., 2010), interviewing techniques and communication, and emotional reactions (Bearman, Cesnik, & Liddell, 2001) and empathy (Deladisma et al., 2007).

Virtual patients are a relatively new addition to the healthcare education toolbox. A search of the CINAHL and Medline databases focusing on empirical research published since 2013 indicates some application of virtual patient methods to develop concepts other than clinical or diagnostic reasoning. Evidence indicates that virtual patients are currently integrated in undergraduate learning curricula across various health professions and practice contexts. Extensions in virtual patient applications in medical education include palliative care (Tan, Ross, & Duerksen, 2013), refugee trauma in primary care (Ekblad, Mollica, Fors, Pantziaras, & Lavelle, 2013) and ethical, professional and legal components (Hooper, 2015).

In nursing, virtual patients have been used to develop clinical concepts of paediatric nursing (Friedman & Goldschmidt, 2014) mental health nursing (Brown, 2008; Guise, Chambers, & Valimaki, 2012; Holland et al., 2013; Sunnqvist, Karlsson, Lindell, & Fors, 2016; Verkuy et al., 2017), cancer care (Moule, Pollard, Armoogum, & Messer, 2015), cardiac care (Kiegaldie & White, 2006), disability care (Sanders et al., 2008), disaster training (Farra, Miller, & Hodgson, 2015), cultural competence (Mathew, Brewer, Crist, & Poedel, 2017) and empathy (Menzel, Willson, & Doolen, 2014). VPs have also been used to develop skills in clinical reasoning (dit Dariel, Raby, Ravaut, & Rothan-Tondeur, 2013; Forsberg, Ziegert, Hult, & Fors, 2016, 2014; Georg & Zary, 2014), interviewing (Kleinheksel, 2014; Sweigart & Hodson-Carlton), communication (Foronda, Gattamorta, Snowden, & Bauman, 2014) including empathic communication (Strekalova, Krieger, Kleinheksel, & Kotranza, 2017) and student recognition and response to a deteriorating patient (Cant, Young, Cooper, & Porter, 2015; Liaw et al., 2016). Further examples are published from midwifery focusing on preeclampsia (Cobbett & Snelgrove-Clarke, 2016), dentistry focusing on paediatric practice (Papadopoulos, Pentzou, Louloudiadis, & Tsiatsos, 2013) and radiological sciences developing students' performance in assessing image quality (Ahlqvist et al., 2013).

However, the predominate focus of the published research is on the effectiveness of the resources in developing the identified learning outcomes. None of the identified papers focus on effectiveness of virtual patients or learning processes during student virtual patient interactions when virtual patients are implemented in health professional curricula to develop non-technical skills. Whilst some studies address isolated elements of non-technical skills, no papers address all categories of non-technical skills, including communication, situation awareness, teamwork, leadership, decision-making, coping with stress or managing fatigue, in undergraduate health professional learners.
2.11 Integrative review methods

The integrative review method was selected to enable a synthesis of research findings from studies using different methods (Whittemore & Knafl, 2005). Integrative review methods summarise empirical or theoretical literature to provide a comprehensive understanding of a particular phenomenon or healthcare problem (Whittemore & Knafl, 2005). Previous reviews regarding virtual patients in healthcare education have aimed to identify the types of virtual patient and the variations between them, with the purpose of identifying the effective features of virtual patient design (Cook & Triola, 2009; Cook et al., 2010). Others aim to clarify the role of virtual patients in healthcare and pharmacy education (Choules, 2007; Cook & Triola, 2009; Jabbur-Lopes, Mesquita, Silva, De Almeida Neto, & Lyra Jr, 2012), while some aim to categorise the outcomes of research to qualify the effect of virtual patients on learning (Cook et al., 2010).

The purpose of the integrative review was to answer the following question: What is the use of, and learning from, virtual patients related to non-technical skills in undergraduate health professional education? The outcomes of the integrative review in this research identified new knowledge to add to the body of knowledge regarding virtual patient and undergraduate health professionals with a specific focus on developing knowledge and attitudes of non-technical skills.

2.11.1 Publication one

Virtual Patients and Nontechnical Skills in Undergraduate Health Professional Education: An Integrative Review

Monica Peddle, MEd, RN\textsuperscript{a,}*, Margaret Bearman, PhD, BComp (Hons), BSci\textsuperscript{b}, Debra Nestel, PhD, FAcadMed, CHSE-A\textsuperscript{c}

\textsuperscript{a}Research Fellow, School of Nursing and Midwifery, La Trobe University, Melbourne, Australia
\textsuperscript{b}Associate Professor, Health Professional Education and Educational Research (HealthPEER), Faculty of Medicine, Nursing and Health Sciences, Monash University, Melbourne, Australia
\textsuperscript{c}Professor of Simulation Education in Healthcare, School of Rural Health, HealthPEER, Faculty of Medicine, Nursing and Health Sciences, Monash University, Melbourne, Australia

KEYWORDS
virtual simulation; virtual patient; nontechnical skills; communication; decision-making; teamwork; undergraduate health professionals; integrative review

Abstract

Background: Technology enhanced simulation such as virtual patients offer flexible, reproducible, and accessible learning experiences for students to develop nontechnical skills.

Method: Integrative review methods were used to synthesize empirical and theoretical literature to provide a comprehensive understanding of virtual patients in curricula relative to nontechnical skills.

Results: Twenty-eight articles were included in the review. Results suggest interactions with virtual patients develop communication, teamwork, and decision-making. Additional themes related to transfer of learning to practice, socialization into roles, and authenticity emerged.

Conclusions: The educational design of the simulation experience, sequencing learning activities surrounding the virtual patient, and authenticity of the virtual patient interaction are identified as important factors for consideration.

Cite this article:


© 2016 International Nursing Association for Clinical Simulation and Learning. Published by Elsevier Inc. All rights reserved.

Analysis of accidents and adverse events within high-risk industries including health care has revealed that 65% to 80% of errors are attributed to breakdowns in communication, teamwork, and decision-making, which are often called nontechnical skills (Flin, O’Connor, & Crichton, 2008). These are “the cognitive, social and personal resource skills that complement technical skills and contribute to safe and efficient task performance” (Flin et al., 2008, p. 1). There is general agreement in the literature that nontechnical skills are comprised of situational awareness, decision-making, communication, teamwork, leadership, managing stress, and coping with fatigue (Flin et al., 2008; Nestel, Walker, Simon, Aggarwal, & Andreattta, 2011). All are important...
for safe and efficient performance of a range of activities and tasks in high-risk industries. While the term “nontechnical skills” may inaccurately represent critical aspects of professional clinical practice (Nestel et al., 2011), for this article, we use the term while acknowledging its limitations.

Key Points

- Online resources such as virtual patients offer learning experiences that are flexible, reproducible and accessible.
- VPs develop undergraduate students’ non-technical skills in teamwork, communication and decision-making.
- Authenticity of emotion, empathy and variability must be considered in VP design.

Understanding of the factors influencing human performance, improved team communication, and support development of solutions for minimizing risks to patients (Flin & Patey, 2009). The development of the Patient Safety Curriculum Guide by the World Health Organization, which aims to build the knowledge and skills of health professionals to better prepare them for safer practice, supports the importance of addressing these concepts in undergraduate health professional programs (Walton, 2011).

Learning through simulation is suggested to provide a robust and effective strategy to successfully develop nontechnical skills (Unsworth, Melling, Allan, Tucker, & Kelleher, 2014) with examples across the learning continuum. Simulation is positively associated with improved communication in handover, the development of leadership skills (Lewis, Strachan, & Smith, 2012), improvements in team behaviors and team performance in crisis situations, and developing situational awareness skills (Lewis et al., 2012).

Simulation has its limitations in undergraduate curricula. Face-to-face simulation approaches are costly, resource intensive for staff, and challenging to schedule when used in an interprofessional approach (Andreatta et al., 2010). Furthermore, there is a risk that implementation of the simulation in relation to facilitation and debriefing approaches may not be standard across the student cohort (Andreatta et al., 2010), and there is often little opportunity for repetitive practice to enable students to develop required knowledge, skills, and attitudes.

Technology-enhanced simulation provides a possible approach to develop nontechnical skills. Technology enhanced simulation is defined as “an educational tool or device with which the learner physically interacts to mimic an aspect of clinical care for the purpose of teaching or assessment” (Cook, Erwin, & Triola, 2010, p. 309). One form of technology-enhanced simulation is the virtual patient. Virtual patients “are interactive computer simulations of real-life clinical scenarios for the purpose of healthcare and medical training, education, or assessment” (Ellaway, Poulton, Fors, McGee & Albright, 2008, p. 1). Virtual patients are flexible, reproducible, can be disseminated across large undergraduate student numbers, and permit access to essential, but at times unavailable, clinical situations for practice and learning (Posel, Fleiszer, & Shore, 2009).

Virtual patient learning outcomes have historically been focused on developing knowledge and diagnostic and clinical reasoning skills (Cook et al., 2010). Diagnostic or clinical reasoning is a complex process “based on knowledge, experience, and other important contextual factors” that along with history, physical assessment, results of laboratory testing and imaging studies, assist the practitioner to develop a mental picture of the presenting case, and make a diagnosis about the patient’s presenting condition (Cox, Irby, & Bowen, 2006, p. 2218). The decision-making referred to in the nontechnical skills literature is not exclusively related to a patient situation and is defined as the “skills for reaching a judgement to select a course of action or make a diagnosis about a situation” (Flin, Glavin, Maran, & Patey, 2003, p. 13). This integrative review focuses on the learning outcomes of virtual patients, whose aim was to develop nontechnical skills, including situational awareness, decision-making (excluding clinical or diagnostic reasoning), communication, teamwork, leadership, managing stress, and coping with fatigue.

The Study/Review

There is considerable literature on the integration of virtual patients into health professional curricula; however, there is little evidence on how interactions with virtual patients develop nontechnical skills.

Aim

This integrative review aims to describe and synthesize literature regarding the use of virtual patient methodology to support learning nontechnical skills in undergraduate health professional education.

Design

Integrative review methods summarize “empirical and theoretical literature to provide a comprehensive
understanding of a particular phenomenon or healthcare problem” (Svavarsdottir, 2006, p. 351) to form new perspectives (Torraco, 2005). The protocols for review, including search terms, data extraction tables, were jointly devised. The searching, quality appraisal, data extraction, and synthesis were primarily undertaken by the first author.

Data Extraction

A standardized format was used to extract data from the studies including author, publication date, country of origin, research question, aim, population and sample, research design, study findings as well as included definition of virtual patient, and educational pedagogy. This structured approach allowed succinct organization of the data to enable “comparison and incorporation of findings from a variety of research methods” (Stubbings, Chaboyer & McMurray, 2012). Extracted data were displayed in a table (Table 2, see online extra available at www.nursingsimulation.org) to permit visualization of patterns and relationships (Whittemore & Knaff, 2005). Data were compared using thematic analysis to generate initial codes. Emerging themes were identified, and data were clustered around these themes (Whittemore & Knaff, 2005). Final themes were identified and confirmed with primary sources and conflicting evidence identified (Whittemore & Knaff, 2005).

Quality Appraisal

Quality was assessed using the criteria identified in Buckley et al. (2009) who developed a series of 11 quality indicators related to study design, conduct, results, analysis and conclusion. Each indicator was rated as being present or absent. Higher quality studies were identified as meeting 7 of the 11 indicators.

Search Methods

The databases of CINAHL, MEDLINE, ProQuest Central, Scopus, Journal@OVID, and Wiley were searched in July, 2014. The search used the following terms in full text: “virtual patient,” “virtual simulated patient,” “virtual simulation” combined with “nontechnical skills,” “human factors,” “communication,” “teamwork,” “leadership,” “decision-making,” and “situational awareness.” The search was limited to publications from the Year 2000 onward. While technology, software, and online educational activities have developed since the year 2000 to include avatars and virtual worlds, the fundamental concept of virtual patients as an interactive computer simulation of a real clinical situations remains (Table 1).

Results

Search Outcomes

Eight hundred and forty-nine potential publications were identified after the removal of duplicates. Review of titles and abstracts led to 767 exclusions, which did not meet the inclusion criteria. Forty articles were sourced from hand-searching references and expert referral. One hundred and twenty-two articles underwent full article review, of which 94 were excluded. Sixty-one articles were excluded as they did not report learning outcomes from teaching utilizing virtual patients, and 15 articles reported on postgraduate programs. Twelve articles reported data published in other original publications. Three articles were in a language other than English, two articles did not report using virtual patients, and one article was published before 2000. In total, 28 articles were included in the integrative review.

Synthesis

Papers originated from United States (n = 17), Australia (n = 4), Sweden (n = 4), Iran (n = 1), United Kingdom (n = 1), and the Netherlands (n = 1). Fifteen studies used quantitative methods and eight studies used mixed methods, with five studies using qualitative approaches. Articles were primarily from undergraduate medical education programs. There were also reports from nursing and pharmacy programs and interprofessional practice. Refer to Table 2 (see online extra available at www.nursingsimulation.org) for an overview of extracted data.

Two common definitions of virtual patients were identified in the review. In four articles (Deladisma et al., 2007; Djukic, Fulmer, Adams, Lee, & Triola, 2012; Lang, Kogan, Berman, & Torre, 2013 Stevens et al., 2006), the virtual patient was described in accordance with Cook and Triola (2009, p. 304) as a “computer program that simulates real-life clinical scenarios; learners emulate the roles of health care providers to obtain a history, conduct a physical examination, and make diagnostic and therapeutic decisions.” Four articles (Edelbring, Dastmalchi, Hult, Lundberg, & Dahlgren, 2011; Foronda, Gattamorta, Snowden, & Bauman, 2014; Orr, 2007; Youngblood et al., 2008) described the virtual patient in accordance...
with Ellaway et al., (2008, p. 1) as “interactive computer simulations of real-life clinical scenarios for the purpose of healthcare and medical training, education, or assessment.” No information regarding the defining characteristics of virtual patients was identified in 17 articles. The second definition supports flexibility in the development of interactions with virtual patients to meet the learning needs of undergraduate health professionals to develop the various knowledge, skills, and attitudes of non-technical skills required for competent, safe practice.

The remaining three articles used a classification system identifying virtual patients employed in the program as falling into either a problem-solving or narrative category (Bearman, 2003; Bearman Cesnik, & Liddell, 2001; Sijstermans, Jaspers, Bloemendaal, & Schoonderwaldt, 2007). The virtual patients in the problem-solving category aim to develop clinical reasoning or diagnostic skills by enabling the learner to gather information and data via a health history and conduct physical examinations and investigations to make diagnostic and management decisions regarding the case (Bearman, 2003; Bearman et al., 2001; Sijstermans et al., 2007). This approach often represents the patient as a case and not a person and can disembodiment the psychosocial aspects of patient care (Bearman, 2003). The second category, the narrative approach, uses a cause-and-effect approach over a period of time (Bearman, 2003; Bearman et al., 2001; Sijstermans et al., 2007). This approach usually depicts a patient’s story over a period of time enabling the user to follow the progression of a patient’s journey and can portray consequences of actions and decisions (Bearman, 2003). The narrative approach enables learners to experience the psychosocial aspects of the patient encounter to develop a greater sense of empathy, build rapport with the participants in the simulation (Bearman, 2003), and support the human interaction experienced in clinical situations to develop communication skills (Bearman et al., 2001).

Communication skills (n = 20) were identified as the aim of virtual patient education activities followed by teamwork and teamwork skills (n = 4). The remaining non-technical skills included decision-making, complex communication, and interpersonal behavior (n = 1). The predominant virtual patient methodology was the use of text interaction interspersed with video-based vignettes (n = 8), followed by avatars in Second Life (n = 6). Other methodology included life-sized fully interactive digital avatars projected onto wall with speech recognition (n = 5), text with images (n = 4), and an online 3D environment avatar (n = 4). Virtual patient methodology was not described in two articles.

The teaching and learning activities surrounding the virtual patient were divided equally between students working as individuals (n = 12) and working in groups (n = 12). Data for four articles were not available. Group numbers of students varied between two (n = 4), four (n = 7), and five (n = 1).

Many studies concerned the efficacy of interactions with virtual patients to teach communication skills. Statistically significant results were reported in communication skills development overall, p < .001 (Orr, 2007). Bearman, Cesnik, and Liddell (2001) noted that learners who interacted with the virtual patient in the narrative category had higher communication scores than those who interacted with virtual patients in the problem-solving category, 1 week after the interaction, p = .034 (Bearman et al., 2001). In addition, significant results are reported for students in the narrative group compared with the problem-solving group in asking open-ended questions, p = .048, and use of appropriate language was significantly different for the narrative group as compared with baseline, p = .017 (Bearman et al., 2001). There was no difference asking core questions between students who interacted with a virtual patient or a simulated patient (SP), p = .05 (Bernard et al., 2006). Students demonstrated increased confidence with history-taking when compared with the control group, p < .05 (Deladisma et al., 2007) and improvement in using a standardized approach to communication from Performance 1 to Performance 2, p < .001 (Foronda et al., 2014). Confidence and abilities of student verbal skills developed when compared with baseline, p = .001, (Orr, 2007) and knowledge improved when compared with baseline, p < .0001 (Sanders et al., 2007, 2008). It is important to note that Kidd, Kinsley, and Morgan (2012) demonstrated a significant correlation between technical difficulties and student learning, p = .01.

Statistically significant results were reported in the ability of the interaction with the virtual patient to develop empathy in students when the virtual patient was displayed

| Table 3 Themes From Thematic Analysis |
| Theme | Subtheme |
| Communication skills | 1. Reinforce or teach new communication skills |
| | 2. Practise communication skills |
| | 3. Build confidence with communication skills |
| | 4. Develop specific verbal and nonverbal communication skills |
| Teamwork | 1. Promote interaction and collaboration with peers |
| | 2. Develop team communication skills |
| | 3. Clarify roles |
| | 4. Develop team skills |
| Decision-making | Socialization into the professional role |
| Transfer of learning to the clinical setting | Authenticity |
| | 1. Realism |
| | 2. Student reactions |
| | 3. Emotion |
| | 4. Empathy |
| | 5. Variability |
Table 4  Virtual Patient Methodology and Communication Skills

<table>
<thead>
<tr>
<th>Subtheme</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reinforce or teach new communication skills</td>
<td>The virtual patient can be used to focus on (Kidd et al., 2012) and teach communication skills (Bearman, 2003; Botezatu et al., 2010; Kidd et al., 2012), and there has been a consistent use of virtual patients to develop communication skills ($p = .48$) in the United States (Lang et al., 2013). Orr (2007) reported statistically significant results in the development of communication skills when compared with baseline ($p &lt; .001$), and this improvement is significantly greater in narrative virtual patients ($p = .034$) when compared with problem-solving virtual patients (Bearman, 2003). However, Botezatu et al. (2010) report that students felt virtual patients were not an appropriate tool for developing communication skills. Through the interaction with the virtual patient, students reported improved understanding of the interviewing process, the use of questions, language, and communication in general (Liaw et al., 2000; Orr, 2007). The interaction with the virtual patient developed skills in interview structure (Edelbring et al., 2011; Sweigart et al., 2010), a better flow in their communication (Foronda et al., 2014), and promoted interaction in respectful and appropriate manner (Courteille et al., 2014). Some students reported activity with the virtual patient as not valuable, as communication is human skill (Bearman, 2003).</td>
</tr>
<tr>
<td>Practise communication skills</td>
<td>Interaction with the virtual patient provided students with the opportunity to practise communication skills in a clinical context to promote student preparation for actual clinical encounters (Bearman, 2003; Edelbring et al., 2011) or with simulated patients (SPs; Stevens et al., 2006). Students reported that the ability to practice with a virtual patient before an encounter with a real person was of benefit in their interaction with the patient (Deladisma et al., 2007; Mack et al., 2007). Facilitators report that students who interacted with a virtual patient were more prepared and had increased self-confidence on presentation to the clinical setting (Sweigart et al., 2014). Furthermore, virtual patients offered the opportunity for repetitive practice in a safe and secure learning environment to promote skill development and expertise (Mack et al., 2007).</td>
</tr>
<tr>
<td>Build confidence with communication skills</td>
<td>Students identified that the interaction with the virtual patient improved their confidence to use communication skills in conducting tasks in the clinical setting with patients but also assisted with developing confidence in general conversations (Sweigart et al., 2014). Students also reported that interacting with a virtual patient significantly improved their confidence in history taking ($p &lt; .05$; Deladisma et al., 2009) and the confidence and abilities of students verbal communication skills ($p \leq .001$; Orr, 2007). Student who interacted with a virtual patient before an SP had significantly lower blood pressure ($p &lt; .05$); however, no differences in anxiety were reported (Mack et al., 2007).</td>
</tr>
<tr>
<td>Developing specific verbal and nonverbal communication skills</td>
<td>Interactions with the virtual patient enabled students to practice specific interviewing techniques, ask open-ended questions (Bearman et al., 2001; Orr, 2007), ask specific questions (Bernard et al., 2006; Stevens et al., 2006), develop interpersonal communication of emotional states ($p = .001$), achieve positive affective learning outcomes (Courteille et al., 2014), develop skills in using identification, situation, background, assessment and recommendations ($p = .001$; Foronda et al., 2014), and motivational interviewing (Villaume et al., 2006). Students reported that their level of awareness of the use of particular words was heightened (Liaw et al., 2000; Orr, 2007) through interacting with virtual patient. Student who interacted with virtual patients demonstrated greater use of questions (Sweigart et al., 2014) and performed significantly better in history taking in comparison with students who had no virtual patient interaction and remained in the clinical setting ($p &lt; .001$; Vash et al., 2007). Three studies reported that the use of virtual patients in learning enabled students to develop, recognize, and demonstrate nonverbal cues and behaviors (Deladisma et al., 2007; Mack et al., 2007; Stevens et al., 2006). The use of life-sized virtual patients was identified as enabling students to demonstrate nonverbal communication behaviors, recognize life like gestures (Deladisma et al., 2007; Stevens et al., 2006), and observe and interpret body language and nonverbal cues (Liaw et al., 2000). Interactions with virtual patients developed interphysician communication (mean 4.16 on a five-point Likert scale; Sijstermans et al., 2007).</td>
</tr>
</tbody>
</table>

life sized on a large screen as compared with a smaller screen. The interaction with the larger virtual patient generated stronger body lean toward the “patient” $p < .001$, stronger interpersonal communication of emotional states, $p = .001$, and improved communication skills, $p = .007$ (Courteille, Josephson, & Larsson, 2014). However, it is important to note that interactions with SPs generated greater empathy than interactions with virtual patients, $p < .05$ (Deladisma et al., 2007), with more head nodding, $p < .05$, and leaning forward, $p < .05$. There was also higher immersion, anxiety, attitude to patient, and clearer questions in interactions between student and SP as compared to interactions with the virtual patient, $p < .05$ (Deladisma et al., 2007).
Team training with virtual patients also demonstrated statistically significant improvement in teamwork, \( p = .01 \), with no difference between students who interacted with a virtual patient or a human patient simulator (Heinrichs, Youngblood, Harter, & Dev, 2008). This finding was supported by Youngblood et al. (2008) who also reported significant improvement in team skills of students interacting with a virtual patient as compared with human patient simulation, \( p \leq .05 \). Orr (2007) reported that the interaction with the virtual patient generated significant awareness of and improvement in teamwork, \( p = .001 \), when compared with baseline. Interactions with the virtual patient also developed skills of students in collaborating with a colleague to plan and implement care to a significant level, \( p = .000 \) when compared with baseline (Sijstermans et al., 2007).

The thematic analysis revealed three themes related to learning outcomes, a fourth related to socialization, a fifth related to transfer of learning, and a sixth theme related to authenticity (Table 3).

**Theme 1—Communication Skills**

The impact of interactions with virtual patients on communication skills was the focus of the majority of articles in this review (n = 20). Seven articles concluded that interactions with virtual patients have the capacity to prepare (Bearman, 2003; Sweigart, Burden, Carlton, & Fillwalk, 2014), develop (Kidd et al., 2012; Liaw, Kennedy, Keppell, Marty, & McNair, 2000; Sweigart, Hodson-Carlton, Campbell, & Lutz, 2010), and enhance (McCallum, Ness, & Price, 2011; Vash, Yunesian, Shariati, Keshvari, & Harirchi, 2007)
communication skills in undergraduate health professionals to a statistically significant level (Bearman et al., 2001; Bernard et al., 2006; Deladisma et al., 2007; Foronda et al., 2014; Orr, 2007; Sanders et al., 2007, 2008; Sweigart et al., 2012; Foronda et al., 2014). However, in opposition to these findings, one set of focus group participants believed that communication skills be directly developed in other ways, and the main role of virtual patients is clinical reasoning (Botezatu, Hult, & Fors, 2010; Table 4).

Theme 2—Teamwork

Thirteen articles included in the review report findings that indicate interactions with virtual patients promote the development of teamwork behaviors and skills. Three articles identified that the implementation of learning activities using virtual patients resulted in a statistically significant improvement in teamwork skills of students involved in the study when compared with baseline (Heinrichs et al., 2008; Orr, 2007; Youngblood et al., 2008). Utilization of virtual patients in learning activities promotes interaction, collaboration, and development of teamwork skills such as discussion before action, questioning of others, listening, and considering alternative actions (Rogers, 2011). The interaction with the virtual patient increased awareness of team communication (Djukic et al., 2012; Foronda et al., 2014) which was particularly evident when student worked in groups to complete the virtual patient assignment (Table 5).

Theme 3—Decision-Making

Six articles reported outcomes related to developing decision-making skills. Active decision-making activities integrated into the virtual patient interaction enabled students to apply critical thinking and decision-making skills by choosing interventions from the “driver’s seat” (Edelbring et al., 2011) and prepared students for the rigors of making decisions in the clinical setting (Heinrichs et al., 2008; Table 6).

Theme 4—Socialization Into the Professional Role

An unforeseen outcome from interactions with the virtual patient was the initiation of students into the personal and professional complexities of real clinical practice (Bearman, 2003). Students reported the interaction with the virtual patient enabled them to adopt the role of the nurse (Rogers, 2011) and feel like a nurse (Sweigart et al., 2010). Virtual patients learning activities provided an avenue for the novice practitioner to feel part of their discipline and socialized into their role (Sweigart et al., 2010).

Theme 5—Transfer of Learning to the Clinical Setting

Four articles highlighted the ability of interactions with virtual patients to support the transfer of knowledge to the clinical setting (Edelbring et al., 2011), and these interactions developed transferrable skills (Botezatu et al., 2010; Table 6).

---

**Table 6  Virtual Patient and Learning Outcomes—Socialization Into the Role and Transfer of Learning to the Clinical Setting**

<table>
<thead>
<tr>
<th>Theme</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Decision-Making</strong></td>
<td>Student reported that they learnt how to make decisions from the interactions with the virtual patient (Sijstermans et al., 2007). Less guidance in the virtual patient enabled students to make more decisions (Bearman, 2003) and supported active decision-making from the driver’s seat (Edelbring et al., 2011). Interactions with the virtual patient enable students to make decisions about management and explore consequences of those decisions on patient outcomes (Heinrichs et al., 2008). Student felt that the decisions made with the virtual patients would be the same in the clinical setting and appreciated the impact of poor communication on decision-making (McCallum et al., 2011). The interaction with the virtual patient developed student confidence in making decision and prepared student to go out and make decisions in the clinical setting (McCallum et al., 2011).</td>
</tr>
<tr>
<td><strong>Socialization into the professional role</strong></td>
<td>Virtual patients were identified as a resource to initiate students into the personal and professional complexities of the clinical setting (Bearman, 2003), and the interaction was seen as a transitory step in coping with clinical reality (Edelbring et al., 2011). Student reported that the interaction with the virtual patient provided preparation for the real life as doctors (Botezatu et al., 2010) and that the experience accords well with real doctor—patient relationships (Deladisma et al., 2007; Stevens et al., 2006). Students reported that the interaction with the virtual patient enabled students to adopt the role of the nurse (Rogers, 2011) and feel like a nurse (Sweigart et al., 2010). Virtual patients learning activities provided an avenue for the novice practitioner to feel part of their discipline and socialized into their role (Sweigart et al., 2010).</td>
</tr>
<tr>
<td><strong>Transfer learning to the clinical setting</strong></td>
<td>Student felt that the knowledge acquired from the interactions with the virtual patient was transferrable to real patients and developed transferrable skills (Botezatu et al., 2010). Working with virtual patients supported transferring knowledge and skill into practice (Edelbring et al., 2011), application of theory to practice (McCallum et al., 2011), and transition from the classroom to the clinical setting (Sweigart et al., 2014).</td>
</tr>
</tbody>
</table>
Table 7 Virtual Patient Methodology and Authenticity

<table>
<thead>
<tr>
<th>Subtheme</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Realism</td>
<td>Student felt that the virtual patients were real (Bearman, 2003) and authentic (Stevens et al., 2006). They engaged in the activity as if it was really happening (Bearman, 2003) and took the activity seriously as if they were really there (Heinrichs et al., 2008; Stevens et al., 2006). Student felt that there was adequate realism to suspend disbelief (Heinrichs et al., 2008) and that physiology models were realistic (Youngblood et al., 2008). Virtual patients that were perceived as real were trustworthy, not fictitious and similar to real clinical situations (Courteille et al., 2014; McCallum et al., 2011). While student felt that the virtual patient was comparable to real interactions (Deladisma et al., 2007), students rated interactions with virtual patients lower than those with simulated patients (SPs; Bernard et al., 2006). Student felt that the virtual patient should reflect real clinical practice, be localized to the cultural context, and based on real cases (Botezatu et al., 2010). The virtual patient as a person was able to make an impact on students (Edelbring et al., 2011). Video recordings were reported to add to the realism of the virtual patient (Botezatu, et al., 2010) as they could talk, move, and had a presence (Courteille et al., 2014). In addition, a life-sized virtual patient with speech and hand gestures was perceived as more authentic (Stevens et al., 2006). Conversely, other student reported that the virtual patient lacked presence (Edelbring et al., 2011), and they did not like the virtual patient as it caused frustration in not being able to read facial expression adequately (Kidd et al., 2012).</td>
</tr>
<tr>
<td>Student reactions</td>
<td>Students were able to react to virtual patients; however, differences in the reactions were reported (Bearman, 2003). Behavior was reported as less genuine than with a real patient (Courteille et al., 2014) and as lacking emotion (Deladisma et al., 2007).</td>
</tr>
<tr>
<td>Empathy</td>
<td>Interactions with virtual patients are able to elicit an empathic response from students including statements, head nodding, and eye contact (Deladisma et al., 2007; Stevens et al., 2006), and students were able to experience the importance of empathy (Liaw et al., 2000). Virtual patients who are displayed on a large screen are noted to elicit greater body lean associated with empathy (p &lt; .001; Courteille et al., 2014). However, other research findings identify that students struggled responding empathetically to virtual patients (Sijstermans et al., 2007) and that the number of empathic responses of students is less with virtual patients than that with SPs (Deladisma et al., 2007).</td>
</tr>
<tr>
<td>Emotion</td>
<td>Interactions with virtual patients can elicit emotional responses, positive (Bearman, 2003) and negative (Bearman, 2003), and these emotions can include embarrassment, fear, irritation, and anxiety (Stevens et al., 2006). Evidence indicates that the empathic responses from students lacked emotion (Deladisma et al., 2007) which was attributed to the lack of complexity and presence of the virtual patient (Edelbring et al., 2011). Stevens et al. (2006) identified that the life-sized virtual patient had more capability to produce emotional effects, and Deladisma et al. (2007) reported that SPs produce more emotional responses than virtual patients. Interactions with virtual patients can produce anxiety in learners (Heinrichs, et al., 2008; Stevens, et al., 2006); however, the level of anxiety is less than that produced with SPs (Deladisma et al., 2007).</td>
</tr>
<tr>
<td>Variability</td>
<td>An issue identified with virtual patients is the lack of variability and complexity (Bearman, 2003). The use of prefabricated responses (Bearman, 2003) and reduced interactivity (Sijstermans et al., 2007) produces a sense of structured processes rather than the unstructured reality of clinical practice (Edelbring et al., 2011). Potential outcomes of this lack of variability include the representation of the clinical setting and situations as being neat and well ordered (Edelbring et al., 2011).</td>
</tr>
</tbody>
</table>

Theme 7—Authenticity

Many of the virtual patients and the interactions were perceived as realistic and presented realistic learning opportunities. Students reported that it felt like “I was there,” and that they were interacting with a real live patient (Bearman, 2003) which prompted the students to take the activity seriously (Heinrichs et al., 2008). Although the interaction with the virtual patient was perceived as realistic, there were times that students did not react as they would with a real patient (Bearman, 2003), and the interaction would be less genuine (Deladisma et al., 2007). Conversely, two articles reported that the interaction with the virtual patient does not reflect the richness of a real interaction with a patient in the clinical setting (Botezatu et al., 2010, Sijstermans et al., 2007; Table 7).

Discussion

The review suggests that interactions with virtual patients successfully and meaningfully develop three of the seven nontechnical skills outlined in this article including communication, teamwork, and decision-making skills of undergraduate health professional students. In addition, interactions with virtual patients can socialize student into their professional role and assist with transfer of knowledge to practice in the clinical setting. Authenticity is an important component to be considered in the design and implementation of virtual patients.

Overall, the findings of the review indicate that virtual patients in the narrative category present opportunities to develop nontechnical skills in learners. The narrative approach highlights the psychosocial aspects of the human interactions experienced in clinical situations and
consequences of decisions. Interactions with virtual patients in the narrative category significantly developed communication skills as compared to interactions with virtual patients in the problem-solving category (Bearman et al., 2001).

Sequencing refers to how learning activities are ordered and highlights how important it is for learning activities to increase in both complexity and diversity (Boling, Hough, Krinsky, Saleem, & Stevens, 2012). Teaching and learning activities should be sequenced to enable knowledge, skills, and attitudes to be developed and built on one another. Scheduling the virtual patient interaction appropriately in a learning sequence enabled students to be prepared for encounters (Bearman, 2003). Students who interacted with virtual patients before real patients demonstrated significant improvement in confidence with history-taking (Deladisma et al., 2007) and verbal skills (Orr, 2007). In addition, students who interacted with a virtual patient before a real person or patient demonstrated decreased anxiety (Deladisma et al., 2007), greater ability to use appropriate techniques (Stevens et al., 2006), and were able to recognize, interpret, and demonstrate appropriate nonverbal behaviors (Deladisma et al., 2007; Liaw et al., 2000; Stevens et al., 2006).

It has been established that poor team performance and a lack of clear and well understood roles, alongside poor team leadership negatively affects the quality and safety of patient care (Manser, 2008; Paige, 2010) particularly when group work approaches are used. Group work approaches require students to use active learning methods including discussion, debate, and exploration. The learning activities with a virtual patient fostered a deeper appreciation and understanding of the student’s role within a team and the role of other health professional in the team (Lang et al., 2013), and skills and behaviors required to effectively function as a member of a team (Rogers, 2011).

An aspect of the virtual patient revealed in the integrative review that impacted on student engagement and learning is the concept of authenticity. The ability to situate the simulation in a realistic setting may heighten learner engagement with the activity (Bradley, 2006), with the widespread belief that the more the simulation mimics the real clinical setting, the greater the engagement and learning (Dieckmann, Gaba, & Rall, 2007). However, authenticity and realism is not only achieved via physical resemblance; it is an integration of the physical, conceptual, and experiential fidelity present in the simulation activity that creates the realism experienced by the participant (Dieckmann et al., 2007). Students reported that the interaction with a life-sized virtual patient felt authentic (Stevens et al., 2006). The life-sized virtual patient elicited statistically significant higher empathic responses in the interaction than interactions with virtual patients displayed on a small screen (Courteille et al., 2014). However, it is important to note that compared with the virtual patient, SPs elicited a more genuine empathic response, more authentic attitude, and clearer questions (Deladisma et al., 2007). Liaw et al. (2000) confirm this finding, reporting students responded emotionally in interactions with virtual patients, and this enabled the student to appreciate the role of empathy in the clinical setting. Authenticity of virtual patients may be achieved through realistic scenarios that are trustworthy and not fictitious to trigger emotional responses from students enabling them to recognize and deal with their emotional responses to specific situations and those of others (Por, Barriball, Fitzpatrick, & Roberts, 2011).

Authenticity of virtual patients also has its limits. The contemporary clinical setting is fast paced, fluid, and at times unpredictable (Rhodes & Curran, 2005). Students report that the interaction with the virtual patient does not reflect the richness of a real interaction with a patient in the clinical setting (Botezatu et al., 2010; Sijstermans et al., 2007). Interactions with the virtual patients can lack variability and complexity (Bearman, 2003), and can be seen as structured rather than resembling the unpredictable reality of clinical practice (Edelbring et al., 2011). Conversely, other students reported that the interactions with the virtual patient required quick thinking (Kidd et al., 2012). Designing simulations which provide learners with a sense of the unpredictability of the clinical environment is an area for future research.

Strengths and Limitations of This Review

Comprehensive search strategies and data abstraction techniques were used, and the resulting synthesis presents important factors to be considered when using virtual patients in learning activities to develop nontechnical skills. However, there were also limitations including, all articles retrieved were in English, and a single reviewer completed the search, data collection, and extraction. Still, rigorous multiple checking of data extraction was completed throughout the review process. While quality assessment is not an integral part of integrative review methodology (Whittemore & Knaff, 2005), the thematic analysis was derived from the findings without consideration of study quality, and there is a risk that the analysis includes studies with invalid findings due to weak design. Finally, as the focus of this review was on learning outcomes, factors such as time and cost of development are not discussed. Synthesizing the literature to understand the relative gains of virtual patients against the cost of development is an area for future research.

Conclusion

This integrative review indicates that interactions with virtual patients are associated with improved learning outcomes related to nontechnical skills in particular,
communication, teamwork, and decision-making. The findings suggest that the virtual patient method is applicable to various disciplines and may play a significant role in preparing students for practice and development of individual schema enabling transfer of learning of nontechnical skills to new situations. Learning nontechnical skills from interactions with virtual patients may require consideration of the educational design of the simulation experience, the sequencing of learning activities surrounding the virtual patient, and the challenges faced in representing the unstructured, unpredictable nature of the clinical environment in a simulation setting.

Supplementary Data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.ecns.2016.04.004.

References


Lang, V., Kogan, J., Berman, N., & Torre, D. (2013). The evolving role of online virtual patients in internal medicine clerkship education nationally. Academic Medicine, 88(11), 1713-1718.


Sijstermans, R., Jaspers, M., Bloemendaal, P., & Schoonderwaldt, E.


2.12 Update to integrative review

Since the publication of the integrative review in 2016, there has been evolution in the application of virtual patients to develop aspects of non-technical skills. Following an extension of the search conducted in the original review using the same key words and databases, 17 papers were identified that met the inclusion criteria, published since 2015 (Table 2.2).

Findings

The majority of papers similarly emanated from the USA (n=11) (Allaire, 2015; Breen & Jones, 2015; Caylor, Aebersold, Lapham, & Carlson, 2015; Foster et al., 2016; Foster et al., 2015; Kleinsmith, Rivera-Gutierrez, Finney, Cendan, & Lok, 2015; Kron et al., 2017; Nicely, 2015; Reis, Faser, & Davis, 2015; Shoemaker, Platko, Cleghorn, & Booth, 2014; Strekalova et al., 2017), with two papers from Sweden (Pantziaras, Fors, & Ekblad, 2015; Sunnqvist et al., 2016) and one each from Canada (Wong, Leslie, Soon, & Norman, 2016), Australia (Quail, Brundage, Spitalnick, Allen, & Beilby, 2016), Slovenia (Sobocan & Klemenc-Ketis, 2015) and Brazil (Menendez et al., 2015). The main theme of virtual patient education remains the development of communication skills (n=9); however, there has been an increase in the reported use of virtual patients to develop aspects of teamwork (n=4) which correlates with the increase in the number of papers that have a multiprofessional audience (n=6) (Table 2.3).

Findings identified extensions to the categories of non-technical skills achieved from virtual patient interactions identified in the original integrative review (Peddle, Bearman, & Nestel, 2016) including situation awareness (Breen & Jones, 2015) and leadership skills (Breen & Jones, 2015; Wong et al., 2016), with virtual patient applications also eliciting student development of reflective skills to improve practice (Breen & Jones, 2015; Sunnqvist et al., 2016) (Table 4).

Similar to the 2016 publication, virtual patient interactions are deemed useful to socialise students to their professional role upon entering into the clinical setting (Kron et al., 2017; Reis et al., 2015; Sunnqvist et al., 2016) and evidence continues to support learning transfer from the virtual patient to different contexts of care (Allaire, 2015; Kron et al., 2017; Menendez et al., 2015; Pantziaras et al., 2015; Shoemaker et al., 2014). Authenticity remains an important concept for learning with virtual patients, with the relevance of the virtual patient for clinical practice and its ability to reflect real clinical situations and practice, an important motivator in learning (Pantziaras et al., 2015; Quail et al., 2016; Reis et al., 2015; Sobocan & Klemenc-
Ketis, 2015). Using virtual patients to develop empathy and empathic responses appears to be gaining traction (Foster et al., 2016; Kleinsmith et al., 2015; Strekalova et al., 2017).

Interestingly, in this update, concepts relating to teaching and learning using virtual patients appeared to be more prevalent. Findings suggest that for novice learners, facilitator support is required to guide learning (Foster et al., 2016; Menendez et al., 2015; Sobocan & Klemenc-Ketis, 2015) and that the complexity of the virtual patient needs to be tailored to learning needs (Kron et al., 2017). Learning is maximised by providing opportunities for individual feedback, discussion and debriefing (Kron et al., 2017; Pantziaras et al., 2015; Sunnqvist et al., 2016). Further, the development of a safe and positive environment facilitates student exploration and integration of new learning with old (Allaire, 2015).
Table 2.2: Integrative review update

<table>
<thead>
<tr>
<th>References</th>
<th>Settings</th>
<th>Country</th>
<th>Study design</th>
<th>Methodology</th>
<th>NTS</th>
<th>Findings</th>
<th>Limitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allaire, J. L. (2015). Assessing Critical Thinking outcomes of dental hygiene students utilizing virtual patient simulation: A mixed methods study. <em>Journal of Dental Education, 79</em>(9), 1082-1092.</td>
<td>Senior dentistry students</td>
<td>USA</td>
<td>Mixed methods pre-test post-test with follow-up student survey</td>
<td>Virtual patient was branching decision tree and included written narratives, patient interviews, photographs and radiographs</td>
<td>Critical thinking and decision-making</td>
<td>More than one-third of the participating students scored at least two points higher on the post-test than the pre-test. However, this is not statistically significant (p=0.075). Students found the virtual patient sessions to be a positive educational experience (86.7% agreed or strongly agreed the virtual patient improved their critical thinking and perceived virtual patient simulation to be an effective teaching method to promote critical thinking, problem-solving, and confidence in the clinical realm). Students reported the interaction contributed to building their critical thinking skills and confidence in making good clinical decisions with 73.4% reporting increased confidence in treating patients.</td>
<td>Small convenience sample, no control group.</td>
</tr>
<tr>
<td>Breen, H., &amp; Jones, M. (2015). Experiential learning: Using virtual simulation in an online RN-to-BSN program. <em>Journal of Continuing</em></td>
<td>Senior nursing students</td>
<td>USA</td>
<td>Program evaluation</td>
<td>Patient stories including pictures, video clips, medical records</td>
<td>Leadership and teamwork, collaboration</td>
<td>Interactions with virtual patients developed reflection skills to improve practice and situation awareness to pick up cues from patients and family. Leadership skills were reported</td>
<td>Nil reported.</td>
</tr>
<tr>
<td>References</td>
<td>Settings</td>
<td>Country</td>
<td>Study design</td>
<td>Methodology</td>
<td>NTS</td>
<td>Findings</td>
<td>Limitation</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>---------</td>
<td>-------------------------------</td>
<td>---------------------------------</td>
<td>----------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td><em>Education in Nursing</em>, 46(1), 27-33. doi:10.3928/00220124-20141120-02</td>
<td>Fourth-year pharmacy, nursing &amp; medical students</td>
<td>USA</td>
<td>Mixed methods with pre-test post-test design and observational data</td>
<td>Second life</td>
<td>Teamwork and multi-professional collaboration</td>
<td>Following student interactions with the virtual patient, student perceptions and attitudes to teamwork improved across all five subscales of the Teamwork Attitudes Questionnaire. Interactions with virtual patients enabled students to function in effective teams and demonstrated an understanding of team member roles. Students were able to ask clarifying questions of their health profession teammates. Students reported awareness of the need to plan communication efforts as a team before error disclosure. Students reported intentions to seek interdisciplinary input, coordinate teamwork and team communication in the future.</td>
<td>Nil reported</td>
</tr>
<tr>
<td>Caylor, S., Aebersold, M., Lapham, J., &amp; Carlson, E. (2015). The use of virtual simulation and a modified TeamSTEPPS™ training for multiprofessional education. <em>Clinical Simulation in Nursing</em>, 11(3), 163-171. doi:10.1016/j.ecns.2014.12.003</td>
<td>USA</td>
<td>Mixed methods with pre-test post-test design and observational data</td>
<td>Second life</td>
<td>Teamwork and multi-professional collaboration</td>
<td>Following student interactions with the virtual patient, student perceptions and attitudes to teamwork improved across all five subscales of the Teamwork Attitudes Questionnaire. Interactions with virtual patients enabled students to function in effective teams and demonstrated an understanding of team member roles. Students were able to ask clarifying questions of their health profession teammates. Students reported awareness of the need to plan communication efforts as a team before error disclosure. Students reported intentions to seek interdisciplinary input, coordinate teamwork and team communication in the future.</td>
<td>Nil reported</td>
<td></td>
</tr>
<tr>
<td>References</td>
<td>Settings</td>
<td>Country</td>
<td>Study design</td>
<td>Methodology</td>
<td>NTS</td>
<td>Findings</td>
<td>Limitation</td>
</tr>
<tr>
<td>------------</td>
<td>----------</td>
<td>---------</td>
<td>--------------</td>
<td>-------------</td>
<td>-----</td>
<td>----------</td>
<td>------------</td>
</tr>
<tr>
<td>Foster, A., Chaudhary, N., Kim, T., Waller, J. L., Wong, J., Borish, M., . . . Buckley, P. F. (2016). Using virtual patients to teach empathy: A randomized controlled study to enhance medical students' empathic communication. <em>Simulation in Healthcare: The Journal of The Society for Medical Simulation</em>, 11(3), 181-189.</td>
<td>First-year medical students</td>
<td>USA</td>
<td>Quantitative RCT</td>
<td>Online text-based interface</td>
<td>History taking and empathic communication</td>
<td>Human-assisted intervention offering immediate feedback on empathy after the virtual patient interaction significantly increases overall empathy (p=0.0277). Students who had human feedback elicited significantly more empathic opportunities in an SP interaction (p=0.0005) and demonstrated higher empathy in response to these opportunities. Empathetic scores to the virtual patient corresponded to responses in real clinical patient interaction in the clinical setting.</td>
<td>One institution with a small sample.</td>
</tr>
<tr>
<td>Foster, A., Chaudhary, N., Murphy, J., Lok, B., Waller, J., &amp; Buckley, P. F. (2015). The use of simulation to teach suicide risk assessment to health profession trainees—rationale, methodology, and a proof of concept demonstration with a virtual patient. <em>Academic Psychiatry</em>, 39(6), 620-629.</td>
<td>Second-year medical students</td>
<td>USA</td>
<td>Quantitative RCT</td>
<td>Tri-dimensional characters with text interaction</td>
<td>Interviewing skills</td>
<td>Virtual patients improve students’ assessment of suicide risk with 88.2% of the students who interacted with a virtual patient asking about suicide when they interviewed a bipolar simulated patient. However, satisfaction score for the virtual patient was significantly lower (p=0.007). Students reported it was hard to establish meaningful dialogue with some responses directing.</td>
<td>Nil reported</td>
</tr>
<tr>
<td>References</td>
<td>Settings</td>
<td>Country</td>
<td>Study design</td>
<td>Methodology</td>
<td>NTS</td>
<td>Findings</td>
<td>Limitation</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>---------------------------</td>
<td>-------------</td>
<td>-------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>--------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Kleinsmith, A., Rivera-Gutierrez, D., Finney, G., Cendan, J., &amp; Lok, B. (2015). Understanding empathy training with virtual patients. <em>Computers in Human Behavior, 52</em>, 151-158.</td>
<td>Third-year medical students</td>
<td>USA</td>
<td>Quantitative program evaluation study with pairwise comparison</td>
<td>Web-based interface with image and text based interaction</td>
<td>Empathy</td>
<td>Third-year medical students expressed significantly higher levels of empathy with virtual patients than with simulated patients (p=0.000). Virtual patients can be implemented to develop empathetic communication skills as they present low risk, low pressure learning opportunities.</td>
<td>No control group and small sample size.</td>
</tr>
<tr>
<td>Kron, F. W., Fetters, M. D., Scerbo, M. W., White, C. B., Lypson, M. L., Padilla, M. A., . . . , Belfore, L. A., . . . (2017). Using a computer simulation for teaching communication skills: A blinded multisite mixed methods randomized controlled trial. <em>Patient Education &amp; Counseling, 100</em>(4), 748-759. doi:10.1016/j.pec.2016.10.024</td>
<td>Second-year medical students</td>
<td>USA</td>
<td>Mixed methods RCT</td>
<td>Avatar based verbal interactions with video and verbal response</td>
<td>Interprofessional communication</td>
<td>Students significantly improved their verbal and non-verbal communication skills for both the intercultural (p&lt;0.0001) and interprofessional (p&lt;0.0001) scenarios. OSCE evaluators rated the communication skills of virtual patients trained students significantly higher (p=0.003) demonstrated ability to transfer learning to different contexts. Students displayed effective communication such as non-verbal facial expressions like smiling and head nodding. Students liked the interactivity and information was retained over a period of time. Students reported working through realistic scenarios before practice as helpful to prepare for clinical encounters. Results</td>
<td>Different time on task between groups, and exposure intervals.</td>
</tr>
<tr>
<td>References</td>
<td>Settings</td>
<td>Country</td>
<td>Study design</td>
<td>Methodology</td>
<td>NTS</td>
<td>Findings</td>
<td>Limitation</td>
</tr>
<tr>
<td>------------</td>
<td>----------</td>
<td>---------</td>
<td>--------------</td>
<td>-------------</td>
<td>-----</td>
<td>----------</td>
<td>------------</td>
</tr>
<tr>
<td>Menendez, E., Balisa-Rocha, B., Jabbur-Lopes, M., Costa, W., Nascimento, J. R., Dosea, M., . . . Lyra Junior, D. (2015). Using a virtual patient system for the teaching of pharmaceutical care. <em>International Journal of Medical Informatics, 84</em>(9), 640-646.</td>
<td>Pharmacy, nursing &amp; medicine students</td>
<td>Brazil</td>
<td>Program evaluation</td>
<td>Web-based text interaction</td>
<td>Communicatio n skills</td>
<td>More than 80% of the participants agreed or strongly agreed that the virtual patient promoted learning. Students reported that virtual patients enabled them to apply theory to practice. However, they felt the resource was complementary to learning and should not replace interactions with real patients. Facilitators were noted by students as important to the learning process in guiding them and providing feedback.</td>
<td>Nil reported</td>
</tr>
<tr>
<td>Nicely, S. (2015). Fostering learning through interprofessional virtual reality simulation development. <em>Nursing Education Perspectives</em>, <em>36</em>(5), 335-336. doi:10.5480/13-1240</td>
<td>Nursing and medical students</td>
<td>USA</td>
<td>Qualitative open ended survey</td>
<td>Graphics, text, and audio sound bites</td>
<td>Interprofessional collaboration</td>
<td>Promoted communication and collaborative skills. Developed role clarity and understanding of triage requirements. Proved to be a strategy for enhancing knowledge, skills and attitudes to interprofessional teamwork and communication.</td>
<td>Nil reported</td>
</tr>
<tr>
<td>References</td>
<td>Settings</td>
<td>Country</td>
<td>Study design</td>
<td>Methodology</td>
<td>NTS</td>
<td>Findings</td>
<td>Limitation</td>
</tr>
<tr>
<td>------------</td>
<td>----------</td>
<td>---------</td>
<td>--------------</td>
<td>-------------</td>
<td>-----</td>
<td>----------</td>
<td>------------</td>
</tr>
<tr>
<td>Pantziaras, I., Fors, U., &amp; Ekblad, S. (2015). Training with virtual patients in transcultural psychiatry: Do the learners actually learn? <em>Journal of Medical Internet Research</em>, 17(2), e46.</td>
<td>Medical</td>
<td>Sweden</td>
<td>Quantitative pre-test post-test</td>
<td>Video recordings triggered by questions asked.</td>
<td>PTSD and communication skills</td>
<td>There was a statistically significant improvement in performance from pre-test to post-test on communication and PTSD symptoms (p&lt;0.001). The active engagement of student in realistic environment enhances learning.</td>
<td>Small sample size, no control group.</td>
</tr>
<tr>
<td>Quail, M., Brundage, S. B., Spitalnick, J., Allen, P. J., &amp; Beilby, J. (2016). Student self-reported communication skills, knowledge and confidence across standardised patient, virtual and traditional clinical learning environments. <em>BMC Medical Education</em>, 16, 73.</td>
<td>Third-year speech pathology students</td>
<td>AUS</td>
<td>Mixed methods RCT with pre/post questionnaire</td>
<td>Conversation al virtual patient controlled by facilitator</td>
<td>Communication skills</td>
<td>The results from this study demonstrated that students in both simulated conditions (simulated patients and virtual learning environments) reported similar increases in self-perceived communication skills, knowledge and confidence. However, students rated their satisfaction with the virtual patient lower due to less realism and lack of natural interactions resulting in lower engagement and enjoyment. Students experienced challenges with the lack of diversity in the virtual patient responses and experienced challenges with developing rapport.</td>
<td>Inconsistencies were reported between each interaction.</td>
</tr>
<tr>
<td>References</td>
<td>Settings</td>
<td>Country</td>
<td>Study design</td>
<td>Methodology</td>
<td>NTS</td>
<td>Findings</td>
<td>Limitation</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------</td>
<td>--------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
<td>--------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Reis, P. J., Faser, K., &amp; Davis, M. (2015). A framework for web-based interprofessional education for midwifery and medical students. <em>Journal of Midwifery &amp; Women's Health</em>, 60(6), 713-717.</td>
<td>Midwifery and medical students</td>
<td>USA</td>
<td>Mixed methods pre-test, post-test and follow-up survey</td>
<td>Web-based interaction with audio, image and video files</td>
<td>Inter-professionality</td>
<td>Interprofessional groups of learners were presented with the opportunity to learn more about each other’s roles, and many students were introduced to the core competencies for interprofessional education and interprofessional collaborative practice. Findings indicated the virtual patient enables students to meet despite disparate schedules and diverse locations whenever it was convenient for their schedules. Student indicated the cases resembled those they meet in practice and the low pressure environment supported learning.</td>
<td>Nil reported.</td>
</tr>
<tr>
<td>References</td>
<td>Settings</td>
<td>Country</td>
<td>Study design</td>
<td>Methodology</td>
<td>NTS</td>
<td>Findings</td>
<td>Limitation</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------</td>
<td>-------------------</td>
<td>-------------</td>
<td>-----------------------------------</td>
<td>-------------</td>
<td>-----</td>
<td>--------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Sobocan, M., &amp; Klemenc-Ketis, Z. (2015). Family medicine education with virtual patients: A qualitative study. Acta Informatica Medica, 23(4), 202-205.</td>
<td>Fourth-year medical students</td>
<td>Slovenia</td>
<td>Qualitative focus groups</td>
<td>Not specified</td>
<td>Not specified</td>
<td>Learning via virtual patient interaction is well structured and has relevance to clinical practice. However, disadvantage included being unable to discuss answers with staff, lack of reliability as to how real patient would react in practice and at times lack of applicability to the cultural context. Virtual patients actively engage students to focus on the task. Student with less clinical experience required more discussion to clarify the situation and their understandings.</td>
<td>Potential bias from moderator of focus group.</td>
</tr>
<tr>
<td>References</td>
<td>Settings</td>
<td>Country</td>
<td>Study design</td>
<td>Methodology</td>
<td>NTS</td>
<td>Findings</td>
<td>Limitation</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------</td>
<td>---------------------------------</td>
<td>---------</td>
<td>-----------------------</td>
<td>-----------------------------------</td>
<td>----------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>Strekalova, Y. A., Krieger, J. L., Kleinheksel, A. J., &amp; Kotranza, A. (2017). Empathic communication in virtual education for nursing students. <em>Nurse Educator</em>, 42(1), 18-22. doi:10.1097/NNE.0000000000000308</td>
<td>Nursing students</td>
<td>USA</td>
<td>Mixed methods analysis of transcripts of conversation and empathic responses</td>
<td>Text based interaction</td>
<td>Empathic communication</td>
<td>Student provided empathic responses to 33.54% suitable opportunities. These findings suggest that empathy as a learnt skill can be incorporated into learning via a virtual patient.</td>
<td>Nil reported</td>
</tr>
<tr>
<td>Sunnqvist, C., Karlsson, K., Lindell, L., &amp; Fors, U. (2016). Virtual patient simulation in psychiatric care – A pilot study of digital support for collaborate learning. <em>Nurse Education in Practice</em>, 17, 30-35. doi:10.1016/j.nepr.2016.02.004</td>
<td>Fourth-semester nursing students</td>
<td>SWEDEN</td>
<td>Mixed methods interviews and questionnaire</td>
<td>Web-SP</td>
<td>Interviewing skills</td>
<td>Student responded favourable to use of virtual patients in mental health nursing (M=6.9±1.4). They found the flexibility useful to train anywhere. They felt it was good to be able to ask questions of the virtual patient and they had to consider which question they needed to ask. Virtual patients can promote students’ independent knowledge development, critical thinking, reflection and problem-solving ability. Virtual patients can also support collaborative learning for nursing students in mental health nursing. Students appreciated the ability to repeat the activity, and to learn from mistakes and master their fear in building therapeutic relationships. Faculty reported</td>
<td>Nil reported</td>
</tr>
<tr>
<td>References</td>
<td>Settings</td>
<td>Country</td>
<td>Study design</td>
<td>Methodology</td>
<td>NTS</td>
<td>Findings</td>
<td>Limitation</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>-------------</td>
<td>-----------------------------------</td>
<td>------------------------------</td>
<td>----------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Wong, E., Leslie, J. J., Soon, J. A., &amp; Norman, W. V. (2016). Measuring interprofessional competencies and attitudes among health professional students creating family planning virtual patient cases. <em>BMC Medical Education</em>, 16(1), 273.</td>
<td>Midwifery, nursing, pharmacy, and medicine students</td>
<td>Canada</td>
<td>Mixed methods survey and interviews</td>
<td>Web-based interactive module</td>
<td>Working in interprofessional teams</td>
<td>Significantly higher post-project scores as compared to the baseline surveys in the health advocate (p=0.05), manager (p=0.02), and medical expert (p=0.03). Statistical significance was observed for the domains in interprofessional communication (p=0.04), role clarification (p=0.01), team functioning (p=0.05), and collaborative leadership (p=0.01). Students reported an increase in their level of confidence in communicating with colleagues. Participant reported interaction with the virtual patient identified communication and respect as two important attributes to successful interprofessional work. Students identified that respect supports open communication and sharing of ideas. Participants reported an increase in their level of confidence when communicating with other team members, while remaining respectful of group.</td>
<td>Small sample size, with participants received incentives for participation. No blinding</td>
</tr>
<tr>
<td>References</td>
<td>Settings</td>
<td>Country</td>
<td>Study design</td>
<td>Methodology</td>
<td>NTS</td>
<td>Findings</td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>----------</td>
<td>---------</td>
<td>--------------</td>
<td>-------------</td>
<td>-----</td>
<td>----------</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>diversity. Virtual patients enabled role clarification among the students and understanding of other professional roles.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Limitation</td>
<td></td>
</tr>
</tbody>
</table>

diversity. Virtual patients enabled role clarification among the students and understanding of other professional roles.
Table 2.3: Themes from integrative review update.

<table>
<thead>
<tr>
<th>Themes</th>
<th>Subthemes</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication</td>
<td>1. Reinforce or teach new communication skills</td>
<td>Interactions with the virtual patient enabled students to understand the need to plan communication efforts as a team before error disclosure (Caylor et al., 2015) and improved students’ assessment of suicide risk (Foster et al., 2015). Students successfully improved their communication skills for both the intercultural and interprofessional scenarios (p&lt;0.0001; Kron et al., 2017). Students who had interacted with a virtual patient were rated significantly higher on their communication skills in OSCE (p= 0.003; Kron et al., 2017).</td>
</tr>
<tr>
<td></td>
<td>2. Practise communication skills</td>
<td>Virtual patients promoted the importance of effective communication skills (Nicely, 2015; Sunnqvist et al., 2016) and clarified that it involves non-verbal facial expressions like smiling and head nodding (Kron et al., 2017). Students were able to practise asking clarifying question to their peers (Caylor et al., 2015) and the virtual patient enabled opportunities for students to practise writing communications (Menendez et al., 2015). However, some students reported it was difficult to establish dialogue and rapport with the virtual patient (Foster et al., 2015).</td>
</tr>
<tr>
<td></td>
<td>3. Build confidence</td>
<td>Students reported increase in their communication confidence (Quail et al., 2016) and confidence in communication skills with other professions (Shoemaker et al., 2014; Wong et al., 2016).</td>
</tr>
<tr>
<td></td>
<td>4. Develop specific verbal and non-verbal</td>
<td>Interactions with the virtual patient enabled students to develop verbal and non-verbal communication skills, such as smiling and head nodding (Kron et al., 2017) and to consider the correct question to ask in the context of the clinical situation (Sunnqvist et al., 2016). Students reported interactions with virtual patient promoted interprofessional communication skills (Nicely, 2015; Wong et al., 2016), and open communication and sharing ideas (Wong et al., 2016).</td>
</tr>
<tr>
<td>Teamwork</td>
<td>1. Promote interaction and collaboration with peers</td>
<td>Virtual patients enabled students to function in effective teams (Caylor et al., 2015), promoted team collaborative skills (Breen &amp; Jones, 2015; Nicely, 2015; Shoemaker et al., 2014; Wong et al., 2016) particularly in mental health nursing (Sunnqvist et al., 2016). Virtual patients enabled students to be introduced to the core competencies for interprofessional education and interprofessional collaborative practice (Reis et al., 2015). Following interactions, student reported increased comfort level working in an interprofessional team with an increased understanding of how and when they may refer a patient to a different profession (Reis et al., 2015).</td>
</tr>
<tr>
<td>Themes</td>
<td>Subthemes</td>
<td>Evidence</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>----------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>2. Develop team communication skills</td>
<td>Students reported intentions to manage team communication in the future (Caylor et al., 2015) and acknowledged that communication is an important attribute to successful interprofessional work (Wong et al., 2016). Students reported an increase in their level of confidence when communicating with other team members (p=0.04) following the virtual patient interaction (Wong et al., 2016).</td>
<td></td>
</tr>
<tr>
<td>3. Clarify roles</td>
<td>Interactions with virtual patient promoted role clarity and learning more about each other’s roles (Breen &amp; Jones, 2015; Caylor et al., 2015; Nicely, 2015; Reis et al., 2015; Shoemaker et al., 2014; Wong et al., 2016) with clarity on specific team member roles (Caylor et al., 2015). Students reported an increased clarity and depth of understanding of each discipline’s approach to evaluation and treatment (Shoemaker et al., 2014).</td>
<td></td>
</tr>
<tr>
<td>4. Develop team skills</td>
<td>Virtual patients developed awareness of team functioning (Wong et al., 2016) with students indicating intentions to coordinate teamwork in the future (Caylor et al., 2015). Following the virtual patient, students appreciated the role of respect as an important attribute to successful interprofessional work (Wong et al., 2016). Students valued the ability to be respectful of group diversity (Wong et al., 2016).</td>
<td></td>
</tr>
<tr>
<td>Decision-making</td>
<td>Many students agreed or strongly agreed that the use of virtual patients improved their critical thinking skills, problem solving and improved their ability to make good clinical decisions (Allaire, 2015; Sunnqvist et al., 2016).</td>
<td></td>
</tr>
<tr>
<td>Situation awareness</td>
<td>Develop situation awareness to pick up cues from patients and family (Breen &amp; Jones, 2015).</td>
<td></td>
</tr>
<tr>
<td>Leadership</td>
<td>Developed an appreciation for the role of leadership (Breen &amp; Jones, 2015) and understanding of collaborative leadership (Wong et al., 2016) and leadership skills by placing the student in the scenario (Breen &amp; Jones, 2015).</td>
<td></td>
</tr>
<tr>
<td>Reflection</td>
<td>Virtual patients developed skills of reflection (Breen &amp; Jones, 2015) and reflective practice (Sunnqvist et al., 2016) to improve practice.</td>
<td></td>
</tr>
<tr>
<td>Socialisation into the professional role</td>
<td>Virtual patients permitted students to practise working through clinical situations that are common, prior to clinical practice (Kron et al., 2017), to help prepare them for future placements and professional practice (Reis et al., 2015). Students reported that the virtual patient enabled them to get over their fear of practice and prepared them to meet a real patient (Sunnqvist et al., 2016).</td>
<td></td>
</tr>
<tr>
<td>Themes</td>
<td>Subthemes</td>
<td>Evidence</td>
</tr>
<tr>
<td>--------</td>
<td>-----------</td>
<td>----------</td>
</tr>
<tr>
<td>Learning transfer to the clinical setting</td>
<td>Virtual patients promoted confidence in treating patients in the clinical realm (Allaire, 2015) with students less hesitant to approach other profession and ask for a consult or referral (Shoemaker et al., 2014). The virtual patient was seen as an intermediate learning activity between theory and practice with real patients and as a good complement to the theoretical part of the course (Pantziaras et al., 2015). Virtual patients gave opportunities to address gaps in their clinical experience (Pantziaras et al., 2015) and apply theory to practice (Menendez et al., 2015). Students felt more confident treating patients because of their experience with the virtual patient simulation (Allaire, 2015). Students were able to transfer learning from the virtual patient to different contexts demonstrated by improvement in communication skills in OSCEs (Kron et al., 2017).</td>
<td></td>
</tr>
<tr>
<td>Authenticity</td>
<td>1. Realism</td>
<td>The students found interacting with the virtual patient to be interactive and significant with a sense of authenticity (Pantziaras et al., 2015). Active engagement of students in realistic environments enhanced learning (Pantziaras et al., 2015). Students reported the cases were clinically relevant just like the real world (Reis et al., 2015; Sobocan &amp; Klemenc-Ketis, 2015). However, some felt the experience was not consistent with the real clinical setting with lower levels of engagement and enjoyment (Quail et al., 2016), and did not think the system portrayed how a real patient would react (Sobocan &amp; Klemenc-Ketis, 2015).</td>
</tr>
<tr>
<td></td>
<td>2. Student reaction</td>
<td>Students liked the flexibility to learn at home or at the clinical placement and to decide when, how long and how often they wanted to practise with the virtual patient system (Allaire, 2015). The students found it pleasant to be independent and to organise the work on their own (Sunnqvist et al., 2016). Some students felt a more tailor-made individualised experience where there they could disregard topics they felt they had already mastered would be beneficial (Pantziaras et al., 2015).</td>
</tr>
<tr>
<td></td>
<td>3. Empathy</td>
<td>Findings suggest that empathy as a learnt skill can be developed via virtual patient interactions to varying degrees (Strekalova et al., 2017). Virtual patient interaction elicited significantly more empathic responses due to less pressure and stress (Foster et al., 2016; Kleinsmith et al., 2015). Training with VPs first could make subsequent interactions with a real patient less stressful and may help the students identify empathetic opportunities in future interactions with real patients (Kleinsmith et al., 2015). Empathy scores elicited with virtual patient are similar to those in real clinical patient interactions (Foster et al., 2016).</td>
</tr>
</tbody>
</table>
2.13 Gaps identified by this review

This review has begun to identify the significant potential of virtual patients to develop other areas of health professional practice required for safe and competent clinical practice (Cook et al., 2013). However, to progress the application of virtual patients to wider areas of learning there needs to be systematic evaluation and exploration of interaction with virtual patients to determine other possible aspects of healthcare practice that can be developed effectively.

Research is needed to determine the non-technical skills categories and elements that can be developed in undergraduate health professionals following interactions with virtual patients. Similarly, further research is needed to explore the learning experience when interacting with virtual patients, the effective activities that students engage in and how that engagement impacts on educational outcomes (Ellaway & Davies, 2011). In addition, examination of the impact of the sequencing and design of the virtual patient on learning and how the design of
the virtual patient impacts of learning outcomes related to non-technical skills (Cook et al., 2013; Ellaway & Davies, 2011) needs addressing. Finally, empirical research is needed to investigate faculty perspectives regarding how they can support student learning knowledge, skill, attitudes and practice of non-technical skills via interaction with virtual patients.

2.14 Summary

In this chapter, literature in relation to non-technical skills, undergraduate health professionals and application of virtual patient methods has been explored. This review demonstrated that non-technical skills, including communication, teamwork, situation awareness, leadership and decision-making, have been achieved from interactions with virtual patients. Additionally, the review identified significant themes recognised in the literature, including socialisation to professional practice, learning transfer, learning beyond the virtual patient and authenticity, that support learning outcomes related to non-technical skills. The findings of the integrative review provided the theoretical constructs for the current research and informed the development of the research methods. The next chapter describes and justifies the methodology and methods employed in this research.
Chapter 3 Theoretical Foundations, Methodology and Methods

3.0 Introduction

This chapter presents the theoretical foundations for this research—the pragmatic paradigm informed by constructivism. The student researcher’s worldview, including values, reality, knowledge and reasoning approaches, are outlined. A discussion about how these align with the pragmatic paradigm and constructivism follows. Finally, this chapter clarifies the student researchers place in the research and outlines the use of reflexivity to ensure research quality.

This chapter also outlines the methodology and methods selected to answer the research questions. It identifies the purpose of the research, discusses the methodology underpinning the study and presents evidence to justify the use of the selected methodology, describing how it aligns with the conceptual framework. Details of the research methods and design are described, including units of analysis, participants, data collection and data analysis. The chapter concludes by outlining the measures taken to ensure credibility and rigour of the research, and related ethical considerations.

3.1 Theoretical foundations

We all have assumptions or theories about the way things are and how the world works. And whether we are aware of it or not, we bring these assumptions to our research (Creswell, 2013). It is part of a researcher’s responsibility to articulate these positions explicitly through a conceptual framework. Theoretical frameworks provide the central tenet to a thesis (Leshem, 2007). They provide a guide for viewing the research as a whole and underpin all aspects of the research, providing a platform from which the researcher demonstrates intellectual and methodological rigour (Durham, Sykes, Piper, & Stokes, 2015). These frameworks enable a researcher to move from a descriptive position to conceptualisation of their research (Leshem, 2007).

3.2 Paradigm

The word ‘paradigm’ has multiple meanings and uses in social research. However, all ‘versions treat paradigms as shared belief systems that influence the kinds of knowledge researchers
seek and how they interpret the evidence they collect" (Morgan, 2007, p. 50). Identifying the paradigm underpinning research ensures that all elements in the research align, by providing a frame and process through which the investigation is completed (Weaver & Olson, 2006). It also provides readers with a base for understanding the findings and critiquing the conclusions (Ling & Ling, 2017).

In this research paradigm represents a worldview, “an all-encompassing way of experiencing and thinking about the world including beliefs about morals, values and aesthetics” (Morgan, 2007, p. 50). Additionally, in this research the paradigm signifies “a set of concepts that form a pattern or model that reflect the world view underpinning a particular subject or pursuit” (Ling, 2017a, p. 23). The paradigm through which this research was viewed, is the pragmatic paradigm informed by constructivism.

The rise of pragmatism as an explicit worldview originated from the paradigm debate, referred to as the paradigm wars of the 1970s (Corry, Porter, & McKenna, 2018). During this time, debate raged over the ascendency of the positivist paradigm in research and the importance placed on one absolute, inviolable truth (Corry et al., 2018). The debate saw challenges to the positivist approach as a means of understanding the world (Corry et al., 2018) and the realisation that reality can never truly be known (Weaver & Olson, 2006). These challenges led to the identification of other paradigms in research including interpretivist/constructivist, transformative, pragmatic and postpositivist (Corry et al., 2018). The pragmatic paradigm has risen in popularity with the increase in mixed methods research, as it allows for mixing of methods to meet research aims (Attree, 2006).

In the pragmatic paradigm, the research purpose and research question drive research design (Creswell, 2013; Ling & Ling, 2017) with the value of an idea, determined by its outcome and conduct in practice (Weaver & Olson, 2006). The methods employed are directed by the needs of the research itself (Biddle & Schafft, 2014; Creswell, 2013). However, researchers should be clear about what method best answers their research question and how (Maudsley, 2011). Research conducted within this paradigm focuses inquiry into practical questions in search of useful answers (Patton, 2015) to improve specific aspects of practice (Ling, 2017b). Pragmatic research positions methodological appropriateness over methodological orthodoxy (Creswell, 2013; Hills, Levett-Jones, Warren-Forward, & Lapkin, 2016; Morgan, 2007; Patton, 2015; Tashakkori & Teddlie, 2008) as “a pragmatist researches what interests them in a way that is appropriate and utilises results in a way that has positive consequences” (Mertens, 2009, p. 26). There is a focus on critical analysis of fact and application and on identifying what works in practice (Weaver & Olson, 2006).
Additionally, Ling and Ling (2017) propose that the pragmatic paradigm can borrow from other paradigms to inform and enable what works best in the research. In this research, the tenets of constructivism are used to inform the studies (Patton, 2015). In a constructivist paradigm the emphasis of the research is focused on the phenomenon under investigation (Ling & Ling 2017). Knowledge is perceived as that which is constructed by the individual or group and that multiple interpretations can exist (Patton, 2015). This dominant assumption of the social construction of reality emphasises that research in a constructivist paradigm needs to be conducted via interaction between the researcher and researched (Mertens, 2009a). Efforts are made to collect multiple perspectives that are compared and contrasted, forcing revisions to previously held ideals (Mertens, 2009).

3.2.1 Axiology

Axiology refers to the “specific value position, motivations, ethical issues, intentions and drivers or purposes of the researcher” (Ling & Ling, 2017, p. 45). In the pragmatic paradigm, values play a major part in conducting research and synthesising the results (Biddle & Schafft, 2014, p. 323; Johnson & Onwuegbuzie, 2004). Pragmatic researchers proceed from their own values position using whatever methods they perceive will bring about the best outcomes for their research (Ling & Ling, 2017). The aim of the research is to answer the research question in a useful and practical way (Patton, 2015) through whatever means are most effective (Ling & Ling, 2017). Pragmatists value engaging with many communities to gain understanding from different perspectives (Mertens, 2009). Similarly, the constructivist paradigm acknowledges the role that values of the researcher play in the research (Mertens, 2009). In the constructivist paradigm the outcomes identified are not independent of the researcher (Mertens, 2009). Additionally, the constructivist paradigm also includes the participants’ values as an important aspect of the research, which should be uncovered and made transparent (Lincoln & Guba, 2013). Application of a constructivist approach assists the researcher to present a balanced and fair representation of the participants’ views, values and beliefs about the research (Given, 2008; Mertens, 2009).

Axiology is a particularly important construct in my research, as I am the lead of the resource under investigation. I value the role of non-technical skills and the impact they have in clinical practice and the place of undergraduate health professionals in safe and quality care. I hold the belief that all individuals are intelligent, have inherent worth and decency. I also value structure, practical applications and useful outcomes that can inform changes in practice, and appreciate the role of the systematic investigation of meaning, how something works and the lived experience of others. The pragmatic paradigm aligns with my axiology, as it works for the
problem being investigated, has practical application and engages people in the field in which it is conducted (Ling & Ling, 2017).

3.2.2 Ontology

In the pragmatic paradigm, the concept of reality is avoided, sidestepped (Feilzer, 2010; Mertens, 2009), or in some cases rejected (Hills, Levet-Jones, Warren-Forward, & Lapkin, 2016). This flexibility enables researchers to be free of intellectual and practical restraints as they are not prisoners of a specific method or approach (Feilzer, 2010). Reality in pragmatic paradigm is reliant on the “realization of a valued outcome in a given context” (Ling & Ling, 2017, p. 31). Pragmatism does not aim to find truths or causal links, but to interrogate a phenomenon with the most appropriate method (Feilzer, 2010). It relies upon the fact that the results work for the problem being investigated (Mertens & Wilson, 2012). However, in the constructivist paradigm, reality is acknowledged to exist in the minds of the person contemplating the phenomenon (Lincoln & Guba, 2013).

The research will be judged by the effectiveness of research outcomes, “rather than correspondence of finding of some true condition” (Mertens, 2009, p. 37). Truth will be determined by the productive consequences, creating useful results (Patton, 2015). Additionally, the principles of the constructivist paradigm enabled the researcher to attempt to “understand the complex world of the lived experience from the point of view of those who have lived it” (Mertens, 2009, p. 16). The constructivist approach will enable the “concepts of importance in the study to emerge as they have been constructed by the participants” (Mertens, 2009, p. 19).

In this research, primary attention was given to the research questions and what worked, rather than the philosophical stance. I took a reflective stance to pay attention to the empirical realities and locate myself in those realities (Ling & Ling, 2017). I advocated for valuable outcomes from research to improve undergraduate nursing education and ultimately, hopefully patient outcomes. I support the view that there is no one truth, but that reality is constructed in the lived experiences of the research participants. I declare an ontological flexibility with no commitment to one view of reality (Ling & Ling, 2017; Mertens, 2009).

3.2.3 Epistemology

Meaning is created from the interaction between the individual and the object. Pragmatists do not believe that there is any one particular way to create knowledge (Ling & Ling, 2017). The pragmatist researcher interacts with diverse members of the community to learn about each
person, how they understand the phenomenon and the potential consequences of different courses of action (Mertens, 2009). Pragmatists are concerned with understandings particular to the situation explored (Ling & Ling, 2017). The pragmatic paradigm emphasises the consequences of actions and real-world utility of the research (Lavelle, Vuk, & Barber, 2013). Outcomes of this research were aimed towards finding answers to practical, concrete, real-world problems that are useful and inform actions (Patton, 2015).

Additionally, the tenets of constructivism enable the research to consider the meaning made by the individual mind and the unique experience of the individual (Crotty, 1998). Constructivism espouses that an individual’s way of making sense of the world “is valid and worthy of respect as any other” (Crotty, 1998, p. 58) and that the participants are central and contribute to the research (Ling & Ling, 2017). Constructivism enabled knowledge to be created by the interaction of the participants and the phenomenon in a particular context (Lincoln & Guba, 2013; Patton, 2015).

In this research, I entered into areas of enquiry to investigate the workability of particular lines of action with findings informing warranted assertions (Morgan, 2007). A defining factor was the focus on what difference it would make to act one way over another (Morgan, 2007; Patton, 2015). I understood knowledge as the individual interpretation of the reality they experienced and therefore that reality may be renegotiated or re-interpreted. My personal position is that what something does and how it works, provides the fundamental evidence to support change.

### 3.2.4 Reasoning Approaches

The pragmatic paradigm stresses critical analysis of fact, applications, actions and outcomes rather than philosophising, abstraction and verbal solutions (Johnson & Onwuegbuzie, 2004; Weaver & Olson, 2006). The choice of the reasoning approach used in pragmatic research is directly linked to the purpose and nature of the research question (Creswell, 2014). Subjective and objective data are valuable in reaching conclusions through inductive and deductive reasoning (Feilzer, 2010; Maudsley, 2011). The importance of common sense and practical thinking are emphasised in the pragmatic paradigm (Mertens, 2009).

In this research, I embraced abductive reasoning, moving back and forth between inductive and deductive reasoning to predict the workability of lines of inquiry (Morgan, 2007). I preserved the principles of uncertainty and flexibility (Feilzer, 2010). Uncertainty supported curiosity and openness to the recognition of unexpected outcomes and findings in the data (Feilzer, 2010). Flexibility supported adaption of the research in phase two to address the findings of the integrative review from phase one (Feilzer, 2010).
3.2.5 Outcomes

Outcomes in the pragmatic paradigm relate to constructed, evidence based, practical solutions that can be expressed as recommendations for action (Ling, 2017a). However, the outcomes may be relative and not absolute as relationships, structures and events investigated are not stable, but subject to change and shifts caused by “precarious and unpredictable occurrences and events” (Feilzer, 2010, p. 9). Pragmatism supports generating theory and then testing it in practice (Weaver & Olson, 2006). Pragmatic research rejects outcomes that are “either completely specific to a particular context that they have no implication for other settings, or some more generalized set of principles” that can be applied to every setting (Morgan, 2007, p. 72). The pragmatic paradigm presents a valuable approach to research in health sciences, as the significance of an initiative is determined by its outcome in practice (Weaver & Olson, 2006).

In this research, the outcomes from pragmatic research take the form of recommendations for practice. Additionally, transferability, the degree to which we can take the findings obtained from one inquiry in a specific context and apply that knowledge in other circumstances, is an important outcome (Morgan, 2007). The outcomes of this research aimed at providing practical solutions for research consumers and application in undergraduate nursing education (Feilzer, 2010).

3.2.6 Relationship of the researcher with the research and researched

In the pragmatic paradigm, it is accepted that values of the researcher will influence interpretation (Maudsley, 2011) and that human subjectivity, human values and context will play a role in the inquiry (Hiles, 2008). There is an implied relationship between the researcher, research and researched with research involving the examination of shared beliefs (Patton, 2015). Additionally, in the pragmatic paradigm there is no forced dichotomy between subjective and objective data; both are important (Morgan, 2007).

In the constructivist paradigm, the researcher and researched are meshed in an interactive process, each influencing the other (Mertens, 2009a). The researcher is viewed as an instrument in the research (Appleton & King, 1997) and develops respectful and genuine rapport with participants to obtain rich and deep data (Appleton & King, 1997). The researcher needs to be open to cues in the data and to be responsive to advance the research (Appleton & King, 1997).

Intersubjectivity is characterised as the meaningful engagement between subjects (De Jaegher, Pieper, Clénin, & Fuchs, 2017) and is a key element of human science research, that
is dependent on the social relationships of researchers, participants and consumers (Patton, 2015). Intersubjectivity is appropriate in pragmatic research as the tenets of objectivity and/or subjectivity are followed, dependent on the research and researcher (Shannon-Baker, 2016). Similarly, constructivists emphasise intersubjectivity to highlight the social aspect of human knowledge that is created through shared ideas, norms and values (Copeland, 2000).

The nature of the naturalistic inquiry in this research put me in close contact with the research and researched. I did not position myself as distant to the research or the researched (Patton, 2015). I was the instrument of data collection and data interpretation. My values, subjectivity and thought processes played a part in the naturalistic inquiry and may have impacted design, data collection, analysis and interpretation. I took care not to become too involved so that it would cloud my judgement, but maintained a closeness to the research and researched to promote understanding. However, I appreciate that value free qualitative science is difficult to attain, and value the social and human purposes of the research. As this research was built from encounters among subjects, including participants and researchers I employed intersubjectivity (Patton, 2015) to enable “checking and comparing results against other people’s reported experiences” (De Jaegher et al., 2017, p. 495).

Table 3.1: Paradigm for this thesis

<table>
<thead>
<tr>
<th></th>
<th>Pragmatic Paradigm</th>
<th>Constructivist Paradigm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Axiology</strong></td>
<td>Values play a major role in conducting research and synthesising findings. The</td>
<td>Values play a major role The researcher also aims to present a balanced and fair</td>
</tr>
<tr>
<td></td>
<td>driving force is the intent to answer the research question in a practical way.</td>
<td>representation of the views of the participants in the research.</td>
</tr>
<tr>
<td><strong>Ontology</strong></td>
<td>Concept of reality is avoided and researchers espouse ontological flexibility.</td>
<td>Realities are socially constructed and there are multiple constructions of meaning and</td>
</tr>
<tr>
<td></td>
<td>Primary attention is given to the research question. Reality is reliant on valued</td>
<td>knowledge.</td>
</tr>
<tr>
<td></td>
<td>outcomes in a given context.</td>
<td></td>
</tr>
<tr>
<td><strong>Epistemology</strong></td>
<td>No one way to create knowledge. Consequence of actions and real-world utility.</td>
<td>Knowledge can be created by the people active in the research through an interactive</td>
</tr>
<tr>
<td><strong>Reasoning</strong></td>
<td>Abductive</td>
<td>process</td>
</tr>
<tr>
<td><strong>Outcomes</strong></td>
<td>Constructed, evidence based, practical solutions.</td>
<td></td>
</tr>
<tr>
<td>**Relationship of</td>
<td>Intersubjectivity</td>
<td>Meshed in the interaction with the participants.</td>
</tr>
<tr>
<td>researcher to research</td>
<td></td>
<td></td>
</tr>
<tr>
<td>and researched**</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.3 Purpose of the research

Descriptive research aims to describe and analyse a particular phenomena (Yin, 2013). It investigates a situation as it currently exists and identifies attributes of particular phenomena to get an overview of a current status, determine needs and inform decisions about that phenomena (Mertens, 2009). Exploratory research entails gathering data to explore the phenomena and identify themes (Mertens, 2009). It assists in defining questions and understanding the research problem (Yin, 2013).

Descriptive exploratory approaches align with the pragmatic paradigm, as they have minimal control over variables and focus on real-world situations. Additionally, as this research focused on a relatively unstudied area, descriptive exploratory research was advantageous, as the research was informed by the views of the participants (Mertens, 2009; Yin, 2013). A descriptive approach also aligns with this research as it was trying to answer ‘what’ questions.

The phenomenon in this research is defined as the virtual patients from VSPR and the participants are categorised as the undergraduate nursing students and facilitators who participated in the research. The focus of the research was on understanding from participants’ perspectives, the undergraduate nursing students and facilitators, the meanings placed on a particular phenomenon, the virtual patients from VSPR, and their role in developing non-technical skills (Patton, 2015).

3.4 Methodology

My predominant methodology was the case study. Inclusive in case study methodology is undertaking prior, preparatory work that investigates the landscape in which the case study sits, laying the background for the research. A qualitative, particularistic case study based on the tenets published by Merriam (1998) was employed. Merriam defines qualitative research as research conducted to understand “the meaning people have constructed, that is, how people make sense of their world and the experiences they have in the world” (Merriam, 2015, p. 15). Case study research is defined as “an intensive, holistic description and analysis of a single instance, phenomenon or social unit” (Merriam, 1998, p. 27). Case study methodology is focused on discovery, insight and interpretation (Merriam, 1998). A particularistic case study focuses on a particular situation, event or phenomenon or as in this research, a program (Merriam, 2015).

The features of case study methodology include:
1. A clear and bounded case. In this research, the clear and bounded case was the virtual patients in the VSPR, also the phenomenon.

A case in case study research can be a single item or being, or component around which there are clear boundaries (Merriam, 1998). The case could be a person, program, group, community or policy, etc. (Merriam, 1998). The case needs to be a clearly defined and bounded system, which limits data collection (Merriam, 1998).

2. Units of analysis. In this research, the units of analysis were individuals. Individual participants were defined as the first- and third-year nursing students and first- and third-year teaching faculty.

Research design using case studies must also specify the unit or units of analysis within the context of the case under investigation (Mertens, 2015).

3. The construction of the theoretical framework that will guide the inquiry. In this research, this framework was established by the use of categories and elements of non-technical skills established by Flin et al. (2013) and the themes from the integrative review by Peddle et al. (2016).

Case study approaches require conceptual organisation, ideas to identify required understanding, structures to direct data collection and frameworks to guide interpretations (Stake, 1995). Case studies align well with the pragmatic paradigm (Fishman & Neigher, 2003) as the phenomenon of interest and the research question(s) determine method and design (De Chesnay, 2016; Hyett, Kenny, & Dickson-Swift, 2014). Merriam highlights the importance in case study research to “utilize processes that help interpret, sort, and manage information and that adapt findings to convey clarity and applicability to the results” (Harrison, Birks, Franklin, & Mills, 2017, p. 10), supporting a pragmatic approach. Case studies allow for deductive as well as inductive findings, aligning with the pragmatic paradigm (Baskarada, 2014). Meriam’s stance is also in line with a constructivist paradigm as she maintains the philosophical assumption that “reality is constructed by individuals interacting with their social worlds” (Merriam, 1998, p. 6). Additionally, constructivism informs the inquiry as it elucidates the individual experience (Hyett et al., 2014).

Employing case study methodology in this thesis enabled thick and rich descriptions of the case under investigation (Mertens, 2009), that is the virtual patients from VSPR. Case study methodology enabled focusing on the case, the virtual patients, and discovering the significant interactions and factors that are distinctive to virtual patients and developing non-technical skills in undergraduate health professional students. Additionally, case study methodology was suitable in this research as I had minimal control over the events under investigation (Merriam,
Case study approaches investigate phenomena using a naturalistic approach to capture participants’ reflections on an actual encounter (Merriam, 1998). The use of case study approaches are best for describing, exploring and understanding a phenomenon in its real-life context (Anthony & Jack, 2009) answering the research questions of what, how and why a phenomenon is the way it is (Yin, 2013). Finally, case study methodology supported extensive data collection which assisted to unearth new and deeper understandings of the phenomena, the virtual patient and their role in developing non-technical skills in undergraduate health professional students (Mertens, 2015).

However, there are some challenges with case study methodology that needed to be addressed in this thesis. As previously discussed, case studies are appropriate for how, why and what questions, however there needs to be specificity in the research questions to guide relevant data collection. Additionally, careful consideration and discussions were held to ensure clear definitions of the case and units of analysis in each component of the research, to avoid confusion or invalidation of the study (Baskarada, 2014).

### 3.5 Research design

This research employed a two-phase design. Phase one was an integrative review to establish the theoretical framework for the study. Phase two employed intrinsic exploratory case study research methods. Each phase is discussed in detail below.

#### 3.5.1 Phase One

The preparatory work included an integrative review and comparative analysis with findings used to establish the framework for the study. To ensure the framework is able to appropriately refine questions in the case study, the information used needs to be current, mature and original (Baskarada, 2014). This approach also ensured I was familiar with the domains and the theoretical issues relevant to the study (Baskarada, 2014). This framework helped guide data analysis and informed the decision to focus on one profession later, namely undergraduate nursing students.

The research questions guiding this phase of the research were:

1. What is the use of, and learning from, virtual patients related to non-technical skills in undergraduate health professional education?
2. How do standards utilised by the Australian Health Professional Registration Agency (AHPRA) to govern registration for practice address non-technical skills required by
health professionals in patient care situations in acute secondary and tertiary healthcare?

This phase determined the non-technical skills achieved from interactions with virtual patients and themes relating to how virtual patient methodology supports learning non-technical skills in undergraduate health professional education. This phase also described the non-technical skills, deemed critical for safe and competent patient care, in the standards documents for health professions registered with Australian Health Professional Registration Agency (AHPRA), as well as those that were absent or not consistent. The findings were extrapolated to recognise relevant themes from literature regarding virtual patients and non-technical skills, and to identify the necessity for teaching and learning non-technical skills in undergraduate health professional education. Additionally, the findings situated the research within the current context of health professional education in Australia. This work informed the frameworks that provide the conceptual organisation used to directly guide the research in phase two.

3.5.1.0 Conceptual organisation

The conceptual organisation of this study utilised the categories and elements of non-technical skills as developed by Flin et al., (2013). These categories developed include communication, teamwork, leadership, situation awareness, decision-making, coping with stress and managing fatigue. Each category has associated elements. This framework has become an important construct on which performance in non-technical skills has been measured in clinical practice (Flin, 2013).

3.5.1.1 Population and sampling

Those health professions registered with AHPRA were the population of this phase of the research. The professions that practise predominantly in secondary, acute and tertiary care settings were included in the sample. These included the professions of dentistry, nursing, medicine, medical radiation, midwifery, occupational therapy, pharmacy, physiotherapy and podiatry. The acute care context was selected as this is the predominant area of employment for new health professional graduates and makes up a large component of clinical placements for undergraduate health professional students.

3.5.1.2 Data selection

Data collection within this phase of the case study involved document analysis. Document analysis is a qualitative, “systematic procedure for reviewing or evaluating documents, both printed and electronic” (Bowen, 2009, p. 27). This analysis enables data to be examined and interpreted “in order to elicit meaning, gain understanding, and develop empirical knowledge”
and is particularly suited to qualitative case studies (Bowen, 2009, p. 27). The documents used in this research were the competency standards for practice for registration of selected professions with AHPRA. (The documents are located in the public domain.)

### 3.5.1.3 Data analysis

Content analysis using deductive data coding was employed (Bowen, 2009). In this research content analysis was used to systematically code and categorise the textual information in the professional standards documents and describe the characteristics of the documents’ content in relation to non-technical skills (Vaismoradi, Turunen, & Bondas, 2013). The process used in this research involved scanning, understanding and interpretation to organise information into clusters related to the research question (Bowen, 2009). The student researcher reviewed all documents to identify pertinent, meaningful and relevant statements (Bowen, 2009). The categories and elements of non-technical skills developed by Flin et al. (2013) were used as *a priori* codes. Statements within the standards documents were initially coded to category codes and then further coded to element codes. Statements in the standards documents that did not align with a non-technical skills category were coded to an “other” category, such as those concerning technical standards.

Following completion of the qualitative comparative analysis, the student researcher made the decision in collaboration with supervisors to limit the scope of the research and focus on one health profession in the phase two. I am a nurse and involved in the design, development and delivery of undergraduate nursing curricula. It made sense to confine my study to that which was also feasible - to focus on undergraduate nursing students.

### 3.5.2 Phase two

Phase two entailed an intrinsic exploratory case study. I was interested in a particular case (Merriam, 2009), that is, the interaction of undergraduate nursing students with the virtual patients in VSPR to develop non-technical skills. The research questions guiding this phase of the research included:

1. What specific non-technical skills do undergraduate nursing students learn following interaction with the virtual patient?
2. How do interactions with virtual patients influence learning non-technical skills in undergraduate nursing students?
3. How do faculty perceive interactions with virtual patients support student learning and practice of non-technical skills?
I was intent on developing insight, discovery and interpretation of the experience participants had when engaging with the virtual patients (Merriam, 1998). Intrinsic case studies are useful when existing theory does not adequately explain the phenomenon (Merriam, 1998). An intrinsic case study described the specific non-technical skills developed by undergraduate nursing students via interaction with virtual patients, outlined how the experience of interacting with virtual patients influenced knowledge, skill and practice of non-technical skills in students, and examined facilitators’ perceptions of how interactions with virtual patients support development of non-technical skills.

3.5.2.0 Conceptual organisation

Literature reviews provide the needed theoretical frameworks to support case study approaches (Yazan, 2015). They can assist with identifying gaps in the literature and relating them to the research questions (Baskarada, 2014). The conceptual organisation of this case study utilised the themes identified in Peddle et al. (2016), the categories and elements of non-technical skills as developed by Flin et al. (2013) and the findings of the analysis of the health professional standards documents. The themes identified in Peddle et al. (2016), including socialisation to professional role, authenticity and transfer of learning to practice and the categories of non-technical skills developed by Flin et al. (2013), including communication, teamwork, leadership, situation awareness, decision-making, coping with stress and managing fatigue, were used as a priori codes.

3.5.2.1 Units of analysis

The units of analysis in this phase of the research included individual participants, in particular first- and third-year nursing students and faculty. The research group, namely the student researcher and supervisors, determined the units of analysis to enable answering the research question.

3.5.2.2 Population and sampling

The population for this phase of the research was undergraduate nursing students from two sites who had used the VSPR virtual patients, and faculty who had facilitated these learning activities. In this study, non-probability sampling in the form of purposive convenience sampling was used. Using this sampling approach, the student researcher was able to access information-rich participants to gain insight, learn and comprehend from those from which most can be learnt (Merriam, 1998).

As previously mentioned, two sites were selected as both were using virtual patients from VSPR in the first and third years of their undergraduate nursing program. Both sites were
proactive in integrating simulation into undergraduate curricula. Sample sizes in qualitative interviewing are important and can be determined by the aim of the study, the specificity of the sample, the quality and depth of information provided by the participants and the analysis approach (Malterud, Siersma, & Guassora, 2016). The aim of this study was narrow and contained; the participants were specific and provided in-depth dialogues and analysis was detailed, therefore a small number of participants were required (Malterud et al., 2016). A minimum sample size for the research that used one moderator and a guide was estimated to be at least three to six focus groups of six to eight participants for first- and third-year students (Guest, Namey, & McKenna, 2017) and between eight and 16 interviews with faculty (Hennink, Kaiser, & Marconi, 2017) across both sites.

Students across both year levels and at both sites were invited to participate in the research electronically by forum posts on learning management system subject sites and invitations via emails. Subject coordinators at both sites forwarded information electronically to students including the participant information statement and consent form. Additionally, follow-up verbal invitations from the candidate after simulation sessions at both sites were used to recruit participants. Faculty at both sites were invited to participate in interviews and focus group electronically via email from the student researcher.

3.5.2.3 Data collection

Qualitative data collection was undertaken via focus groups and semi-structured individual interviews with data collected from three sources. Undergraduate nursing students in the first and third years of the Bachelor of Nursing programs using focus groups and individual interviews, and faculty who were employed as either continuing or casual academic facilitators of subjects in the Bachelor of Nursing using individual interviews and one focus group across two separate sites.

Soliciting multiple sources of data in a real-life context can give more in-depth understanding of participants’ experiences and perceptions (Yin, 2003) and provide multiple measures of the same construct (Baskarada, 2014). The use of in-depth data from multiple sources also enables findings to be more convincing and more accurate (Baskarada, 2014). Additionally, undertaking this in-depth data collection required only a few cases to be studied which ensures focus can be given to thoroughly examine each case (Mertens, 2009).

Focus groups are interviews with small groups of typically six to eight participants, whereby participants get to hear each other’s comments and are able to respond or add to what they hear (Patton, 2015). Focus groups are characterised by direct interaction between the participants (Patton, 2015). They were used in this research to enable participants to consider
their views in relation to others and obtain high quality data (Patton, 2015). Additionally, focus
groups offered a cost-effective approach to solicit diverse perspectives in relation to using
virtual patients to develop non-technical skills (Patton, 2015). The aim of the focus group was
to explore the experience of students when interacting with virtual patients and the subsequent
non-technical skill knowledge, attitudes and practice developed.

As per Merriam (1998) semi-structured interview uses questions that are more open-ended
which allowed me to respond to emerging situations and new ideas on a topic. Semi-structured
individual interviews are appropriate when studying people’s opinions or perspectives and
experiences, to focus on what is meaningful for them (Kallio, Pietilä, Johnson, & Kangasniemi,
2016). Semi-structured interviews were selected in this research to enable flexibility in order
to understand the perspectives of the participants, namely the faculty and to accommodate
availability of participants (Baskarada, 2014). The ability to probe and improvise research
questions when something interesting or novel emerges in semi-structured individual
interviews was deemed important in this research (Baskarada, 2014; Kallio et al., 2016). An
interview guide was developed based on the literature, to structure discussion and as a tool to
guide data collection across focus groups and interviews for all groups (Kallio et al., 2016)
(Appendices 6, 7 & 8).

Pilot testing may be used to refine “data collection plans with respect to both the content of the
data and the procedures to be followed” (Yin, 2009, p. 92). Any pilot study should reflect on
the outcomes identified and, where necessary, provide ways to integrate lessons into the next
data collection round. The aim of pilot testing the interview and focus group guide was to
ensure adequate coverage and that relevant content was obtained (Kallio et al., 2016). Any
subsequent changes to the data collection processes should be completely and accurately
documented (Baskarada, 2014). The interview and focus group guide were piloted in 2014
with first-year students and faculty, with subsequent changes made to the guide in 2017. A
critique of the initial focus groups and interview transcripts identified a lack of clarity at times
from participants in recalling the virtual patient from VSPR, thus visual reminders were included
to ensure clarity and accuracy in recall. Ground rules were outlined and discussed and
icebreaker activities added to develop an environment of support and collegiality. The changes
made were to enable focus groups to use an inverted funnel process which enables
participants to move from familiar to less familiar concepts to encourage conceptualisation
(Morgan, 2012). Additionally, some of the questions were adjusted to ensure they addressed
the theoretical prepositions to guide data collection using the themes identified in Peddle et al.
(2016), a requirement of case study methodology. The interviews and focus groups entailed
three phases:
1. Orientation – overview of the study and an outline of the interview process.

2. Data gathering – to gather information using the interview and focus group guide.

3. Closing – opportunity for a final summary from the participants with the interviewer presenting key points to confirm accuracy from participants.

All focus groups and interviews were conducted by the student researcher, except one that was facilitated by another faculty member, in a private room at each site, at a convenient time for the participants. A briefing session was held to orientate the additional faculty member to the research and the interview guide. Any confusion from additional faculty was clarified by discussion with the candidate. Focus groups and interviews were predominantly conducted in person, except two. One focus group was conducted using video-conferencing and one interview over the telephone. Seven focus groups and one individual interview were conducted with third-year students comprising 31 participants. Eleven focus groups and one individual interview were conducted with first-year students comprising a total of 40 participants. Focus groups and interview with third-year students ranged from 20 to 53 minutes in duration. Focus groups and individual interviews with first-year students ranged from 14 to 37 minutes in duration. One focus group and twelve individual interviews were conducted with 15 undergraduate nursing education faculty at both sites. Interviews ranged from 11 to 42 minutes while the duration of the focus group was 48 minutes. Of the 45 first-year students, 35 were from University A, comprising nine males and 26 females, and 10 students, all females, from University B. Of the 31 third-year students, 24 were from University B with three males and 21 females, and seven females, from the University A. Contextual notes were made at the time of the focus group and interviews. Other demographic data such as year level and scenarios completed were collected. Each interview and focus group were audio recorded and professionally transcribed. Transcriptions were checked for accuracy against the original audio recording.

3.5.2.4 Data analysis

As per case study protocols, analysis in this research was based on established theoretical propositions (Baskarada, 2014). The aim of the analysis is to generate concepts from the units of analysis which are compared to previously developed theory (Baskarada, 2014). In the context of case studies, “data analysis consists of examining, categorising, tabulating, testing, or otherwise recombining evidence to draw empirically based conclusions” (Yin, 2009, p. 126).
Framework analysis was used to analyse data from the interviews and focus groups. Framework analysis has a history of use in multiple disciplines in health sciences including social policy, psychology healthcare and nursing research (Parkinson, Eatough, Holmes, Stapley, & Midgley, 2016). Framework analysis is suitable for studies that explore the experience of the participants, the significance of the interaction for them and the meanings they attach to it (Parkinson et al., 2016). Additionally, the ability of framework analysis to encompass a priori issues and those that arose in the data were deemed important for this research (Parkinson et al., 2016).

Framework analysis used in this research involved a series of steps including:

1. Transcription – a word-for-word transcription was obtained for all interviews and focus groups. The transcriptions included the content, as the conventions of the dialogue were not necessary.

2. Familiarisation with the interview/focus group - the candidate listened to each audio-recording multiple times, to verify the accuracy of the transcript and to familiarise herself with the data.

3. Coding first transcripts – themes identified in an integrative review by Peddle et al. (2016) and the non-technical skills categories developed by Flin et al. (2013) were used to develop a priori codes in a codebook used as part of the framework to guide analysis of the data (Appendices 9 & 10).

4. Developing a working codebook – themes and patterns were identified in the ‘other’ data, which led to new codes being established and the framework being adapted to address new issues arising in the data on consensus of all researchers (Appendices 9 & 10).

5. Applying the analytical framework (Table 3.2) supported by the code book - coding the data was a process of systematically applying the framework to each transcript to make the data more manageable (Parkinson et al., 2016).

6. Charting data into the matrix - sections of text were identified and assigned to an a priori code using NVivo (QSR International). Data that did not fit with an a priori code were coded to an ‘other’ code.

7. Interpreting the data - following the completion of the framework analysis, an extended analysis of each component of the case study was developed with the final categories codes and elements displayed in a hierarchy. Specific nuances associated with each stage of the research are specified in each paper (Gale, Heath, Cameron, Rashid, & Redwood, 2013).

Framework analysis is a process of consolidation, reduction and interpretation (Merriam, 1998). It can be “adapted for use with deductive, inductive, or combined types of qualitative
analysis” (Gale et al., 2013, p. 119). The aim of the coding process is to classify all data so it can be systematically compared. Additionally, it is important to look for the unexpected in the data when completing inductive coding and not to just code in a literal, descriptive way (Gale et al., 2013). Framework analysis is a flexible supporting thematic analysis, inductive and deductive analysis and comparative analysis. Framework analysis enables themes to be recognized in the data via thematic analysis or established a priori. It supports maintaining an open mind and to be open to ideas and constructs in the data using intuitive thinking whilst ensuring the original constructs are addressed (Srivastava & Thomson, 2009).

Table 3.2: Framework underpinning analysis.

<table>
<thead>
<tr>
<th>Category</th>
<th>Subcategory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication</td>
<td>Reinforce or teach new communication skills</td>
</tr>
<tr>
<td></td>
<td>Practise communication skills</td>
</tr>
<tr>
<td></td>
<td>Build confidence with communication skills</td>
</tr>
<tr>
<td></td>
<td>Develop specific verbal and non-verbal communication skills</td>
</tr>
<tr>
<td>Teamwork</td>
<td>Promote interaction and collaboration with peers</td>
</tr>
<tr>
<td></td>
<td>Develop team communication skills</td>
</tr>
<tr>
<td></td>
<td>Clarify roles</td>
</tr>
<tr>
<td></td>
<td>Develop team skills</td>
</tr>
<tr>
<td>Decision-making</td>
<td>NA</td>
</tr>
<tr>
<td>Leadership</td>
<td>NA</td>
</tr>
<tr>
<td>Situation awareness</td>
<td>NA</td>
</tr>
<tr>
<td>Coping with fatigue</td>
<td>NA</td>
</tr>
<tr>
<td>Managing stress</td>
<td>NA</td>
</tr>
<tr>
<td>Socialisation into professional role</td>
<td>NA</td>
</tr>
<tr>
<td>Learning transfer to the clinical setting</td>
<td>NA</td>
</tr>
<tr>
<td>Authenticity</td>
<td>Realism</td>
</tr>
</tbody>
</table>
As per case study approaches, a case study database was created to store qualitative evidence and a chain of evidence developed to explain how conclusions have been drawn (Baskarada, 2014). The database enables a link from the conclusions presented in the case study report to the preliminary analysis, the qualitative evidence and the original research questions (Baskarada, 2014). The conclusions in this case study were validated upon consensus from all researchers, namely student researcher and supervisors. All researchers examined excerpts of coded data for consistency, coherency and fit with the code. The research team discussed discrepancies or differences and revised or renamed codes as necessary.

### 3.6 Trustworthiness in qualitative research

Trustworthiness is important in qualitative research as data analysis is judgement dependant, it is important to allay doubts and enhance integrity of the results. Risks arise in the research as I was intimately involved in shaping the findings (Patton, 2015). Trustworthiness is the means of “demonstrating the plausibility, credibility and integrity of qualitative research” (Cronin, 2014, p.10). To ensure trustworthiness, the student researcher engaged in a methodical and meticulous search for alternative options, deviating patterns and opposing explanations (Patton, 2015).

Trustworthiness in this research was afforded with abiding by the guidelines regarding case study research methods with clear parameters for the research being stated (Cronin, 2014) and well-informed theoretical frameworks to guide the study (Hyett et al., 2014). Triangulation of findings from the multiple sources of data, (i.e. the units of analysis in this case study) enabled deep understandings of the application of virtual patients to develop non-technical skills (Merriam, 1998). In this research, triangulation involved comparing perspectives and experiences from different participants including first- and third-year nursing students and academic faculty. Concepts identified from different units of analysis using data collected from different sources and at different times were compared and contrasted. This triangulation enabled identification of similarities and differences across the units of analysis.
Peer examination is another process that can be used to facilitate trustworthiness of qualitative research. According to Merriam (1998), peer examination involves asking colleagues to comment and examine the findings of the research as they emerge. In this research, supervisors participated in the data analysis of the various components of the case study engaging in independent data analysis, discussion of findings and providing feedback.

There are four criteria for assessing trustworthiness in qualitative research, namely credibility, dependability, confirmability and transferability. Each is discussed below with the strategies used in this research outlined.

### 3.6.1 Credibility

Credibility relates to how the research findings align with reality and the participants’ interpretations of that reality (Merriam, 1998). Credibility refers to the truth of the data and the accurate representation of the data in the interpretation by the researcher (Polit & Beck, 2014). In this research, I created a database to document all activity surrounding the research including my engagement in the research, the data collected, the analysis process and the conclusions. Multiple researchers were involved in all phases of the research and accepted methods were used, including framework analysis and case study design. Data validation via member checking was not a feature of the research as the focus was on the immersion in the data and recognition of important themes.

### 3.6.2 Dependability

Dependability refers to the extent to which the research findings can be replicated (Merriam, 1998). Additionally, it refers to the consistency of findings generated by the data collected (Cronin, 2014; Merriam, 1998). In this research, detail is supplied to describe the research process to support constancy of data in similar conditions (Polit & Beck, 2014). Additionally, the use of frameworks, such as the categories and elements of NTS, developed external to this research offer affordances for the research to be replicated.

### 3.6.3 Confirmability

Confirmability is the ability of the researcher to demonstrate that the findings of the research align with the data and participant responses (Polit & Beck, 2014). In this research, coded examples from standards documents and rich quotes from participants are presented to depict and evidence themes and categories identified in the research.
3.6.4 Transferability

Transferability refers to how findings identified in qualitative research can be applied to other groups (Polit & Beck, 2014). In this research, transferability is supported by the thick and rich descriptions obtained in the focus groups and individual interviews (Merriam, 1998). Additionally, the multisite design using naturalistic methods supports transferability of findings to other situations (Merriam, 1998).

3.7 Empathic neutrality

As mentioned earlier, the use of naturalistic inquiry put the student researcher in close contact with the research and researched. The student researcher was the instrument of data collection and data interpretation (Patton, 2015). However, if I became too involved it may have clouded judgement. Alternatively, if I was too distant it may have reduced understanding. I was conscious of the role of subjectivity in my thought process and its impact on design, data collection, analysis and interpretation (Darawsheh, 2014). I appreciate objectivity and its aims of value-free science, however it ignores the social and human purposes of research (Patton, 2015). The middle road is suggested to be empathic neutrality. Neutrality, whilst not an easy position to adopt, requires the researcher to be aware of and deal with perceptions, biases and predispositions (Patton, 2015).

A standpoint of empathic neutrality was adopted in this study (Patton, 2015). Empathic neutrality enabled the student researcher to understand the participants’ perspectives and situations without judgement, and supported communication with authenticity, sensitivity, respect, awareness, and responsiveness to build rapport, trust and openness (Patton, 2015). It enabled me to be fully present and focused in the moment (Patton, 2015). An empathic position enabled me to use interpersonal interactions to immerse myself in another world, to understand their experiences and perceptions (Patton, 2015). Interactions in the research were underpinned by an openness to others and a nonjudgmental stance (Patton, 2015). However, it is acknowledged that I inevitably influenced research findings. I was active and involved in the research which enabled generation of insight (Patton, 2015). I was attentive to what was going on and tried to maintain focus on the interaction to enable me to take in what is being said (Patton, 2015). This influence was recognised and minimised through reflexivity (French & Stavropoulou, 2016).
3.8 Reflexivity

Reflexivity in qualitative research is used to establish quality and increase the confidence, congruence and credibility of findings (Darawsheh, 2014). Reflexivity impacts the judgement of the significance of the findings (Patton, 2015). However, there is some contention as to whether reflexivity is a criterion, a tool or a strategy of rigour in qualitative studies (Darawsheh, 2014). When viewed as a criterion, reflexivity is a marker of quality, when viewed as a tool reflexivity promotes quality of qualitative research, when viewed as a strategy reflexivity enables the researcher to ensure credibility of data, dependability of the study and conformability of findings (Darawsheh, 2014). In this study, reflexivity was viewed as a strategy to ensure quality of the research process.

Reflexivity in this thesis refers to “the process of a continual internal dialogue and critical self-evaluation of the researcher’s positionality, as well as active acknowledgement and explicit recognition that this position may affect the research process and outcome” (Berger, 2015, p. 220). Reflexivity entailed self-reflective processes where I looked at my perceptions, including theoretical, political and cultural influences that are the origins of my own voice and perspectives (Patton, 2015). Examining my own thoughts, actions and assumptions allowed me to bring these to a conscious level and develop an awareness of how these may influence the research process (Darawsheh, 2014). Furthermore, reflexivity supported credibility, by making the decisions made and the research process transparent (Darawsheh, 2014; Patton, 2015).

In this research, three avenues were used to address reflexivity: the participants, the audience and the researcher.

**PARTICIPANTS:** How do they know what they know? What has influenced their worldview? How do they perceive me? How do I perceive them?

**AUDIENCE:** How will they make sense of my work? What will they bring to it? How do they perceive me? How do I perceive them?

**RESEARCHER:** What do I know? How do I know it? What shapes my perspectives? How does this perspective shape my data? What voice will I use to share it? (Patton, 2015)

Reflexivity acknowledged the impact that the participants and I had on each other (Darawsheh, 2014) and the need to understand what the effects were and how they impacted on the data (Patton, 2015). In this research, I established and maintained reflexivity by using a self-
reflective process involving questionnaires, completed online using Qualtrics, to examine my internal dialogue and enable a critical self-evaluation of my skills, commitment, framing and positionality in and towards the research. I completed this online questionnaire monthly and utilised the three avenues outlined above to capture my consciousness and self-commentary when immersed in the research. This approach to reflexivity enabled me to be self-aware and permitted employing my skills and attributes to develop rapport with participants to support further exploration of the phenomenon under investigation whilst controlling subjectivity, so as not to impart my views or perceptions on the participants’ data (Darawsheh, 2014).

The following table summarises the phases in the research with the associated research question and provides a rationale to justify the research approach, sampling and data collection.
<table>
<thead>
<tr>
<th>Phase</th>
<th>Research question</th>
<th>Methods</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>How has virtual patient methodology been used to support learning non-technical skills in undergraduate health professional education?</td>
<td><strong>Approach</strong>&lt;br&gt;Integrative review</td>
<td>To enable a synthesis of research findings from studies using different methods and summarise empirical or theoretical literature to provide a comprehensive understanding of a particular phenomenon or healthcare problem (Whittemore &amp; Knafl, 2005).</td>
</tr>
<tr>
<td>1</td>
<td>How do standards utilised by the Australian Health Professional Registration Agency (AHPRA) to govern registration for practice address non-technical skills required by health professional in patient care situations in acute secondary and tertiary healthcare?</td>
<td><strong>Sampling</strong>&lt;br&gt;Databases of CINAHL, MEDLINE, Proquest central, SCOPUS, Journal@OVID and WILEY were searched in July, 2014. The search used: 'virtual patient', 'virtual simulated patient', 'virtual simulation' combined with 'non-technical skills', 'human factors', 'communication', 'teamwork', 'leadership', 'decision-making', and 'situation awareness'&lt;br&gt;<strong>Data collection</strong>&lt;br&gt;Data was extracted using a systematic approach and displayed in a table&lt;br&gt;<strong>Analysis</strong>&lt;br&gt;Thematic analysis</td>
<td><strong>Data collection</strong>&lt;br&gt;<strong>Analysis</strong>&lt;br&gt;Thematic analysis</td>
</tr>
<tr>
<td>Phase</td>
<td>Research question</td>
<td>Methods</td>
<td>Rationale</td>
</tr>
<tr>
<td>-------</td>
<td>-------------------</td>
<td>---------</td>
<td>-----------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Approach</td>
<td>Sampling</td>
</tr>
<tr>
<td>2</td>
<td>What specific non-technical skills did undergraduate nursing students learn following interaction with the virtual patient?</td>
<td>Intrinsic exploratory case study</td>
<td>Undergraduate health professional students engaged with the VSPR</td>
</tr>
<tr>
<td></td>
<td>How do interactions with virtual patients influence learning non-technical skills in undergraduate nursing students?</td>
<td>Intrinsic exploratory case study</td>
<td>Undergraduate health professional students engaged with the VSPR</td>
</tr>
<tr>
<td></td>
<td>How do interactions with virtual patients support learning and practice of non-technical skills: A faculty perspective</td>
<td>Intrinsic exploratory case study</td>
<td>Undergraduate health professional facilitators engaged with the VSPR</td>
</tr>
</tbody>
</table>
3.9 Ethical considerations

Researchers need to be aware of and address ethical issues that may arise in their research. Ethical issues can occur at any time in the research process from design of the research proposal to dissemination of findings. Ethical practice is a complex process that involves more than following static rules but is a pervasive idea underpinning all steps of the research continuum. Ethics guides the entire process of planning, conducting and using research (Mertens, 2009). However, there are specific requirements for the ethical treatment of people who participate in studies (Mertens, 2009). Individuals who participate in research have certain rights (Creswell, 2014).

The three principles of ethical conduct include:

- Beneficence of treatment of participants
- Justice
- Respect for participants (Sims, 2010).

In this study, the principle of beneficence, that is maximising good outcomes and minimising risk, was addressed by informing all participants about the research, how the research would be conducted, any potential risks and the measures taken to reduce the risks and the measures taken to protect their rights (Sims, 2010). All participants were provided with a Participant Information Statement outlining the research purpose and aims, how the results would be used and any likely consequences or risks involved. In this research, anonymity of the participants from the student researcher was not possible as the researcher undertook all data collection. However, confidentiality of all research participants’ data was maintained to protect privacy (Mertens, 2009). Identifying features were removed from all transcribed data. Additionally, no identifying features or data were used in any reporting. To identify participants unique identifiers were used where required in reporting, but did not enable tracing data back to an individual (Mertens, 2009). All digital data were securely stored on a password protected computer. Finally, strict professional boundaries, including adhering to the interview guidelines, communicating clearly, and setting ground rules, were observed at all times in the interviewing process to protect the rights of the participants (McDermid, Peters, Jackson, & Daly, 2014).

Justice, that is, a fair distribution of risk and benefits, was maintained by sharing of the research findings both positive and negative via publication (Sims, 2010). All participants were treated fairly and equally, and no repercussions were intended or actioned if participants declined to
participate in the research. Specifically, students knew that their academic grades would not be impacted by not participating in the research, and faculty were informed that information provided was anonymous and no reports with identifying information were provided outside the research. All participants were enabled to participate in the research equally. The student researcher, in acknowledging that all voices were important in the research and each interested person should be able to participate, enabled individual student interviews and faculty focus group to facilitate involvement.

Respect for participants, that is, protecting autonomy and ensuring well informed voluntary participants, acknowledges that all participants will make their own decisions concerning participation in and withdrawing from a study (Sims, 2010). Individuals were not offered any financial or other incentive to induce them to participate in the research. All students who participated received a certificate of participation in the research to present as part of their resume and applications for employment.

A significant concept in this research was the potential power imbalance between the student researcher and the researched. In data collection, if a prior relationship exists between the researcher and researched there is potential for disparities in power (McDermid et al., 2014). Therefore, it is important to note that at the time of data collection I was on leave, with no role or authority in teaching or employment for any participant. Whilst I knew some of the faculty who participated in the research, I did not know any of the first- or third-year students. At the commencement of focus groups and interviews, rapport, rules of engagement including guidelines to maintain confidentially of each focus group members and the information provided were discussed, with qualification that truthful comments, positive and negative, were invited and welcomed from participants. Careful negotiation between me as the student researcher and the researched was undertaken to invite truthful participation from the participants (McDermid et al., 2014). Language utilised in the focus groups and interviews was tailored to suit the participants. Roles of participants and interviewer were clarified and data obtained were rechecked during the interview to ensure meaning was not distorted and allowed representation of the participants’ voices.

In this research, prior to the commencement of data collection, all participants were informed of the purpose of the study, the risks, if any, to the participant and what the data was to be used for, via Participant Information Statements and verbally, using language participants could understand. All participants freely volunteered and had decision-making capacity, or competence, to participate in the research or not. Additional questions were invited from participants prior to the commencement of the interviews and focus groups for clarification. All participants were advised that once the data collection commenced, they were unable to
withdraw from the research due to anonymity of the data. Written informed consent was obtained prior to data collection.

The specific ethical issues related to this thesis and the actions taken to address each issue are identified in the table below, adapted from Creswell (2013, pp. 58-59).

Table 3.4: Ethical considerations

<table>
<thead>
<tr>
<th>Steps in the research</th>
<th>Ethical issues</th>
<th>Actions taken</th>
</tr>
</thead>
</table>
| **Prior to conducting the study** | Ethical approval from Human Ethics Committee | Ethical approval obtained from Monash University Human Ethics Committee. Approval number CF12/3958 – 2012001891, 14 December 2012. Amendments submitted  
  o July 2014 – amendments to research procedures  
  o May 2015 – amendments to investigator details. |
| | Obtain permission from sites | Reciprocal ethics approval obtained from  
  o La Trobe University Human Ethics Committee, 8 March 2013.  
  o University of Melbourne, Melbourne Medical School Evaluation Committee, 23 Feb 2016.  
  o Victoria University, Human Ethics Committee, April 2017. |
| | Authorship of publication | Credit for work completed in each stage of the research is acknowledged in publications and authorship order is determined accordingly. |
| **Beginning to conduct the study** | Disclose purpose of the study | All individuals participating in the research were informed of the research purpose and aims, how the results would be used and any likely consequences or risks involved.  
  o All participants were forwarded a Participant Information Statement (approved by MUHEC) |
| | Seek voluntary informed consent | Consent to participate in the different phases of the research was obtained.  
  o Consent to participate in individual interviews or focus groups was indicated by signing written consent forms.  
  o All participants were deemed competent to undertake informed decision-making in the study |
| **Collecting data** | Potential power imbalance between researcher and researched | Rapport was developed with participants to support sharing of data. Language utilised in the focus groups and interviews was tailor made to suit the participants. Roles of participants and interviewer were clarified, data obtained was rechecked to ensure meaning was not distorted and reflexivity allowed representation of the participants’ voices. Opening of the focus groups and interviews set up an |
### Steps in the research

<table>
<thead>
<tr>
<th>Ethical issues</th>
<th>Actions taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoid deception of participants</td>
<td>During the focus groups and interviews the purpose of the study was discussed openly. How data will be used was clarified before commencement of data collection including interviews or focus groups.</td>
</tr>
<tr>
<td>No excessive incentives for participation</td>
<td>Participants, including student and facilitators, in focus groups and interviews were not offered incentives to assist with recruitment to the research. Certificates of participation were forwarded to all participants.</td>
</tr>
<tr>
<td>Ensure privacy and anonymity</td>
<td>No identifying features or data will be reported with the use of unique identifiers where required in reporting.</td>
</tr>
<tr>
<td>Avoid siding with participants</td>
<td>The data reported multiple perspectives from multiple data sources at two distinct sites.</td>
</tr>
<tr>
<td>Avoid disclosing only positive results</td>
<td>The researcher was open to all findings in the data, positive and negative.</td>
</tr>
<tr>
<td>Plagiarism</td>
<td>All references have been cited according to referencing guidelines and licence conditions regarding reprinting or adapting others works.</td>
</tr>
<tr>
<td>Reporting accurate data and conclusion</td>
<td>Honesty was maintained at all times in reporting data obtained in the research. Dependability of the data is evidenced by the presentation of qualitative quotes.</td>
</tr>
<tr>
<td>Maintain privacy and anonymity</td>
<td>No identifying data will be reported.</td>
</tr>
</tbody>
</table>
| Report on conflict of interest or compliance issues | Funding bodies for the research included;  
  - Health Workforce Australia  
  - Department of Health Victoria  
  - Federal Department of Health and Aging |
| Share findings and data with others                 | Copies of publications will be made available to participants and stakeholders upon request. |

### 3.10 Summary

This chapter has presented the conceptual framework of the research. In this research, the student researcher was committed to the thorough study of a practical real-world research problem, and considered answering the research question to be more essential than the methods used (Maudsley, 2011). The focal point of the research was the valued outcomes and recommendations for action (Creswell, 2013; Ling & Ling, 2017) for consumers of the research. The student researcher perceived truth as that which provided productive consequences, with outcomes providing practical and useful solutions to concrete problems (Patton, 2015). I did
not manipulate or control the environments in this study, but maintained focus on the phenomenon and used lines of enquiry that corresponded with the social construction of reality. Intersubjectivity was used to highlight “perspectives that are influenced by and co-created by more than one subject” (De Jaegher et al., 2017, p. 492). These concepts are revisited in the discussion/conclusion to demonstrate how they worked.

This chapter also outlined the methodology and methods underpinning each phase of the study. The study design including theoretical framework, unit of analysis, sample, data collection and data analysis approaches were described. Additionally, measures taken to establish rigour and trustworthiness in the data were discussed. The next chapter in this thesis presents the findings of the descriptive case study investigating how standards of practice for registration as a practising health professional in Australia were found to address non-technical skills.
Chapter 4  Non-technical skills and Health Professional Competencies in Australia

4.0  Introduction

The foundation for this thesis is that non-technical skills are a fundamental component of safe and competent practice for health professionals in Australia. Therefore, to ensure that new graduates can meet competency standard requirements, undergraduate health professional curricula need to incorporate education in relation to non-technical skills.

This chapter presents the evidence underpinning the premise that non-technical skills are required for safe and competent health professional practice in secondary and tertiary acute care settings in Australia. As such, non-technical skills are an essential component of undergraduate health professional education. This chapter provides the base for this thesis by ensuring an adequate and appropriate foundation to underpin subsequent investigations. The thesis aims to generate a body of work exploring effective teaching and learning strategies to develop non-technical skills in undergraduate nursing students.

4.1  Background

The Health Practitioner Regulation National Law Act (2009) (referred to in this thesis as the Act) governs health professional registration in Australia. The Act was implemented “to provide for the protection of the public by ensuring that only health practitioners who are suitably trained and qualified to practise in a competent and ethical manner are registered” (Australian Health Professional Councils, 2011). Under the Act, national boards are required to develop or approve standards, codes and guidelines for the health profession concerned (Australian Health Professional Councils, 2011). Therefore, as non-technical skills are identified as a critical component of patient safety, and the categories established by Flin et al. (2013) are accepted constructs in practice, standards developed by National Boards governing registration as a health professional in Australia should encompass non-technical skills.

Additionally, according to the Act, an approved accreditation authority must accredit education programs leading to health professional registration in Australia. Accreditation standards for undergraduate health professional curricula ensure the professional competency standards for
registration with the Australian Health Professional Regulation Agency (AHPRA) for practice are protected in the course. The accreditation process ensures that approved courses produce graduates who are proficient to practise competently and safely and that graduates are eligible for registration in Australia. Accordingly, if non-technical skills categories and elements are present in the standards documents of selected health professions governed by AHPRA, then undergraduate health professional curricula and accreditation requirements should include these constructs.

However, little is known about if and how non-technical skill categories and elements are addressed in competency standards required for registration in health professional practice in Australia or if non-technical skills should be an explicit component of undergraduate education curricula. The published peer-reviewed paper included in this chapter presents the findings of a qualitative comparative analysis, undertaken to determine similarities and differences between the datasets (Mills, Van de Bunt, & De Bruijn, 2006). The datasets included the categories and elements of non-technical skills according to Flin et al. (2013) and the standards documents of selected health professionals who practise in secondary and tertiary acute care settings in Australia. The significance of the findings for undergraduate health professional education and course accreditation is outlined.

4.1.1 Publication two

What non-technical skills competencies are addressed by Australian standards documents for health professionals who work in secondary and tertiary clinical settings? A qualitative comparative analysis

Monica Peddle, Margaret Bearman, Natalie Radomski, Lisa Mckenna, Debra Nestel

ABSTRACT

Objectives At minimum, safe patient outcomes are recognised as resulting from a combination of technical and non-technical skills. Flin and colleagues provide a practical framework of non-technical skills, cognitive, social and interpersonal, that complement technical skills, with categories identified as situational awareness, communication, team working, decision-making, leadership, coping with stress and managing fatigue. The aim of this research was to explore the alignment of categories and elements of non-technical skills with those in the published standards documents of several health professions in Australia.

Design A qualitative comparative analysis using document analysis and deductive coding examined, extracted and interpreted data from competency standards documents focusing on non-technical skills categories and elements.

Participants A purposive sample of 11 health professions competency standards documents required for registration in Australia.

Findings The 11 competency standards documents contained 1616 statements. Although standards documents addressed all non-technical skills categories, there was limited reporting of managing stress and coping with fatigue. Of the 31 elements included in the non-technical skills framework, 22 were not common to all health professions and 3 elements were missing from the standards documents. Additionally, the documents were composed differently with no common taxonomy and language across different health professions.

Conclusion While commonalities identified in the standards documents related to non-technical skills categories are likely to support patient safety, gaps in associated elements may undermine their effectiveness. The notable lack of reference to stress and fatigue requires further attention for health professional well-being in Australia. A shared taxonomy with clear statements may offer the best support for collaborative practice and positive patient outcomes. Competency standards need to be flexible to respond to the emerging demands of current healthcare practice along with consumer and health service needs.

INTRODUCTION

There is consensus that medical error is a combination of human factors and system factors, with up to 80% of errors in healthcare associated with failures in non-technical skills such as communication, teamwork and decision-making. A deficit in the non-technical skills of surgeons can contribute to deterioration in technical performance. When nurses do not have the required skills to function as a member of a team, team effectiveness is impacted. When non-technical skills of medical emergency teams are rated as low, there has been an associated lower patient survival. Non-technical skills are described as ‘the cognitive, social and personal resource
skills that complement technical skills, and contribute to safe and efficient task performance.\(^7\)

Work led by Flin and colleagues identified the non-technical skills critical for safe and competent work practice in high-risk industries. They describe seven categories of non-technical skills, situation awareness, decision-making, communication, team working, leadership, managing stress and coping with fatigue, each containing a number of key elements (table 1).\(^7\) The non-technical skills framework represents an hierarchical structure of categories down to elements.\(^8\) Elements detail the specific skills and components of performance and constitute the main working level of the system.\(^9\) The framework has become an important construct on which performance in non-technical skills has been measured in clinical practice.\(^10\) The categories and elements provide ‘a set of established constructs and a common vocabulary for learning about the important behaviours that influence safe and efficient task execution’.\(^7\) Evidence of application of these non-technical skills can be found in acute settings in healthcare, including anaesthesia, surgery, pharmacy, histopathology, intensive care, emergency and paramedicine.\(^11\)

### COMPETENCY STANDARDS IN HEALTH PROFESSIONS

Initial core competencies were detailed descriptors for each profession that described the essential values,
knowledge, attitudes and skills. These initial competencies evolved to form the standards and expectations that became part of the prerequisites for current health professional registration. Professional standards are defined as agreed professional standards that are measurable, allowing behaviour to be observed and assessed while specific workplace tasks and roles are performed. Competency standards are used: to communicate scope of practice; by health professionals to assess their own performance; to determine suitability for registration; to provide a framework and inform course curricula; to develop position descriptions and to underpin performance assessment.

As standards outline desired characteristics and threshold competencies required for competent practice, and non-technical skills have been identified as an important component of competent practice, non-technical skills statements should be included in professional standards for registration of health professionals. Inclusion is supported by the findings of an investigation into the quality of healthcare in the USA published in 2000, To Err is Human, which recommended greater attention be paid to patient safety in performance standards and expectations for health professionals. Additionally, national committees in the USA call for attention to standards to address the significant problems associated with quality and safety in healthcare.

The Australian Health Practitioner Registration Agency (AHPRA) is the overarching national agency responsible for regulating health professional registration in Australia. Each profession has a national regulatory board responsible for protecting the public; the boards set standards, codes and guidelines for registered health professionals. Additionally, each board is responsible for assessment of providers and their programmes of study to ensure they meet accreditation standards. The related nomenclature is complex and includes performance standards, competency-based standards, standards for practice and professional capabilities. We use the term ‘standards documents’ to refer to the AHPRA documents.

There is a paucity of literature examining the alignment of professional standards with the non-technical skills framework developed by Flin et al. Previous comparative analysis undertaken aimed to compile robust lists of common domains of competence for application across multiple healthcare professions to support interprofessional education and identify common themes for competencies in patient safety and quality improvement. Only one study was located that reported a comparison undertaken using the non-technical skills framework. Greig et al. conducted an analysis of medical specialty curricula to identify the prevalence of non-technical skills. The authors reported that non-technical skills terms occurred infrequently and were most prevalent in critical care specialties, including anaesthesia, emergency and intensive care, with limited detail in assessment of non-technical skills. Non-technical skills are relevant across all practice settings and professions and are recognised as crucial for safe and competent patient care; however, little is known about how various standards documents, required for registration, address non-technical skills.

**RESEARCH QUESTION**

To address the perceived gap in the literature, we sought to answer the following question: what non-technical skills categories and elements are addressed by the Australian registration standards documents for health professionals who work in secondary and tertiary clinical settings?

**METHODS**

Using document analysis to examine, extract and interpret data, a qualitative comparative analysis was performed on the standards documents and non-technical skills categories and elements. Steps for the document analysis included finding, selecting, appraising and synthesising data. Ethical approval was not required as all documents analysed are in the public domain.

**Patient and public involvement**

No patients or public were involved in this research.

**Finding and selecting**

Standards documents of health professionals registered with AHPRA who practise acute care (defined as ‘a pattern of health care in which a patient is treated for a brief but severe episode of illness, for the sequelae of an accident or other trauma, or during recovery from surgery’) in secondary settings (‘Services provided by hospitals, such as acute care, as well as services provided by specialists’) or in tertiary settings (‘Highly specialised or complex services provided by specialists or allied health professionals’) were selected. These included the professions of Dentistry, Nursing, Medicine, Medical Radiation, Midwifery, Occupational Therapy, Pharmacy, Physiotherapy and Podiatry. The acute care context was selected as this is the predominant area of employment for new health professional graduates and makes up a large component of clinical placements for undergraduate students. The standards documents of the selected health professions were located through websites of relevant societies or associations (June, 2015) (online supplementary box 1). To ensure authenticity and currency of the documents retrieved for analysis, each standards document was reviewed and verified by a registered member of each profession. The Nursing and Midwifery Board of Australia approved new competency standards for Registered Nurses (first level) and Enrolled Nurses (second level) in January 2016. These new standards were included in our research.

**Qualitative analysis**

Content analysis using deductive data coding was employed. We used the categories and elements of non-technical skills developed by Flin et al as a priori...
open access

Table 2 Competency statements and levels of statements in standards documents

<table>
<thead>
<tr>
<th>Profession</th>
<th>Level one</th>
<th>Level two</th>
<th>Level three</th>
<th>Level four</th>
<th>Level five</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dentistry</td>
<td>Domain</td>
<td>Description</td>
<td>Indicators</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enrolled nurse</td>
<td>Domain</td>
<td>Standards</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical radiation</td>
<td>Domain</td>
<td>Capability statement</td>
<td>Evidence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medicine</td>
<td>Learning Area</td>
<td>Category</td>
<td>Learning topic</td>
<td>Competency or capability</td>
<td></td>
</tr>
<tr>
<td>Midwifery</td>
<td>Domain</td>
<td>Competency</td>
<td>Element</td>
<td>Cues</td>
<td></td>
</tr>
<tr>
<td>Nurse practitioner</td>
<td>Standard</td>
<td>Statement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occupational therapy</td>
<td>Unit</td>
<td>Domain</td>
<td>Performance Criteria</td>
<td>Cues</td>
<td></td>
</tr>
<tr>
<td>Pharmacy</td>
<td>Domain</td>
<td>Standard</td>
<td>Element</td>
<td>Performance Criteria</td>
<td>Evidence examples</td>
</tr>
<tr>
<td>Physiotherapy</td>
<td>Standards</td>
<td>Element</td>
<td>Criteria</td>
<td>Evidence</td>
<td></td>
</tr>
<tr>
<td>Podiatry</td>
<td>Competency Standard</td>
<td>Element</td>
<td>Performance Criteria</td>
<td>Examples of evidence</td>
<td></td>
</tr>
<tr>
<td>Registered nurse</td>
<td>Standard</td>
<td>Criteria</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Statements in levels identified by bolded italics were used in comparative analysis.

codes. Statements within the standards documents were initially coded to category codes and then further coded to element codes. Statements in the standards documents that did not align with a non-technical skills category were coded to an other category, such as those concerning technical standards. The aim was to produce an overall picture of the standards documents, with indications of frequency of categories and elements of non-technical skills. To ensure rigour of the analytic process, a selection of standards statements from all professions were coded by all authors, providing a benchmark for further coding completed by a single investigator (MP) who reviewed all selected documents. This investigator read all documents to identify meaningful and relevant statements related to non-technical skills that were coded accordingly.

FINDINGS

Each of the standards documents was composed differently. The documents contained multiple variations of descriptive statements at different levels of granularity as outlined in table 2. The hierarchy of statements ranged from two levels (Registered Nurse) to five levels (Pharmacy). The statements used for analysis were those containing consistent behavioural and measurable statements.

Standards documents of 11 professions were reviewed with a total of 1616 statements. All non-technical skills categories were found to be addressed in the standards documents (table 3). A total of 592 statements were coded to non-technical skills (NTS) categories with 27 statements coded twice. Any statement that did not align with the categories and elements of non-technical skills was coded to the other category. One thousand and twenty-four statements were coded to the other category.

Analysis identified 204 (34%) statements coded to the communication category and 126 (21%) to leadership. The decision-making category had 99 (17%) statements, team working 95 (16%), situational awareness had 53 (9%), managing stress 12 (2%) and coping with fatigue had 3 (1%) statements. Of the 31 elements included in the study, 6 were common in all standards documents, 22 elements lacked commonality and 3 elements were missing from all standards documents.

The frequencies of non-technical skills categories identified in the standards documents selected for analysis are represented in figure 1, with the percentage breakdown of non-technical skills statements compared with other statements in each professional standards document in figure 2. Examples of coded statements are presented in online supplementary box 2.

DISCUSSION

This study sought to identify what non-technical skills categories and elements are addressed by the Australian registration standards documents for health professionals who work in secondary and tertiary clinical settings. The non-technical skills categories addressed in the standards documents are communication, leadership, decision-making and team working. Less reference was made to situational awareness, and minimal reference was made to managing stress and coping with fatigue. There has been some uptake of non-technical skills by the various professional bodies, but a more deliberate approach and systematic use of non-technical skills literature would be beneficial in future versions of these documents.

Six elements were common across the standards documents (table 3). The hierarchical nature of the non-technical skills framework suggests that successful achievement
Table 3  Non-technical skills categories and elements in standards documents across professions

<table>
<thead>
<tr>
<th>Category</th>
<th>Elements</th>
<th>Dentistry</th>
<th>Enrolled Nurse</th>
<th>Medical Radiation</th>
<th>Medicine</th>
<th>Midwifery</th>
<th>Nurse Practitioner</th>
<th>Occupational Therapy</th>
<th>Pharmacy</th>
<th>Physiotherapy</th>
<th>Podiatry</th>
<th>Registered Nurse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Situation awareness</td>
<td>Gathering information</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Interpreting information</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Anticipating future states</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Decision-making</td>
<td>Situation assessment - defining problem</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Generating and considering one or more response options</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Selecting and implementing an option</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Outcome review</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Communication</td>
<td>Send information clearly and concisely</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Include context and intent during information exchange</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Receive information especially by listening</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Identify and address barriers to communication</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Team working</td>
<td>Support others</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Solve conflicts</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exchange information</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Coordinate activities</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Performance monitoring</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Feedback</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Closed loop communication</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Backing up behaviours</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Team self-awareness</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fostering team interdependence</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Leadership</td>
<td>Use authority</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maintain standards</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plan and prioritise</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Manage workload and resources</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td></td>
</tr>
</tbody>
</table>

Continued
of non-technical skills categories may rest on the implementation of individual elements. As a large number of elements were not consistent or missing from the standards documents, doubts may be raised regarding the overall effectiveness of non-technical skills implemented in clinical practice. For example, closed loop communication was missing from the team working category in all professions but medicine, which may influence effective collaborative practice. Further, in the communication category, a notable omission from all but one profession, midwifery, was ‘listening’. Active listening is identified as important in receiving information, essential for safe patient care.\(^7\)\(^{20}\)\(^{29}\) In the standards documents reviewed, the need to generate and consider one or more response options in the decision-making process was inconsistent. When making decisions, it is important to generate a number of potential options to be compared to determine which one best fits the situation,\(^7\) so this is clearly a limitation in some standards documents.

One positive finding from this study highlights that competencies commonly identified in literature underpinning effective interprofessional practice are present in the standards documents. These include clarity regarding other health professional roles, mutual respect and trust, communication, effective teamwork skills, a willingness to collaborate and contribute to shared plans and goal setting.\(^30\) These commonalities should encourage and support health professionals to intentionally and effectively work together to implement quality and safer healthcare.\(^31\)\(^{32}\)

Two categories that were mostly absent from the standards documents are coping with fatigue and managing stress. Recent evidence suggests that current Australian junior medical officers’ fatigue levels are significantly worse than the general population.\(^33\) Fatigue leads to decreased alertness and concentration, reduced motivation and productivity, impaired information processing and increased risks of accidents.\(^34\) The importance of managing stress in relation to patient outcomes and for the health and well-being of the health professional is highlighted by the relatively high incidence of work-related stress, burnout and suicide in health professionals. A recent report identified that the suicide rate for female health professionals in Australia was significantly higher compared with those in other occupations.\(^35\) While many organisations have released documents and guidelines to support health professional well-being, current published evidence suggests a need for further attention to consider omissions in the standards documents, particularly in the managing stress and coping with fatigue categories, to ensure health professional well-being.

The percentage of statements within standards documents for nursing, medicine and midwifery related to non-technical skills was higher compared with the other professions (figure 2). These professions are involved largely in acute patient care in secondary and tertiary settings. Professional standards documents for dentistry, occupational therapy, pharmacy, physiotherapy and...
podiatry have a lower proportion of competency statements addressing non-technical skills as defined by Flin et al.7 While these professions practise in acute care, the predominate context of care is primary or community care. The development of the non-technical skills framework used in this research has tended to be from acute care areas in anaesthesia and surgery.9 In these settings, the patient is anaesthetised, therefore the non-technical skills categories and elements focus on co-ordination and communication between the interprofessional team and are less directly concerned with the patient.36 Additionally, each working environment has its own unique requirements for non-technical skills that are specific to the needs and characteristics of that profession.37 Hence, for professions practising mainly in primary and community care with alert and engaged patients, the identified categories and elements of non-technical skills developed by Flin et al may not have sufficient relevance.

This research highlights ‘a lack of a common language describing the domains of health professionals and their specific competencies’20 and emphasised the siloed approach of individual national regulatory boards that has been reported as ‘counterintuitive to team-based care’.17 A common taxonomy across all standards documents has been proposed to provide a shared baseline.20 A shared interprofessional language is important to further facilitate and foster collaborative education and practice. Further, many statements contained ‘multifaceted attributes related to collaborative attitudes, values, knowledge, skills and behaviours packaged together in one single statement’.31 It would be helpful for each profession to talk about the same thing in a clear unambiguous manner. A bold move would be to facilitate collaboration across the regulatory boards in Australia to review and clarify the standards documents to achieve a common taxonomy, with shared statements and a greater commonality of fundamental skills.17

Finally, a recent report from the Council of Australian Governments Health Council identifies that accreditation processes should ensure the healthcare workforce responds to changing healthcare needs and that currency of competency standards is maintained.17 However, the findings of this study question the ability of the regulatory bodies to respond to emerging drivers in practice to support the development of a flexible and responsive health workforce.17 It is important that all health professional regulatory boards, in Australia and internationally, pay attention to the standards documents for each profession to ensure they reflect contemporary practice and meet current consumer and health service needs.17

Figure 1 Categories of non-technical skills in standards documents by profession (each statement was coded to Flin et al (2013) categories and elements of non-technical skills. Any statement that fell outside these categories was coded to other).
Study limitations

The strength of the study is in bringing together standards documents from several professions and viewing them through one lens. Rigour of the analytic process was established by the coding of a random selection of competency statements by all authors and presentation of sample statements from each code (online supplementary box 2).

One limitation of this study is the inclusion of only those professions registered by AHPRA. There are health professions that practise in secondary and tertiary care who are not registered by AHPRA (eg, speech therapy and dietetics). Additionally, while the research has focused on professions practising in acute care in secondary and tertiary settings, the competency standards documents address a wider arc of care. Caution must be also exercised when reviewing the compared statements and the proportionality of statements as they may have been drawn from different levels within the documents. Coding was challenging because there was no common taxonomy and shared language. The standards documents are structured differently with varied levels of statements that are complex and multifaceted.

Additionally, the study did not collect data on the significance of particular non-technical skills in various professions, hence some of the variation noted in the standards documents may be appropriate depending on working context and practice requirements, for example, coping with fatigue may not be significant if long stretches of duty are uncommon for that particular profession. It is worth underlining the obvious point that this work refers to aspirational standards rather than actual practice. While this study was conducted using Australian competency standards documents, we believe the issues raised are indicative of the nature of competency standards in similar countries globally.

CONCLUSION

The commonalities in non-technical categories and elements identified across the standards documents offer support for safer, collaborative healthcare practices and patient outcomes in Australia. While the findings are encouraging, there is some concern regarding non-technical skills elements that are inconsistent or missing across the standards documents. Hence, these standards may be insufficient to support current needs and demands for competent non-technical skills that are critical to maintain patient safety. Attention is required from regulatory bodies to consider omissions and other inconsistent and missing elements across non-technical skills categories. We suggest that regulatory bodies respond to emerging demands of current clinical practice and work together to develop a common taxonomy, with clear, unambiguous statements. This would likely facilitate collaborative education and practice.

This research confirms that non-technical skills are required in the practice of health professionals for registration with AHPRA. Consideration should be given to mandating non-technical skills education as a component of professional development.
of the accreditation for undergraduate health professional curricula. Curricula should include non-technical skills content, practice and assessments to ensure graduates can meet the requirements in accordance with associated standards.

Author affiliations
1 School of Nursing and Midwifery, College of Science Health and Engineering, La Trobe University, Bundoora, Victoria, Australia
2 Centre for Research in Assessment and Digital Learning (CRADLE), Deakin University, Melbourne, Victoria, Australia
3 Faculty of Medicine, Nursing and Health Sciences, Monash University, Melbourne, Victoria, Australia
4 Faculty of Medicine, Nursing and Health Sciences, Monash Institute for Health and Clinical Education, Monash University, Clayton, Victoria, Australia

Contributors MP carried out all aspects of the study, including study design, coding for document analysis, interpretation of the data and writing the manuscript. DN, MB and NR supervised the study and contributed to study design, coding and interpretation of the document analysis and the writing of the manuscript. LM contributed to the interpretation of data and writing of the manuscript. The final manuscript has been read and approved by all authors.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent Not required.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement No additional unpublished data is available.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: http://creativecommons.org/licenses/by-nc/4.0/.

REFERENCES
4.2 Implications for this thesis

Importantly, for my thesis, this research designates that non-technical skills are required in the practice of health professionals for registration with AHPRA. Specifically, standards for registration with AHPRA as a registered nurse identify categories and elements in situation awareness, decision-making, communication, teamworking, leadership, and managing stress. The identification of these non-technical skills categories in the standards documents necessitates consideration be given to mandating non-technical skills education as a component of the accreditation standards for undergraduate nursing, as well as other health professional curricula.

Undergraduate nursing curricula should include non-technical skills content, practice, and assessment to ensure graduates can meet their requirements in accordance with associated standards. Australian Nursing and Midwifery Accreditation Council, Registered Nurse Accreditation Standards identify that undergraduate nursing curricula should have “a program of study that is congruent with contemporary and evidence-based approaches to professional nursing practice and education” (ANMAC, 2016, p. 12). However, specific reference to categories and elements of non-technical skills is not clear. Reference is made in the conceptual framework standard to communication, leadership, and collaborative practice; however, no details are provided to clarify what these refer to. Additionally, specific reference in the program content standard is made to the following knowledge and skills:

a. critical thinking, analysis, and problem solving
b. quality improvement methodologies
c. research appreciation and translation
d. legal and ethical issues in health care and research
e. health informatics and health technology (ANMAC, 2016, p. 14).

Noticeably absent is reference to the range of non-technical skills categories and elements that are considered critical for safe and quality care in the clinical practice setting. Conversely, it is important to note that one category was missing from the standards documents for registered nurses, namely coping with fatigue. Moreover, many elements were absent in the communication, situation awareness, and decision-making categories which present significant challenges in practice. Having non-technical skill categories with inconsistent and missing elements may be insufficient to support safe and quality care in the clinical setting. For
An interesting finding from the comparative analysis was the lack of common taxonomy across the standards documents. Each document was composed differently with variations in the levels of descriptive statements. Many statements in the standards documents lacked clarity and addressed multiple attitudes, values, knowledge, skills and behaviours in a single statement. The registered nurse standards document was relatively simple in comparison to other professions, with only two levels of descriptive statements. Having a shared taxonomy would enable a common baseline to support health professionals to purposely and successfully collaborate to deliver quality and safe care.

Whilst the inclusion of some categories and elements of non-technical skills in the standards documents across the professions is promising, attention is required from regulatory bodies to consider omissions, particularly in the managing stress and coping with fatigue categories in light of the published evidence, and other inconsistent and missing elements across other non-technical skills categories. Further, we suggest that the regulatory bodies collaborate to develop a shared taxonomy with clear unambiguous statements that would offer support for collaborative education and practice and maintenance of patient safety with positive patient outcomes moving forward. Moreover, we call on the accreditation bodies to identify the inclusion of specific categories and elements of non-technical skills as a requirement of curriculum accreditation.

To ensure that undergraduate nursing students are adequately prepared for clinical practice they need to be exposed to content regarding non-technical skills and be provided with opportunities to practise these skills in realistic clinical situations. Integration of the virtual patients from the VSPR provide just that. Information on categories and elements of non-technical skills, the potential strategies that can be used in practice, and opportunities to apply these strategies in realistic clinical practice situations.
4.3 Summary

This chapter has demonstrated that non-technical skills are addressed in competency standards documents for professions that practise in secondary and tertiary acute care settings in Australia. The findings are extrapolated to identify that these skills are therefore a necessary component of undergraduate health professional education. This chapter explored the role that virtual patients may play in developing these fundamental but critical skills in undergraduate nursing students.

This chapter has also identified some shortcomings in the standards documents to be considered by the regulation bodies to support interprofessional, collaborative practice. One noticeable area absent from the documents is dealing with stress and managing fatigue. Suggestions were made to address these shortcomings to support collaborative education and practice.

This chapter has established a case for this research by ensuring an adequate and appropriate foundation to underpin subsequent investigations that is the existence of non-technical skills in standards documents for registration as a registered nurse. The following chapters aim to generate a body of work exploring effective teaching and learning strategies, specifically using virtual patients, to develop non-technical skills in undergraduate nursing students.
Chapter 5  Case Study

5.0  Introduction

The findings of the comparative analysis establish the requirement for education regarding non-technical skills in undergraduate health professional curriculum. Therefore, it is imperative that educational resources aimed at developing knowledge, skills and attitudes of non-technical skills to meet registration standards are designed, constructed, implemented and systematically investigated to establish their effectiveness.

This chapter outlines the requirements of education programs for registration as a registered nurse (RN) and their roles and scope of practice in Australia. Additionally, an in-depth description of the intervention used in this case study to develop non-technical skills in undergraduate nursing students is included. The findings of each component of the case study are presented including:

1. Identifying what specific non-technical skills are developed following interactions with virtual patients,
2. Explanation of how interactions with virtual patients develop non-technical skills, and
3. Exploration of faculty perceptions on developing non-technical skills using virtual patient interactions.

Focus groups and individual interviews with undergraduate nursing students and faculty were used to gather data. Findings of each component of the case study are discussed in three published peer-reviewed manuscripts presented as part of this chapter.

5.1  Background

Nursing practice in Australia is divided into two levels: the bachelor degree prepared Registered Nurse (RN) and the diploma educated Enrolled Nurse (EN). The Australian Nursing and Midwifery Accreditation Council (ANMAC), an independent accreditation body, develops specific standards for accreditation and also determines whether education programs meet these standards. ANMAC must assess and approve these programs leading to registration as a RN or EN, prior to their introduction.

Differences exist between the roles and scope of practice of RNs and ENs. Whilst each practitioner is accountable and responsible for his or her own practice, RNs are independent practitioners with roles in leadership and delegation while ENs practise under the supervision
of an RN. RNs are responsible for ensuring person-centred, evidence-based care in "preventative, curative, formative, supportive, restorative and palliative" environments (ANMAC, 2016, p. 2). RNs determine, coordinate, provide and ensure safe, competent, quality care in dynamic systems in collaboration with other health professionals (ANMAC, 2016).

5.2 Intervention

Two university-based Schools of Nursing, with degrees approved by ANMAC, leading to registration as a RN with AHPRA that were active in the integration of simulation-based learning in curriculum, were purposively selected to participate in this research. Virtual patients from VSPR were implemented across all years of the existing curricula at each site. The virtual patients were integrated into curricula at purposively designated points where the curriculum based clinical topics, complexity of scenario, contexts of care, and learning outcomes aligned with the virtual patients. At both sites, the virtual patients were integrated into workshops as small group activities each facilitated by one faculty member. The activity, focusing on the virtual patient in the workshop, was scheduled for one hour in duration. All students enrolled in the subjects participated in the workshop activity using virtual patients from VSPR.

First- and third-year students (n= 76) were selected, as the scheduling of the virtual patient activity providing recency of exposure to the virtual patient. First-year students (n= 45) were in the second semester of study of a three-year, six-semester program. Third-year students (n= 31) were in the sixth and final semester of study in their program. Prior to participating first-year students had completed the introduction to non-technical and communication skills accessing the online VSPR module and one, one-hour recorded lecture regarding non-technical skills. Third-year students had undertaken the introduction to non-technical skills, communication, teamwork, situations awareness, and decision-making accessing online VSPR modules with three, one-hour recorded lectures. In this study, first-year students completed the Falls scenario. Third-year students completed either the Falls, Aggressive Patient, Administering Blood Products, Teamwork and Post-operative simulation, or the Falls and Teamwork simulations.

Faculty comprised academics (n= 15) who were all RNs. Experience of faculty in tertiary education was varied, with some faculty having recently commenced in the role, with less than 12 months experience (n=3) and others with over 10 years experience (n=2). All faculty had completed fundamental simulation training covering facilitating simulation and debriefing. All faculty were orientated to the simulation and provided with a written facilitator guide to support consistency of the learner experience.
The “choose your own adventure game” approach facilitated small group discussion following each video vignette. This discussion was guided and moderated by faculty and was supported by the facilitator guide which detailed specific non-technical skills elements to be considered after each individual video vignette. A concluding debriefing was facilitated for first-year and third-year students. Debriefing consisted of:

- a reaction phase,
- discussion of the clinical elements of the virtual patient,
- discussion of the non-technical skills elements such as missing, ineffective or positive non-technical skills in the virtual patient
- identifying areas for improvement and what to do next time.

During the debriefing, faculty used an Advocacy Inquiry approach in questioning techniques. Advocacy inquiry is a style of speaking that pairs advocacy, such as an assertion or observation, with an inquiry, such as a question (Rudolph, Simon, Rivard, Dufresne, & Raemer, 2007). This approach enables an instructor to state their hypothesis in the advocacy statement and then test that hypothesis in the inquiry (Rudolph et al., 2007). This enabled faculty to use observed behaviours to present queries to participants, to investigate underlying thinking that guided the participants’ actions (Rudolph et al., 2007). Using this approach helps bring to the surface participant thinking and facilitates and the meaning making processes used to support deep learning (Rudolph et al., 2007).

Data were collected using focus groups and individual interviews. For first-year students, data collection was completed immediately after the simulation experience. For third-year students data collection occurred immediately following the experience or within the same week. Forty-five first-year students (comprising 35 females and 10 males) and 31 third-year students (comprising 27 females and 4 males) consented to participate. Fifteen faculty (comprising 2 males and 13 females) consented to participate.

### 5.3 Exploring specific non-technical skills developed through virtual patients

Examining the effectiveness of educational resources is imperative in teaching and learning. In healthcare, program evaluation is particularly important to ensure accreditation standards are met, standards of care maintained and patient safety improved (Lannan, 2017). Qualitative approaches, such as case studies, are suitable as they can capture participant
stories, elucidating program outcomes (Patton, 2015), and suggest recommendations to maximise learning.

The following published peer-reviewed paper presents the findings of the exploratory case study that systematically examined the influence of virtual patients from VSPR on the development of knowledge, attitudes and practise of non-technical skills in undergraduate nursing students. The paper reports on the specific non-technical skills developed in interactions with virtual patients.

5.3.1.0 Publication three

Development of non-technical skills through virtual patients for undergraduate nursing students: An exploratory study

Monica Peddle⁎, Lisa Mckenna⁎, Margaret Bearman⁎, Debra Nestel⁎

⁎ School of Nursing and Midwifery, College of Science, Health and Engineering, La Trobe University, Australia
⁎ Centre for Research in Assessment and Digital Learning (CRADLE), Deakin University, Australia
⁎ Monash Institute for Health and Clinical Education, Faculty of Medicine, Nursing and Health Sciences, Monash University, Australia

ARTICLE INFO

Keywords:
Virtual patient
Virtual patient simulation
Web-based simulation
Non-technical skills
Undergraduate nursing

ABSTRACT

Introduction: Non-technical skills (NTS) are fundamental requirements for health professional graduates for safe and competent practice. Technology enhanced simulation, including virtual patients (VPs), is suggested to be effective in developing NTS.

Purpose: The purpose of this paper is to explore what participants learnt about NTS following interactions with the VPs in the case study.

Design: Case study methodology was used to explore learning by undergraduate nursing students related to NTS following interactions with VPs. First- (n = 40) and third-year (n = 31) undergraduate nursing students from two universities in Victoria, Australia agreed to participate in focus groups and interviews. These were audio-recorded, transcribed and then underwent framework analysis. A priori codes in the framework used NTS categories including communication, situation awareness, teamwork, decision-making skills, leadership, managing stress and coping with fatigue.

Findings: Overall, students in both years and universities reported that interactions with VPs developed knowledge and skills across all categories of NTS to varying degrees. Third-year students suggested that interactions with VPs enabled development of knowledge and skills, as well as practise of selected NTS in the clinical setting.

Conclusion: Interactions with VPs across the curriculum may assist undergraduate nursing students in developing knowledge, skill and practice of NTS categories including communication, situation awareness, teamwork, decision-making skills and duty, advocacy and empathy.

1. Introduction

Non-technical skills (NTS) are the cognitive, social and interpersonal skills associated with technical skills that contribute to safe and efficient clinical performance (Flin et al., 2013). Although their name has been contested, there is no single word that describes the cluster of essential skills (Nestel et al., 2011). Breakdowns in NTS such as teamwork, decision-making and leadership are related to adverse events in healthcare (Hobgood et al., 2010) resulting in unintentional, but at times, serious harm to patients. Traditionally, the evolution of these skills happened over time in clinical practice as the practitioner developed from novice to expert (Josephsen and Butt, 2014). However, current clinical practice environments necessitate health professionals learning these foundational abilities prior to graduation (Josephsen and Butt, 2014).

Technology enhanced simulation is suggested to be effective in developing NTS in health professionals (Unsworth et al., 2014). One form of technology enhanced simulation is the ‘virtual patient’. Virtual patients (VPs) can be defined as “interactive computer simulations of real-life clinical scenarios for the purpose of healthcare and medical training, education, or assessment” (Ellaway et al., 2008, p. 1). VPs offer advantages over traditional simulation approaches, including consistent and predictable progression withoutcomesdrivenbyalgo-

rithms and feedback provided on performance (Cant and Cooper, 2014). VPs are flexible, can be repeated at times convenient to the learner (Cant and Cooper, 2014) and can be disseminated across large student populations enabling access to critical clinical scenarios for learning and practice (Pose et al., 2009). VPs build on existing learning frameworks of the millennial learner, while preparing them to engage with technology, central to nursing practice (Foronda et al., 2013).
Further, VPs can reduce face to face teaching time and utilisation of costly resources (Cant and Cooper, 2014). However, VPs can be costly to develop and may require specific skills, expertise and resources to build and maintain. Additionally, VPs can be subject to security issues including malicious attacks and are reliant on solid and dependable internet services (Cant and Cooper, 2014).

VPs involve a variety of formats including single or multiuser environments with synchronous or asynchronous engagement. They can be situated in 3D web-based communities, text-based virtual reality systems (Foronda et al., 2013) or use gaming strategies with outcomes determined by cascading decisions (Cant and Cooper, 2014). Literature reports the dominant VP approach for developing NTS involves text interspersed with video vignettes (Peddle et al., 2016). Avatars in 3D virtual worlds and life-sized projection of digital avatars with speech recognition are also prevalent (Peddle et al., 2016).

Historically, VPs were integrated into undergraduate health professional curricula to develop knowledge and diagnostic reasoning (Cook et al., 2010). Recently, positive findings have been reported regarding use of VP methods to develop NTS including communication, teamwork and decision-making skills in undergraduate health professionals (Foronda et al., 2013; Peddle et al., 2016). However, many studies focus on isolated categories rather than NTS as a whole, with limited studies focusing on undergraduate nursing students. Professional nursing practice is complex and most often practised as part of an interprofessional team (McKenna et al., 2014), demanding effective NTS for safe and competent practice. Therefore, it is important that students are prepared for the demands of clinical practice in relation to NTS prior to graduation. However, there is a paucity of evidence regarding application of VPs and NTS in undergraduate nursing students.

2. Purpose

The purpose of this paper is to explore what undergraduate nursing students learnt about specific NTS following interactions with VPs.

2.1. Virtual Simulated Patient Resource (VSPR)

The Virtual Simulated Patient Resource (VSPR) (www.vspr.net.au) is a web-based resource comprising a selection of online, interactive learning modules and VPs that can be integrated across a learning continuum. The aim of the VSPR is to develop knowledge, skills, attitudes and practice of NTS in undergraduate health professionals. The categories and elements of NTS developed by Flin et al. (2013) were used as a guide in developing the resource. The VSPR design was informed by constructivist learning theory, supporting an individual's reconstruction of knowledge and meaning, developed through prior experiences, based on new learning experiences (Grapczynski et al., 2015). Learning was designed to be student-centred, promoting learner engagement, interaction and reflection (Grapczynski et al., 2015). The research reported in this paper focuses on the VPs in the VSPR.

The VPs in VSPR belong to the narrative category portraying a patient’s story as it evolves over time with a cause-and-effect approach to demonstrate consequences of actions and decisions (Bearman, 2003). This approach is suggested to depict the patient as a person, enabling representation of the psychosocial aspects of the human interaction experienced in the clinical setting (Bearman, 2003). The VPs use a “choose your own adventure game” approach. Participants are presented with a series of choices, each branching into different possibilities (Friedman, 1995). While the outcomes of decisions are predetermined by a decision tree with branching algorithm, every choice made by participants in the simulation impacts future options (Friedman, 1995). The VPs use video vignettes set in genuine clinical environments, with realistic clinical situations and representative human actors as characters. Videos are produced using a storytelling approach, enabling multiple interpretations of one situation (Saldes, 2005).

Simulation activities using VPs can be completed as self-directed or group learning activities supported by facilitator-guided, peer discussion after each video vignette and final debriefing. Participants engage in the simulations as themselves. Briefing, provided by text-based documents, presents the relevant evidence-base, along with patient history and current situation. At the conclusion of each video vignette, participants select, from two choices appearing on the screen, an appropriate option to progress the simulation. Triggered by the participant's selection, the branching algorithm determines the next video vignette in the simulation. Decisions made by participants lead to a positive or negative patient outcome. Feedback is provided from visualisation of the consequences of decisions and final patient outcomes, along with peer and facilitator discussion and debriefing when completed in group activities.

VSPR is distinguished from other web-based simulation activities, as the resource focuses on developing participants’ awareness of the impact of NTS on patient outcomes along with knowledge, skill, attitudes and practice. The video vignettes contain minimal depictions of technical or procedural skills, or clinical interventions. The VPs present multiple professional perspectives, highlighting that patient safety is everyone’s business. Further, the VPs present common, everyday patient care situations within acute and primary care contexts, rather than focusing on primary responses in emergency care situations. Finally, the ‘play your own adventure game’ approach enables learners to experience evolving consequences of ineffective NTS in practice. Table 1 reports the details of the simulation-based intervention. The table provides information on the key elements of the simulation and identifies the simulation exposures and how the simulation was used in the research.

2.2. Design

This paper reports on one aspect of a larger exploratory research project, which employed case study methodology. A case study is defined as “an intensive, holistic description and analysis of a bounded phenomenon such as a program, an institution, a person, a process, or a social unit” (Merriam, 1998). Case studies are best to describe, explore and understand phenomenon in its real-life context (Anthony and Jack, 2009). The clear and bounded case in this research is the VP from the VSPR. The exploratory case study was intrinsic in nature as the aim was to understand this particular case, the VPs in VSPR (Stake, 1995). The theoretical framework surrounding this exploratory case study was informed by the themes identified in Peddle et al. (2016) and the NTS categories developed by Flin et al. (2013), situation awareness, decision-making, communication, teamwork, leadership, coping with fatigue and managing stress. The unit of analysis in the exploratory case study was the year level of the undergraduate nursing students.

2.3. Population and Sampling

In Australia, a Registered Nurse requires an undergraduate degree level education. Two university nursing schools in Victoria, Australia, with active Bachelor of Nursing programs were using VSPR and both were proactive in the integration of simulation into curricula. Purposive convenience sampling was used to select participants to explore our study aims. First- and third-year students who had interacted with VPs were invited to participate. Students were recruited via invitations disseminated online through subject forums and verbal invitations at each site post-simulation activities. Recruitment occurred from March to April 2017 and was completed by the primary author (MP). Forty-five first-year and 31 third-year students consented to participate. Human Research Ethics approval was obtained for the study and guidelines adhered to throughout the study.
Table 1
Key elements of the VSPR simulation (Adapted from Cheng et al. (2016)).

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Sub-elements</th>
<th>Descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simulation type</td>
<td>Simulation approach</td>
<td>Web-based choose your own adventure game composed of video vignettes interspersed with a series of choices, each branching into different possibilities.</td>
</tr>
<tr>
<td></td>
<td>Simulation functionality</td>
<td>Every choice made by the participants in the simulation impacts on future options available.</td>
</tr>
<tr>
<td>Participant orientation</td>
<td>Orientation to the simulation environment</td>
<td>As self-directed activity, the introduction to the simulation is text based. As group based activity, the introduction to the simulation activity and environment is given by facilitators using written information.</td>
</tr>
<tr>
<td>Simulation environment</td>
<td>Location</td>
<td>Self-directed activities completed in locations convenient to the learner. Group activities completed in allocated classrooms on campus.</td>
</tr>
<tr>
<td></td>
<td>Equipment</td>
<td>Technologically compatible device with stable internet connectivity with additional audio-visual display equipment in group based activities.</td>
</tr>
<tr>
<td></td>
<td>External stimuli</td>
<td>Stimuli in video vignettes is representative of realistic clinical situations including machinery alarms, telephone calls, visitors and significant others and overhead paging and announcements.</td>
</tr>
<tr>
<td>Simulation event scenario</td>
<td>Event description</td>
<td>The activity was governed by written instructions as guidelines for facilitators to support consistency of participant experience.</td>
</tr>
<tr>
<td></td>
<td>Learning objectives</td>
<td>Learning objectives for the activity include: Apply knowledge and skills of non-technical skills to realistic clinical situations. Explore potential consequences of failures in non-technical skills in clinical practice.</td>
</tr>
<tr>
<td></td>
<td>Group vs. individual practice</td>
<td>Activities were conducted in groups and as self-directed learning activities.</td>
</tr>
<tr>
<td></td>
<td>Use of adjuncts</td>
<td>Moulage was utilised in preparing actors for patient roles including for example traumatic injury, bleeding wounds and suture lines.</td>
</tr>
<tr>
<td></td>
<td>Facilitator/operator characteristics</td>
<td>All facilitators were experienced clinicians and/or educators and were required to attend orientation to the subject and facilitating the simulation.</td>
</tr>
<tr>
<td></td>
<td>Pilot testing</td>
<td>Pilot testing of all simulations was completed during development and construction of the Virtual Simulated Patient Resource.</td>
</tr>
<tr>
<td></td>
<td>Actors</td>
<td>All persons but two involved in the scenarios were professional actors. All scenes were scripted.</td>
</tr>
<tr>
<td>Instructional design or exposure</td>
<td>Duration</td>
<td>Scenarios completed as self-directed activities had no time limitations. Virtual Patient Simulations were allocated one hour during class based activity.</td>
</tr>
</tbody>
</table>

(continued on next page)
### Table 1 (continued)

<table>
<thead>
<tr>
<th>participant groups</th>
<th>Timing</th>
<th>Data collection occurred immediately after completion of the Virtual Patient Simulation as a group based activity.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency/repetitions</td>
<td></td>
<td>Student can access the resource at any time with unlimited repetitions.</td>
</tr>
<tr>
<td>Clinical variation</td>
<td></td>
<td>Multiple different patient scenarios including multi-professional acute care, primary health care and obstetric specific. Year one students completed the Falls scenario. Year three students completed either the Falls, Aggressive Patient, Administering Blood Products (self-directed) Teamwork (self-directed) and Post-operative simulation or the Falls and Teamwork simulations.</td>
</tr>
<tr>
<td>Adaptability of intervention</td>
<td></td>
<td>Each simulation was consistent with predictable progression based on branching algorithms across all participant groups.</td>
</tr>
<tr>
<td>Range of difficulty</td>
<td></td>
<td>Simulations in the VSPR cater for varying levels of learning needs across the learning continuum. For nursing programs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LEVEL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>YEAR ONE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>YEAR TWO</td>
</tr>
<tr>
<td></td>
<td></td>
<td>YEAR THREE</td>
</tr>
<tr>
<td>Nonsimulation interventions and adjuncts</td>
<td></td>
<td>Prior to participating in the simulations students had completed: Year one students - an introduction to non-technical and communication skill online module and one 1-hour recorded lecture. Year three students - introduction to non-technical skills, communication, teamwork, situations awareness, and decision making online modules with three 1-hour recorded lectures.</td>
</tr>
<tr>
<td>Feedback and/or debriefing</td>
<td>Integration</td>
<td>Simulations were integrated into purpose designed points of current curriculum where contexts of care, clinical topics, complexity of scenario and learning outcomes aligned with simulations.</td>
</tr>
<tr>
<td>Source</td>
<td></td>
<td>Feedback mechanisms include visualisation of the consequences of choices made and the patient outcome, along with peer and facilitator discussion when completed as group activities.</td>
</tr>
<tr>
<td>Duration</td>
<td></td>
<td>The simulation activity including debriefing was to be completed in one hour.</td>
</tr>
<tr>
<td>Facilitator presence</td>
<td></td>
<td>One facilitator was present for classroom based activities.</td>
</tr>
<tr>
<td>Facilitator characteristics</td>
<td></td>
<td>Facilitators were Registered Nurses and female. All facilitators were orientated to the simulation and provided a facilitator guide. All debriefing was student centred.</td>
</tr>
<tr>
<td>Content</td>
<td></td>
<td>Non-technical skills.</td>
</tr>
<tr>
<td>Structure/method</td>
<td>Phases of debriefing included:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• A reactions phase,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Discussion of the clinical considerations of the situation,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Discussion of nontechnical skills demonstrated, missing and/or ineffective in the simulation,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Identification of areas for improvement and what to do differently next time.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Summary of participant learning Note: Phase 2 and 3 can be completed in any order. Questioning techniques utilised Advocacy Inquiry approaches.</td>
<td></td>
</tr>
<tr>
<td>Timing</td>
<td></td>
<td>Discussion of events depicted in the scenarios occurred sequentially though the simulation after each video vignette. The simulation was summarised with a concluding debrief.</td>
</tr>
<tr>
<td>Scripting</td>
<td></td>
<td>A written guide to support facilitation and debriefing of the activity was disseminated to all facilitators.</td>
</tr>
</tbody>
</table>
3. Methods

3.1. Data Collection

As part of the case study design, data collection focused on qualitative data collected from focus groups and interviews. A semi-structured topic guide was developed to explore students’ perceptions and experiences of interacting with the VPs. The topics and techniques were piloted, with revisions made to ensure relevant data was obtained. Box 1 identifies focus group topics (available online).

Ten focus groups and one individual interview were conducted with first-year students and 6 focus groups, including two regional, and one individual interview, with third-year students. Focus groups with first-year students and the interview ranged from 14 to 37 min duration and with third-year students from 20 to 53 min duration. Focus group numbers ranged from two to nine students. All focus groups and interviews were facilitated by the first author (MP) except one, which due to timing conflicts was facilitated by local faculty on site using the same topic guide. Focus groups were conducted face-to-face, in a private room at a time convenient to the participants, except one that was facilitated via video-conferencing to a regional area. Contextual notes were made along with reflections post-sessions. Audio-recordings were professionally transcribed. Other demographic data such as year level, prior experience in healthcare and VPs completed was also collected. Written consent was obtained prior to participating.

3.2. Data Analysis

Framework analysis was used to analyse data supporting consolidation, reduction and interpretation of data as per case study methods (Yazan, 2015). Framework analysis can be “adapted for use with deductive, inductive, or combined types of qualitative analysis” (Gale et al., 2013, p. 119) and provides a useful tool to organise text assisting in interpretation (Fereday and Muir-Cochrane, 2006). The aim of the coding process was to classify all data so it could be systematically compared (Gale et al., 2013).

The aspect of the case study reported here focussed on exploring what nursing students learnt about particular NTS. The conceptual organisation of the case study used the NTS categories developed by Flin et al. (2013) as theory-driven a priori codes guiding deductive analysis. One author (MP) coded all transcripts (n = 18) in NVivo. Inductive data analysis enabled recognition of data-driven codes that were discussed and added on consensus. Data coded was examined by MP and LM for coherence, consistency and fit. An extended summary of each code was developed with illustrative quotes selected from different units of analysis to identify similarities or differences amongst the level of leaners and their experiences with the VPs and perceptions of NTS. Revision of the extended analysis by MP and LM prompted codes to be reorganized and renamed upon consensus with identification of final categories and subcategories.

3.3. Findings

Overall, students from both years and universities reported that interactions with VPs developed knowledge and skills of all categories of NTS to varying degrees. Third-year students suggested that interactions with VPs enabled development of knowledge and skills, as well as practise of NTS in the clinical setting.

Seven NTS categories were recognised, with 27 sub-categories identified in the data. In reporting findings, Y1-FG1 to Y1-FG10 and Y1-Int refer to focus groups and individual interview with first-year students, whilst Y3-FG1 to Y3-FG6 and Yr3-Int refer to focus groups and individual interview with third-year students.

3.4. Communication

Communication was the most referenced NTS category developed across both year levels. Sub-categories included: importance of communication, communication strategies in practice, taking communication skills for granted and communication with the patient (Table 2). Students specified interactions with VPs highlighted how important communication skills are for safe patient outcomes with descriptions of poor communication skills and associated outcomes. Students acknowledged they often took communication skills for granted as they perceived communication as a ‘simple’ skill already mastered. However, interactions with the VPs ‘opened their eyes’ to the role of effective communication in healthcare. Students identified specific strategies for implementation in practice with third-year students describing specific communication strategies implemented in practice. First-year students highlighted the VPs made them aware of the importance of effective communication with patients, however third year students did not highlight this.

3.5. Situation Awareness

Most students reported that their level of situation awareness increased following interactions with VPs. Sub-categories included: increased level of awareness, gathering data, managing distractors and the deteriorating patient (Table 2). Most students reported that they had more clarity about what they were looking for in practice and greater awareness of what was going on around and with their patients, including the impact of distractions in the clinical setting. Students identified the importance of gathering all relevant data to generate a complete picture. Third-year students specifically identified interactions with VPs developed abilities to recognise patient deterioration by identifying trends.

3.6. Teamwork

Interactions with VPs developed students’ understandings of effective teamwork. Sub-categories included: working as a team, teamwork skills, patient as a member of the team and teamwork in action (Table 2). Interactions with VPs facilitated students’ appreciation that patient care requires all health professionals to work together to maximise patient outcomes. Students recognised the importance of interacting and connecting with others, role clarity, seeking support from others and mutual respect as important in effective teams. Students described barriers to teamwork and impacts on patient outcomes. However, only third-year students highlighted the importance of the patient being included as a member of the team and reported that they had recognised teamwork in the clinical setting.

3.7. Decision-making

Focus groups identified interactions with VPs facilitated understanding of decision-making. Sub-categories included: stop and think, the decision-making process, consequences of decisions, decisions from the driver’s seat and making decision points more grey (Table 2). Some students reported interactions with VPs made them actually stop and think about decisions and the potential consequences, rather than just act. Students reported interactions with VPs highlighted the decision-making process with students enjoying making decisions from the ‘driver’s seat’ and feeling in control of the situation. However, some third-year students felt the options presented to advance the simulation were limited while others indicated the options were too ‘black and white’.

3.8. Leadership

Learning related to leadership from interacting with the VPs was reported less with sub-categories identified including: guidelines and protocols, accountability and situational leadership (Table 2). Both year
levels identified risk to patient outcomes from poor leadership demonstrated by not following guidelines or protocols. First-year students described how interacting with the VPs raised their awareness of open disclosure and being accountable for decisions. However, third-year students appreciated the development of situational leadership and delegation skills.

3.9. Stress and Fatigue

Reference to categories of stress and fatigue was significantly less compared with other categories. Sub-categories included: competing demands and experiencing fatigue and stress in practice (Table 2). Interactions with VPs enabled students to realise how competing professional demands and high patient care loads create stressful environments in hospitals. First-year students identified that interacting with the VPs portrayed the role fatigue plays in performance.

3.10. Professional Practice

Some students identified that interactions with VPs highlighted professional practice, with sub-categories including: performing to a standard, recognising importance of empathy, advocacy for patients and colleagues and the complementary role of NTS with technical skills (Table 2). Students described a sense of duty to the patient and the importance of empathy and advocacy for patients, with third-year student identifying advocacy for colleagues. Some students identified how technical and NTS complement each other and the important role each plays in professional practice and safe patient care.

4. Discussion

Within this case study, the exploration of how VPs influenced NTS, students identified that interaction with VPs developed their knowledge and skills of communication, situation awareness, teamwork and decision-making skills. To a lesser extent, students reported developing awareness of leadership skills, while managing stress and coping with fatigue were only minimally described. Students also reported developing professional skills including humanistic attributes of duty, advocacy and empathy. However, variance in the complexity of NTS learning across the year levels was noted. First-year students described fundamental development of NTS knowledge and skill, with limited...
depth in understanding across all categories. Whereas, third-year students revealed greater sophistication in learning, describing nuances across NTS categories and associated implementation of knowledge, skills and attitudes related to communication, situation awareness and teamwork skills in practice.

The findings of this case study, exploring how VPs influenced NTS, suggests undergraduate nursing students perceive interactions with VPs can develop practise of NTS in categories including communication, teamwork, decision-making, situation awareness, leadership and professional practice. The findings present significant opportunities for nursing education, as VP approaches can be distributed across large, diverse student populations, are more flexible, consistent and can be repeated at times convenient to the learner. Further, application of VPs may reduce costs and enable engagement of larger student cohorts than traditional simulation approaches.

Students from both year levels identified particular communication strategies, such as speaking up and active listening, that were important in professional practice. Additionally, third-year students identified specific communication strategies such as Introduction, Situation, Background, Assessment and Recommendations (ISBAR) and situation awareness skills to identify deteriorating patients, they applied in practice. While there is substantive literature regarding simulation and learning outcomes, there is limited evidence regarding transfer of learning to the workplace (Boet et al., 2014). The findings of this case study, exploring how VPs influenced NTS, suggest learning developed via interactions with VPs is integrated into the practice of students and implemented in the clinical setting.

Students expressed taking communication skills in practice for granted. Communication skills were perceived as second nature and ‘already mastered’, requiring little further development and refinement. Taking communication skills for granted is a reported phenomenon in healthcare professionals (Daff, 2012; Tremayne, 2017) which can generate complacency and skill deterioration over time (Haq et al., 2004; Saperstein et al., 2017). However, in this the case study, exploring how VPs influenced NTS, students described how interactions with VPs emphasised effective communication requires practise to ensure adequate, appropriate and accurate information is exchanged at the correct time. VPs may present an effective resource for maintaining focus on effective communication skills in undergraduate nursing students to support patient safety.

Some students stated they were conscious of being more aware in practice and had more clarity about what to look for following interactions with VPs. Situation awareness in nursing students is crucial, however it is an underdeveloped concept in undergraduate nursing curricula with low levels of situation awareness reported in final year nursing students (McKenna et al., 2014). Third-year students highlighted interactions with VPs improved their ability to identify patient deterioration via recognition of changes, trends and patterns. Resources, such as VPs, with capacity to improve students’ abilities to identify deteriorating patients, would be a valuable addition to undergraduate nursing education.

Third-year students described effective teams in action in the clinical setting and were particularly conscious of inclusion of the patient as a member of the team following interactions with VPs. This facet of teamwork is minimally reported in nursing literature. Arguably, the patient has the most important role in the healthcare team (Frosch, 2015). Educational resources such as VPs, that facilitate health professionals to empower patients in teams, are fundamental to ensuring patients having active participation in their care (van Dongen et al., 2017).

Decision-making is fundamental to nursing practice and is often undertaken in time pressured, uncertain situations (Johansen and O’Brien, 2016). However, undergraduate nursing students rarely experience the obligation and liability of making decisions on their own in practice (Kumaran and Carney, 2014). This case study, exploring how VPs influenced NTS, suggests interactions with VPs enables students to make independent decisions and experience consequences of decisions made. However, third-year students identified the decision options presented in the VPs as limiting and too black and white. Additional experience seems to develop awareness in students of alternate solutions and pathways. Hence, it is possible the VP decision pathways may not suit more experienced learners.

A lack of experience in accountability and responsibility has been identified as a significant stressor for new nursing graduates (Kumaran and Carney, 2014). The opportunity to experience accountability and responsibility may assist transition to graduate practice. In this case study, exploring how VPs influenced NTS, students expressed experiencing being accountable for patient outcomes, with first-year students particularly interested in repercussions following an adverse event. However, third-year students who only had a few months until graduation and independent practice, were more interested in situational leadership skills, including delegation and role clarity.

The NTS of managing stress and coping with fatigue were not well identified by students in this case study exploring how VPs influenced NTS. Limited students identified sources of stress in practice and potential impact of fatigue on practice. However, signs and symptoms of stress and fatigue, and coping strategies were absent from focus groups and interviews. These outcomes may be because the VP scenarios did not emphasise the topics of fatigue and stress, or that VPs may be less suitable to develop these NTS in undergraduate nursing students.

Humanistic traits such empathy and advocacy are noted to be an important requirement for patients (Richardson et al., 2015), essential for establishing rapport, enhancing patient satisfaction with links to positive clinical outcomes (Williams et al., 2014). Findings from this case study exploring how VPs influenced NTS, identified that VPs can elicit emotional and empathic responses from undergraduate nursing students. These findings are supported by the findings of a systematic review reported by Bearman et al. (2015) that suggest simulation, including VPs, may be useful in developing empathic behaviours in undergraduate students. These findings also align with those reported in the review by Peddle et al. (2016) suggesting that VPs may have the ability to develop students’ empathic skills.

4.1. Strengths and Limitations

The strengths of the research relate to adherence to case study methodology and data collection across two sites and two year levels, with analytical suppositions to guide data analysis that are accepted in clinical practice. Categories and sub-categories were constructed by MP and LM with conflicts resolved through discussion and consensus from all authors. The naturalistic setting of the study, along with data sources across two-year levels, units of analysis, at two sites, supports transferring findings to other student cohorts. While this paper report reports one aspect of larger case study, it provides insight into students’ perceptions and practice of NTS after engaging with the VPs, caution must be exercised as focus group composition may not be representative of the wider population and there is risk that data arises from dominant participants. It is also important to note that the lead author contributed to the design and development of the VPSP.

This research focused on undergraduate nursing students. Further research is required to investigate the perceptions and experiences of students from other professions following interactions with VPs. The relationship between quantity of clinical experience and decision-making process warrants investigation to enable insight into the decision-making nuances of more experienced students to ensure learning resources offer suitable complexity to optimise learning. Finally, to confirm the suggested benefits in teaching and learning afforded by interactions with VPs to develop NTS knowledge, skills and practice are likely, a comparison between outcomes of face to face simulation experiences and VPs may be warranted.
5. Conclusion

The findings of this aspect of the case study which explores how VPs influenced NTS, suggests integrating interactions with VPs across a curriculum assisted students in developing knowledge, skill, attitudes and practice of NTS categories including communication, situation awareness, teamwork, decision-making skills and humanistic attributes of duty, advocacy and empathy. Students perceive that leadership skills are developed to a lesser extent, with minimal learning related to managing stress and coping with fatigue. These findings point to the value of VPs in developing safe and competent practice and, ultimately, enhancing patient safety.

Funding Notes

The VSPR was funded by a grant from Health Workforce Australia through the Victorian Department of Health in 2012, with follow-up funding from the Commonwealth Department of Health in 2014 and 2016.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.nedt.2018.11.008.

References

Frosch, D.L., 2015. The patient is the most important member of the team. BMJ 350, g7767.
5.3.2 Implications

The findings of this case study indicate that virtual patients may provide valuable learning experiences for undergraduate nursing students to develop knowledge, skills and practise of non-technical skills, which provides significant opportunities in undergraduate nursing education curricula. However, one area of non-technical skills not well addressed by virtual patients was coping with fatigue and managing stress. Interestingly, the data identified other non-technical skills outside the categories developed by Flin et al. (2013). These skills were empathy, advocacy to establish rapport with the patient, as well as professional behaviour, such as duty of care and performing at a professional standard. Finally, the findings advocate that undergraduate nursing students follow the Benner novice to expert learning trajectory (Menard & Maas, 2019). The level of student experience influenced cues perceived and decisions made. First-year students, as novice learners, used rules to guide decisions. However, as advanced beginners, third-year students perceived that the decision options available in the virtual patient simulation, did not align with their concrete experiences, suggesting that their previous experiences may have developed alternate pathways and solutions for clinical situations.

Stress and fatigue were not well reported in the data and further investigation is needed to identify if virtual patients are suited to these non-technical skills or if the actual scenarios did not include these topics. The recognition of non-technical skills outside the traditional non-technical skills categories and elements developed by Flin and colleagues align with the premise that non-technical skills are specific to each profession and each context where care is implemented. These findings reinforce that categories and elements may not be comprehensive or specific enough to capture all the required cognitive and interpersonal skills that support safe and competent care. Finally, it is important that virtual patients conform to the level of experience of the student to ensure the level of complexity and options to progress the simulation develop non-technical skills.

5.4 How virtual patients develop non-technical skills

Process enquiry focuses on how something happens (Patton, 2015). Examining how something works looks at not only formal and expected outcomes but also informal and unexpected outcomes (Patton, 2015). Establishing how something works is important in developing best practice, ensuring teaching and learning strategies support learning (Tanner, 2001) and in identifying what teaching practices contribute most to attaining desired learning outcomes (Tanner, 2001). Qualitative enquiry is useful to investigate processes as it provides
detailed descriptions of individual experiences and what occurs (Patton, 2015). These descriptions assist us informing others of how a program works and provide information about the resource to enable informed decisions to be made (Patton, 2015).

This component of the case study explores how interactions with virtual patients from VSPR developed non-technical skills in undergraduate nursing students’. Qualitative data from focus groups and individual interviews were analysed using framework analysis supported by a codebook. Data collection occurred from March to April 2017. Four themes with associated categories and sub-categories were recognised in the data.

The following published peer-reviewed paper presents the findings of the exploratory case study that systematically examines the influence of virtual patients from VSPR on the development of knowledge, attitudes and practice of non-technical skills in undergraduate nursing students. This paper reports on how interaction with the virtual patient developed non-technical skills in undergraduate nursing students.

5.4.1 Publication four:

Exploring undergraduate nursing student interactions with virtual patients to develop ‘non-technical skills’ through case study methodology

Monica Peddle¹*, Margaret Bearman², Lisa Mckenna¹ and Debra Nestel³

Abstract

Background: Virtual patients are a recent addition to the educational arsenal to develop non-technical skills in undergraduate health professionals. The Virtual Simulated Patient Resource (www.vspr.net.au) is a web-based resource that uses branching, narrative virtual patients to develop knowledge, attitude and practice of all categories of non-technical skills in undergraduate health professionals. However, there is limited literature exploring how the interaction with a virtual patient influences the development of knowledge, attitude and practice of non-technical skills in undergraduate nursing students.

Methods: An intrinsic case study method, using focus groups and individual interviews, enabled exploration of the experience of undergraduate nursing students when interacting with a virtual patient to develop non-technical skills. Purposive sampling identified participants to address the research question. Framework analysis supported by a codebook enabled deductive and inductive data analysis.

Results: Forty-five first-year and 31 third-year students consented to participate. Findings indicated that the different years interacted differently with the virtual patients. Four themes were recognised in the data: how the virtual patients enabled learning non-technical skills, learning surrounding the virtual patient encounter, changing the way students perceive practice and potential limitations to learning.

Conclusions: Interactions with virtual patients influence learning knowledge, attitudes and practice of non-technical skills in undergraduate nursing students via authenticity in the virtual patient interaction, socialisation to the professional role, vicarious learning and learning by making mistakes. Potential limitations to learning from virtual patient interactions include fear, overconfidence, groupthink and confusion. To manage limitations to learning, facilitation approaches, opportunities for reflection, constructive feedback and debriefing may be key. This study demonstrates learning non-technical skills via interactions with virtual patients can change the way students perceive practice, with learning transferable to the clinical setting to support safe and competent patient care.

Keywords: Virtual patient, Simulation, Non-technical skills

* Correspondence: m.peddle@latrobe.edu.au

© The Author(s). 2019 Open Access This article is distributed under the terms of the Creative Commons Attribution 4.0 International License (http://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made. The Creative Commons Public Domain Dedication waiver (http://creativecommons.org/publicdomain/zero/1.0/) applies to the data made available in this article, unless otherwise stated.
Introduction
Virtual patients (VPs) are defined as “interactive computer simulations of real-life clinical scenarios for the purpose of healthcare and medical training, education, or assessment” [1]. Traditionally, VPs have been used to develop diagnostic and clinical reasoning in medical and nursing students [2, 3]. Advances in technology and educational methodology have supported the evolution of VPs to address wider areas of learning, including “non-technical skills” (NTS). Interactions with VPs are suggested to be effective in developing categories of NTS including communication, teamwork and decision-making across all health professions [4]. However, there are limited publications exploring how the experience of interacting with VPs influences students’ learning knowledge, skill, attitudes and practise of NTS. Understanding student learning experiences is important to ensure learning activities facilitate students’ academic development.

An integrative review identified features of interactions with VPs in developing NTS in undergraduate health professionals. Three themes were reported: socialisation to the professional role, transfer of learning to the clinical setting and authenticity [4]. However, studies included in the review only addressed isolated categories of NTS. No publication addressed the full suite of NTS categories of communication, situation awareness, teamwork, leadership, decision-making, coping with stress or managing fatigue. There is debate regarding the use of the term non-technical skills to describe these complex behaviours identified as critical components of safe and competent practice for health professionals [5]. We use the term in this paper whilst acknowledging its limitations.

The purpose of this study was to explore experiences of undergraduate nursing students when interacting with VPs designed to develop a broad range of NTS such as communication, situation awareness, teamwork, leadership, decision-making, coping with stress or managing fatigue. The study investigated how students’ interactions with VPs influenced learning and practice of NTS.

Research question
The question underpinning this research was: How do interactions with VPs influence learning NTS in first and third-year undergraduate nursing students?

Method
The virtual simulated patient resource
The Virtual Simulated Patient Resource (VSPR) (www.vspr.net.au. Melbourne, Victoria. Australia) is a freely available web-based resource, funded by Health Workforce Australia and the Department of Health, Victoria, Australia. The primary author led the design, development and authorship of the VSPR. The resource uses e-Learning modules and branching narrative VPs to develop knowledge, skills, attitudes and practice of all categories of NTS, including communication, situation awareness, teamwork, leadership, decision-making, coping with stress or managing fatigue in undergraduate health professionals [6]. The study investigated how students’ interactions with VPs influenced learning and practice of NTS.

Grounded in constructivist theory, interactions with VPs support construction of new knowledge and understanding by interrogating prior knowledge and experience [7]. Students engaged in the simulation as themselves. The narrative VP used a “choose your own adventure game” approach with short video vignettes, depicting a patient’s story over time. The simulation progressed when students selected from two choices appearing on the screen following the video vignette. A decision tree using a branching algorithm determined the next video in the simulation sequence. Consequences of decisions resulted in positive or negative effects on the patient’s outcomes, providing intrinsic feedback to students on their actions. VP interactions were completed as independent and/or small group activities. In small group activities, learning was supported by group discussion at the end of each video vignette and a concluding facilitator-guided debriefing. Students have unrestricted access to the modules and VPs in the VSPR enabling repetition. Seven VP scenarios are available in the VSPR (Table 1).

Design
This paper reports part of a larger multisite exploratory, qualitative research project using case study methodology [8] with focus groups and individual interviews. We were intent on insight, discovery and interpretation of the learning experience participants have when engaging with a particular case, in this instance, the VPs in the VSPR [9]. The year level of the undergraduate nursing student comprised the unit of analysis. The themes identified in Peddle et al. [4] provided the conceptual organisation for this case study, identifying areas of needed understanding, directing data collection and guiding interpretations [10]. University Human Ethics Research Committee granted ethical approval (Ethics approval ID number: CF12/3958 – 20120018910). Reciprocal ethical approval was obtained at all study sites.

Population and sample
Purposive convenience sampling was used to identify suitable participants to address the research question. First- and third-year undergraduate nursing students from two university nursing schools in Victoria, Australia, using VSPR were invited to participate. Recruitment comprised either invitations disseminated through online subject forums or verbally after simulation activities. The primary author (MP) undertook all recruitment from March to April 2017. Forty-five first-year and 31 third-year students consented to participate.
Data collection
A topic guide supported data collection via focus groups and individual interviews. The topic guide was piloted for acceptability, usability and question clarity, with outcomes guiding amendments to the question schedule and approaches (Additional file 1). Data collection occurred in person, in a private room, except for one focus group that used video-conferencing to a regional location. The primary author (MP) facilitated all focus groups and interviews except one, which due to scheduling issues was facilitated by another faculty member using the same topic guide. All focus groups and interviews were audio-recorded and professionally transcribed. In accordance with ethics approval, informed written consent was obtained prior to participation.

Data analysis
Framework analysis supported by a codebook was used to analyse data. Framework analysis is appropriate in deductive, inductive or combined qualitative analysis [11],

<table>
<thead>
<tr>
<th>VP title</th>
<th>VP topic</th>
<th>Positive patient outcomes</th>
<th>Negative patient outcomes</th>
<th>Target learner audience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Falls</td>
<td>Preparing patient falls in the clinical practice setting.</td>
<td>Patient assisted to toilet. Patient discharged 2 days later.</td>
<td>Patient falls when toileting independently. Sustains laceration to forehead, fractured right neck of femur and head injury. Patient remained in hospital for several weeks for treatment and rehabilitation.</td>
<td>Novice learner</td>
</tr>
<tr>
<td>Ward round</td>
<td>Interprofessional teamwork including patient as a member of the team.</td>
<td>Correct diagnosis and management and patient commenced on appropriate medication. Patient discharged 3 days later.</td>
<td>Incorrect diagnosis and management. Patient experiences acute pulmonary oedema and requires emergency medical team intervention. Patient admitted to high-dependency unit and follow-up rehabilitation for several weeks.</td>
<td>Advanced beginner</td>
</tr>
<tr>
<td>Aggressive patients</td>
<td>Recognising and responding to aggression.</td>
<td>Patient frustration and agitation correctly identified and managed resulting in de-escalation of the situation.</td>
<td>Patient frustration and agitation is not recognised. Patient behaviour escalates into aggressive violent outburst. Security measures are required to manage patient situation.</td>
<td>Advanced beginner</td>
</tr>
<tr>
<td>Community</td>
<td>Managing warfarin therapy in the community post coronary artery bypass grafts.</td>
<td>Patient receiving warfarin therapy has high International Normalised Ratio identified and emergency medical treatment instigated.</td>
<td>High international normalised ratio not identified. Patient sent home from clinic with no emergency treatment. Patient experiences large cerebral haemorrhage and dies shortly after.</td>
<td>Advanced beginner</td>
</tr>
<tr>
<td>Administering blood products</td>
<td>Risks associated with administering blood products in the clinical setting.</td>
<td>Incorrect patient identification is recognised. Correct patient is located and verified. Blood product administration proceeds without incident.</td>
<td>Following incorrect patient identification, wrong patient administered blood product. Patient experiences severe haemolytic transfusion reaction and admitted to intensive care unit.</td>
<td>Advanced beginner</td>
</tr>
<tr>
<td>Post-operative</td>
<td>Recognising and responding to patient deterioration in the immediate post-operative period.</td>
<td>Patterns and trends are recognised early with appropriate treatment implemented. Normal fluid balance returned in post-operative phase.</td>
<td>Patterns and trends are not recognised and no treatment implemented. Patient experiences acute kidney injury post-operatively.</td>
<td>Competent</td>
</tr>
<tr>
<td>Midwifery</td>
<td>Woman with epidural analgesia in labour experiences episode of hypotension.</td>
<td>A pathological fetal heart rate pattern is detected following episode of hypotension. Fluid resuscitation is initiated and a change to maternal position. Normal vaginal birth.</td>
<td>There is a delay in recognising, reporting and responding to a pathological fetal heart rate pattern. Fetal compromise ensues resulting in emergency caesarean section and neonate resuscitation.</td>
<td>Competent</td>
</tr>
</tbody>
</table>
as it assists in organising and managing text so it can be systematically compared [11] and interpreted [12].

Themes identified in an integrative review by Peddle et al. [4] were used as theory driven, a priori codes in the codebook, guiding deductive data analysis. Two authors (MB and MP) independently coded a focus group transcript to test applicability of the codebook. Results were compared and modifications made to the codebook. Inductive data analysis enabled recognition of data-driven codes. Each code was discussed and added to the codebook by agreement. All codes in the codebook were given labels, defined with reference to existing literature and provided a description [12].

Codes were entered as nodes in NVivo (QSR International Pty Ltd. Melbourne, Victoria, Australia, Version 11), and one author (MP) coded all subsequent transcripts (n = 18). During the coding process, one author (MP) exported data from randomly selected nodes, which were examined by an additional author (MB) for coherency, consistency and fit. Specific areas of concern were discussed, leading to codes being reorganised and retitled on consensus. An extended summary of each code was developed, with illustrative quotes selected from the data from different units of analysis (year level of students). Codes along with associated illustrative quotes were reviewed, revised and grouped.

Findings

One individual interview and ten focus groups were conducted with first-year students, and one interview and six focus groups with third-year students. First-year focus groups and the interview ranged from 14 to 37 min, with third-year focus groups and interview ranging from 20 to 53 min. Individual interviews were conducted where only one student accepted the invitation to participate but could not reschedule and wanted their voice to be heard in the research.

The unit of analysis in this case study was the year level of the student. An important finding highlighted by all students was that prior experience—as indicated by the year level—altered perception of cues and information in scenarios and affected options selected. Data indicated that first-year students, with limited or no prior experience in healthcare, experienced challenges with terms, language and situations portrayed complicating learning. On the other hand, third-year students conveyed that their prior experience enabled them to readily distinguish significant cues and important information, enabling them to perceive the care situation more easily.

Four themes were recognised in the data: how the VP enabled learning NTS, learning surrounding the VP encounter, changing the way students perceive practice and potential limitations to learning (Table 2).

<table>
<thead>
<tr>
<th>Theme</th>
<th>Category</th>
<th>Sub-category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How the VP enables learning to happen</td>
<td>Socialisation to role</td>
<td>“This is how I should be.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“Develops self-confidence.”</td>
</tr>
<tr>
<td></td>
<td>Authenticity</td>
<td>“Real but not real.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“The same thing happens.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“Sometimes bad things happen”</td>
</tr>
<tr>
<td>2. Learning surrounding the VP encounter</td>
<td>Vicarious learning</td>
<td>Learning through mistakes</td>
</tr>
<tr>
<td></td>
<td>Design</td>
<td>Vicarious learning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reflective practice.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“Connects with the content.”</td>
</tr>
<tr>
<td>3. Changing the way students perceive practice</td>
<td>Fear</td>
<td>“We’re all involved in patient safety”</td>
</tr>
<tr>
<td></td>
<td>Overconfidence</td>
<td>Practical value</td>
</tr>
<tr>
<td></td>
<td>Groupthink</td>
<td>“That’s not the way we do it here!”</td>
</tr>
<tr>
<td>4. Potential limitations to learning</td>
<td>Confusion</td>
<td>Groupthink</td>
</tr>
<tr>
<td></td>
<td>Barrier of the classroom</td>
<td>“We all got to work together,”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“Connects with the content.”</td>
</tr>
</tbody>
</table>

How the VP enabled learning NTS

Five categories describe how interactions with VPs facilitated learning NTS: socialisation to role, learning through making mistakes, vicarious learning, authenticity and design. The first two categories have multiple sub-categories.

Socialisation to role

The ‘socialisation to role’ category explores how the student came to understand the norms, expectations and behaviours expected in practice. There are two sub-categories: “this is how I should be” and “develops self-confidence”.

“This is how I should be” All students articulated that interacting with VPs enabled them to think and feel like nurses: “It’s really making me see, putting myself in them and this is going to be me, this is what I’ve got to do, this is how it’s going to be, this is the relationship I need to have” (Yr1/Grp11/Participant 3). Students developed insight into the environment, characters and events that may occur during practice, enabling identification of appropriate behaviours in specific situations: “It just gives you examples of how things might go...” (Yr3/Grp1/Participant1). Interactions with VPs enabled students to value their role, demonstrated application of
professional standards in practice and developed insight into working in interprofessional teams: “... it places you in a situation where it’s not just the patient. It’s putting you in situations like - staff members and doctors...” (Yr3/Grp4/Participant 5). Interactions with VPs enabled recognition of at-risk situations and behaviours and strategies to ask for help: “...it gives an example of the best way to... go to a buddy nurse and ask for help” (Yr3/Grp1/Participant 3). All students described how interacting with VPs role-modelled professional practice.

However, whilst some first-year students expressed that interacting with VPs validated preconceived expectations, for others, the simulation provided opportunities to reframe or clarify misconceptions: “The authenticity of the VP enabled students to see relevance of the VP interaction to their professional development as it represented real practice that was familiar. There are three sub-categories: ‘real but not real’; ‘the same thing happens’; and “sometimes bad things happen”.

“Real but not real” Most students reported the VPs as ‘real’ with authentic characters, situations, environments and events that appealed to students, enabling immersion and engagement, motivating learning. Authenticity in the interaction heightened awareness that medical errors can happen and how errors occur in practice with competent, experienced professionals: “These are actually people who are already professionals; they are registered nurses, doctors” (Yr1/Grp5/Participant 1). Many students conveyed that interacting with VPs made them cognisant of the imperfect reality of clinical practice, stating it was valuable to see ‘real’ practice: “Not everybody is going to be like a perfect friendly robot. You’re going to have co-workers who are going to be difficult. You’re going to have people and patients who aren’t going to be always respectful” (Yr1/Grp10/Participant 2). Many students were surprised how quickly clinical scenarios changed, with this variability adding authenticity to the experience: “Just to keep in mind that anything could happen to the patient and [it] might escalate very quickly” (Yr3/Grp7/Participant 4). Though, students from both years qualified that they could tell the experience was not real: “Like it didn’t feel not real, it seems pretty realistic for the most part” (Yr1/Grp1/Participant 1) “...but you just know it’s not real” (Yr3/Grp 3/Participant1).

“The same thing happened” Students described the situations, events, performance of characters and responses from patients as relatable and familiar, endorsing the interaction as relevant and credible: “When I did my placement, the same thing happened. When doctors were doing rounds, they included physio and the nurse... having arguments, as well” (Yr3/Grp4/Participant2). Students identified the scenarios emphasised various roles, multiple points of interaction and multitasking present in patient care activities, accentuating genuine risks associated when working in a team: “It shows you how hard it is to kind of communicate when you’ve got 1,000 things going on” (Yr1/Grp1/Participant 2).

“Sometimes bad things happen” Many students thought the depiction of poor patient outcomes necessary for learning: “I think it’s useful to demonstrate severe consequences because there’s a lot of risk involved and sometimes bad things will happen and I think it’s something that we need to be exposed to” (Yr1/Grp10/Participant2). Some students valued experiencing poor patient outcomes via simulation rather than in practice: “To know what the terrible repercussions will be and I’d rather do it on this” (Yr3/Grp1/Participant2). Students described how interacting with the VP highlighted the likelihood they may experience poor professional practice: “...you know that there would be nurses like that out there that...does her poor version of [practice]. It’s scary” (Yr3/Grp3/Participant2).
However, third-year students were able to qualify that the patient outcomes depicted in the VP scenarios were believable. Furthermore, third-year students valued how interactions deepened their understanding of negative patient outcomes related to poor NTS.

**Learning through making mistakes**

Learning through making mistakes afforded students opportunities to see consequences of actions, galvanising some into action and prompting thinking through decisions.

All students stated it was beneficial to experience consequences of decisions made in the scenario especially when they ‘got it wrong’ (Yr3/Grp1/Participant1) and could visualise poor patient outcomes: “I think it allows you to make mistakes without actually hurting someone and learning...” (Yr1/Grp6/Participant1). Many students deliberately selected incorrect options to see the negative consequences, reporting the experience galvanised them into action: “It just shows that if you don’t speak up - what can come of it. It gives you the courage to speak up” (Yr3/Grp4/Participant7). Students appreciated understanding how mistakes and errors are managed: “That was quite a big eye opener. There are consequences for your patient... mistakes but also their family as well and you’ve got to be the one to stand up and take responsibility for it” (Yr1/Grp10/Participant3).

Students from all year levels identified how interacting with VPs “really made you think” (Yr1/Grp3/Participant3) about decisions and potential consequences: “We got one of the questions wrong... Then it was like ‘oh my gosh, we didn’t even realise! We’re just like ‘Yes that sounds right’. We didn’t really think about it” (Yr1/Grp3/Participant2). Students clarified the interaction got them thinking ahead trying to predict outcomes: “Like you’re really thinking ahead and your sort of thinking what can go wrong or... how could this improve for the patient situation” (Yr3/Grp2/Participant1).

**Vicarious learning**

Strong emotional responses triggered by interacting with VPs afforded students feeling present in the care interaction, experiencing professional behaviours and the emotional burden of practice.

Students valued opportunities to experience clinical situations without the situation happening to them, learning via experiences of others: “It’s giving you an insight into an experience you haven’t got” (Yr3/Grp3/Participant1) and preparing them for future practice situations: “…instead of...freezing in the moment you have kind of seen it before” (Yr3/Grp1/Participant1). Many indicated they were present, participating in care activities, controlling the situation with responsibility for the patient: “I feel like...we were in the scene; like you were there...I saw myself as that nurse and whatever she said, I said. And how the doctor spoke with her, I just saw myself in...her shoes” (Yr1/Grp2/Participant1). However, some students felt like observers, with a “birds-eye view” (Yr3/Grp7/Participant3).

Interacting with VPs triggered emotions including frustration related to practitioner performance and choice, pride when positive patient outcomes were achieved, and guilt, terror and fear when negative patient outcomes eventuated. Students indicated interactions developed empathy with patients as well as health professionals: “It sort of puts us in her shoes and thinking what would I be doing next if I was this person” (Yr3/Grp3/Participant3).

However, only first-year students reported interactions with VPs enabled them to experience emotions they would likely experience in practice, giving insight into reactions and the emotional burden of practice: “…it also shows you the emotional burden you’re going to be taking on. If you make a mistake, it’s real... from one little mistake, by not communicating. The patient gets hurt so it’s real” (Yr1/Grp11/Participant2).

**Design**

The VP design, including the organisation and visualisation, were beneficial to learning, supporting interpretation and easier recall. The VPs were reported to be well organised, easy to navigate and aesthetically pleasing. Students liked the flow of the VPs with short, sharp, detailed videos complementing learning. Students appreciated the variation to teaching approaches in curricula, opportunities for repetition reinforcing learning and consistency afforded for all students across learning experiences. Most students reported the visual depiction of the VP a major benefit for learning, with videos easier to interpret and recall in practice and the information staying with them longer: “If I see a video and I see how it’s done and I see how you’re meant to act, how your tone of voice is; that for me works better. I need to visualise something to get a better understanding” (Yr1/Grp3/Participant2). Students stated the VPs were easy to engage with and appreciated “not [being] thrown in the deep end” (Yr3/Grp2/Participant1). Students preferred the real human reactions and interactions portrayed in the VPs over mannequin-based simulation, commenting: “the patient actually responds” (Yr1/Grp4/Participant1).

**Learning surrounding the virtual patient encounter**

Students identified that learning content and activities surrounding the VP interaction supported learning knowledge, skill, attitudes and practice of NTS. There were three sub-categories: “we’ve all got to work together”, “reflective practice” and “connects with content”.

“**We all got to work together**” Students reported learning in small group approaches was powerful. They valued group discussions enabling them to identify missed
cues, view situations differently and clarify concepts: "if you watch it by yourself you don’t realise it but you’re focusing on one thing, but...when you start talking, everyone will go, “Didn’t you see that guy do this?” and, “What about when she did that?” And I’m like, “Oh, I didn’t even see that” (Yr3/Grp7/Participant3). Students valued opportunities to practise NTS including, appreciating other perspectives, managing conflict, considering different ways of thinking and collaborating with others to solve problems: “I like how the video made a classroom full of people with different skills work together...that’s what’s going to happen when we’re actually in the healthcare industry. So, it was good practice communicating and working with different people” (Yr1/Grp3/Participant2).

“Reflective practice” Interacting with VPs promoted student reflection on practice: “It’s very good for reflective practice, learning what you’ve done, where you went wrong, how you’d improve it next time, why you shouldn’t have done that” (Yr1/Grp8/Participant3). Students across all year levels clarified when they would reflect on their interactions with the VP and complete follow-up activities to make sense of learning. Other students explained they would repeat the interaction when they needed a refresher.

“Connects with the content” Students reported interacting with VPs reinforced concepts learnt in other subjects. Students clarified the interaction offered more detail and a means to integrate learning as a cohesive whole: “I feel like it does connect with the content that we’ve been learning so far. I wasn’t thinking in my head ‘I don’t need to watch this, this is not relevant’. I was thinking ‘this is really important and I should use this resource’...even when I was doing lab, I felt like it was in touch with what my lab teacher was going through” (Yr1/Grp3/Participant1).

Changing the way students perceive practice
Students identified how interacting with VPs enabled application of specific strategies in practice. Three sub-categories were identified: practical value, “that’s not the way we do it here” and “we are all involved in patient safety”.

Practical value
Many students described application of skills learnt from interactions with VPs to situations in practice. Students clarified how the realistic presentation of situations in VPs made it easier to recall the scenarios in practice: “So, if you were in that same situation, you think back to this video it’ll be in your head” (Yr1/Grp8/Participant4). Many students described intentions to implement NTS demonstrated in VPs in their practice: “When you do

watch it...you pick up little things, yes, that’s good...I’ll take that away with me. I like how she said that, I am [going to] use that” (Yr3/Grp1/Participant3). Students reported using reflective practices developed to reflect on their practice: “just to think after your working day, what I could do better, what went wrong and why it wrong and just thinking what can you improve” (Yr1/Grp5/Participant1).

However, first-year students identified benefits to technical aspects of practice such as one first-year student describing how participating in the VPs enabled her to manage a resident who had a fall. While third-year students identified how interactions shaped unconscious patterning: “It’s like we indirectly take stuff from them...I don’t go on placement and say I am [going to] do exactly this that I saw in the video. Then you do it and you realise... ok...I learnt that from the video” (Yr3/Grp1/Participant3).

“That’s not the way we do it here!” All students reported discord when transferring NTS learnt interacting with VPs to the clinical setting several weeks after the activity. A first-year student described: “Placement was a bit confronting for me it was...not what I expected. We had been taught a lot of – ‘This is the way things should go.’ But...in the placement things did not necessarily go like that. I think that perhaps not all the things we learnt at the university were in place in the workplace” (Yr1/Grp1/Participant2). Third-year students described shortcuts taken, practice not evidence-based and gaps in knowledge regarding NTS.

“We’re all involved in patient safety” Students reported interacting with VPs assisted understanding the link between NTS and patient safety: “The point is that...it doesn’t matter what kind of level you are...we’re all involved in a patient’s safety.” (Yr1/Grp5/Participant1).

However, most first-year students were not aware of, or did not have, clarity around NTS in practice. Conversely, most third-year students articulated clear understanding of NTS: “It could be fatal on the patient’s outcome, as well. It could lead to either further complications, or it could lead to death of the patient” (Yr3/Grp4/Participant2).

Potential limitations to learning
Five categories were associated with potential limitations to learning including: fear, overconfidence, barrier of the classroom, confusion and groupthink.

Fear
Only first-year students raised the potential negative impacts of poor patient outcomes on learning. First-year students were surprised by “all the bad outcomes” (Yr1/Grp5/Participant1), expressing fear and being “freaked-out” (Yr1/Grp5/Participant1). These students suggested portrayal
of poor patient outcomes might cause overthinking, hesitation or second-guessing oneself in practice.

**Overconfidence**

Only first-year students indicated that interactions with VPs had corrected overconfidence: "... I thought I would not make the patient fall. That's it, I've got it! And then when I'm making the choices I'm like, oh okay" (Yr1/Grp8/Participant4). Conversely, third-year students highlighted risks in developing overconfidence following the VP interaction: “You get confidence but not real confidence” (Yr3/Grp3/Participant2) and "I look at all the procedures and I’m like, “Yeah, I can do this.”” (Yr3/Grp5/Participant6). Other third-year students indicated: "Like if it was an emergency and they made you go to the phone, you wouldn’t be so confident, but...it wouldn’t phase you” (Yr3/Grp3/Participant2).

**Barrier of the classroom**

Some students from both year levels could not move beyond the barrier of the classroom environment and engage in the learning: "I could tell like it’s sort of set up, just like the way people communicate. Like they know what they’re going to say, which doesn’t really happen in real life, but the situation was real, but I could just tell that it wasn’t real” (Yr1/Grp4/Participant 2). Some qualified they were waiting and expecting something to happen making the experience feel contrived. One student clarified that to consolidate learning achieved from interacting with VPs, they would need to experience the situation in practice.

**Confusion**

Several students across both year levels reported they found some options in the VP interaction confusing, with wording difficult to understand such as “Vital signs within reportable limits” and “Patient observations demonstrate a significant pattern.” However, nearly all students qualified; once the next video in the VP sequence played, they could make sense of the question.

However, first-year students reported issues with fundamental medical terminology and understanding clinical features of the scenario, whereas third-year students expressed frustration at limited options available: “With the options, I thought it was limited, because you only had two choices. I thought, if there was maybe...four choices, at least you were more able to...critically think a bit more” (Yr3/Grp4/Participant9), clarifying choices appeared “black and white” (Yr3/FG5/Participant2) with no right options available at times.

**Groupthink**

Students indicated it was a “majority rules” (Yr1/Grp6/Participant1) approach and communicated at times “there was a bit of tension in the class with the other students” (Yr1/FG9/Participant2) and discussions “kind of turned into an argument” (Yr1/FG7/Participant2), with “people being disrespectful” (Yr1/FG7/Participant1) due to dissenting opinions. At times, when "somebody brought up one point we all kind of changed our minds” (Yr1/Grp9/Participant1), others chose to remain quiet: “I picked the correct answer first but then when everyone else said it was the other one I was kind of like okay I'll kind of be a bit quiet” (Yr1/Grp8/Participant5) and conform to groupthink.

**Discussion**

This research reinforces findings indicating interactions with VPs develop knowledge, skills, attitudes of NTS in undergraduate health professionals via socialisation to professional role and authenticity in the VP interaction, with skills transferrable to practice. It clarifies that learning NTS via VP interactions can change the way students perceive practice. New themes in this research suggest learning through making mistakes, vicarious learning, design of the VP and learning surrounding the VP interaction are significant factors facilitating learning NTS via VP interactions. Lastly, this research highlighted potential limitations to learning and practise of NTS including fear, overconfidence, classroom barrier, confusion and groupthink.

A number of particularly interesting findings from this research add to existing understandings of VPs. These are learning through mistakes, vicarious learning, groupthink, impact of overconfidence on practice and consideration of the prior experience of the learner. Each of these findings is discussed in turn.

Learning through mistakes is proposed to have a powerful impact on learning [13]. When learners make mistakes, they have strong emotional responses, which may encourage motivate [13–15] and promote deep learning, supporting knowledge retention and transfer of learning [13]. Additionally, simulated mistakes can amplify student awareness of the possibility of clinical errors in practice [15, 16]. The design of the VP in this study, to demonstrate negative patient outcomes, supported discussion, developing critical thinking [17] and identification of gaps in knowledge and skill [13]. Students reported that experiencing and exploring mistakes in interactions with VPs facilitated learning. They described strong emotional reactions to negative outcomes such as guilt, terror and fear, as well as sometimes deliberately seeking to make mistakes to see what the consequences were. This led to them to reflect on how they would act in practice and seeing patient safety as everyone’s responsibility.

Conversely, this study highlighted that learning through mistakes could negatively influence learning, causing students to be scared or “freak-out” about possibilities of harming patients in practice. Experiencing negative consequences can be traumatic for some learners, leading to
defensive practice [18] including fear of failure in practice and hesitation in initiating patient care [19]. In this research, whilst interaction with the VP made real for learners the possibilities of making mistakes in practice, they also sparked feelings of guilt, terror and fear. When VPs depict error and adverse events resulting in serious harm or death to patients, consideration may be needed by faculty to provide opportunities for reflection. Reflection can enable re-contextualisation of the experience and facilitation of learning [18] to translate the experience of “getting it wrong” into positive learning about NTS.

Vicarious learning proposes it is possible to learn through another’s first-hand experience [20]. Vicarious learning is advocated to be an important strategy for novice learners who have a deficit of prior knowledge and experience [21]. Timbrell [21] suggests vicarious learning assists novices to generate personal meanings from secondhand experiences, supporting transfer of learning to clinical practice [21]. In this research, students indicated interactions with VPs placed them in the clinical situation, involving them in the patient care situation, enabling them to contemplate how they may think, respond and act in future clinical situations. Additionally, vicarious learning enables coding of observed behaviours to be used to guide future action [22]. In this study, students highlighted interactions with VPs supported framing future behaviours, “I’m going to use that”, to guide practice.

Novice learners benefit from small group discussions as they provide opportunities for learners to recognise important factors and cues, connect knowledge and assess and analyse their own understanding [23]. However, this research shows a potential limitation to learning NTS is “groupthink”. Groupthink is when humans influence or bias each other’s decision-making [24]. In this research, learners reported exactly this. Groupthink can result in poorer decisions, as members of the group may not consider all options, or some group members may impose self-censorship to avoid inconsistency [24]. If learners perceive an environment as psychologically safe, they are more likely to engage in open discussion and share ideas without fear of repercussions [25]. Strategies to facilitate this safe environment where participation and learning is enhanced and disengagement is minimised [26] in interactions with VPs warrants further exploration.

Improved self-confidence is often cited as an outcome from simulation-based learning [27]. This research identifies that there is also a risk of developing overconfidence, or “miscalibration of one’s own sense of accuracy and actual accuracy” [28]. Overconfident practitioners are deemed more likely to make mistakes [29] as they are less likely to “consult with colleagues or utilise tools, protocols or practice guidelines to aid their decision-making” [30]. Moreover, overconfidence is linked to diagnostic error [28]. Strategies to reduce risks of developing overconfidence include refining expertise via further education and training, reflective practice to increase self-awareness and constructive feedback to assist learners be better calibrated to their personal performance [28]. This study suggests a need for balance between reflection and constructive feedback to assist learners better align perceived competency with actual competency in interactions with VPs.

Other limitations to learning in VP interactions included frustration at the wording of options to progress the simulation and third-year students perceiving “no right” options available to respond to the clinical situation. This study highlighted that students’ prior experience influenced perception of cues and ability to interpret significance of information, which in turn affected options selected. As learners developed expertise, they moved from reliance on objective facts and rules to using past concrete experiences and seeing the situation as a whole, rather than a compilation of its parts [31].

First-year students are novice learners; hence, when wording and question formulation deviated from the rule bound principles, they experienced confusion and frustration [31]. These students possessed limited understanding of NTS and appreciated role modelling of specific behaviours in practice that assisted in clarifying misconceptions. However, lack of experience for first-year students may have created confusion, which at times detracted from their learning. Moreover, first-year students suggested that interactions with VPs that result in poor patient outcomes might develop fear of practice.

Accordingly, third-year students, as advanced beginners, were able to perceive the situation holistically and based on their prior concrete experiences, at times suitable options to respond to clinical situations were not available [31]. Third-year nursing students demonstrated clear understandings of NTS, using the believable, realistic, VP scenarios to benchmark and assess their own practice. However, these students indicated there were risks in developing overconfidence in practice and that at times, no right options were available to progress the simulation, due to their prior clinical experience.

Strengths and limitations
Theoretical suppositions were used to guide data analysis as per case study methodology. Data collection occurred across 2-year levels at two distinct sites. Transferring findings to other student cohorts is supported by the naturalistic study setting, with multiple data sources. Themes, categories and sub-categories were created, labelled and defined by MP and MB by agreement. Data were examined for consistency, coherency and fit with conflicts resolved through discussion and consensus from all authors. Focus groups and interviews facilitated a detailed, in-depth understanding of the learning experience of undergraduate nursing students. However, caution must
be exercised as focus group composition may not be representative of the wider population and there is risk that data arises from dominant participants. During data collection, the primary author was on research leave and had no formal relationship with the students who participated in the research. Moreover, it is important to note that the primary author led the design, development and authorship of the VSPR. Hence, the primary author worked closely with co-authors to ensure rigour in the research, transparency in analysis and trustworthiness of findings.

Recommendations
The focus of this research was undergraduate nursing students. Additional research is required to examine the learning experience of students interacting with VP from other professions. Additionally, the role of faculty and debriefing in reconceptualising learning from negative patient outcomes, specific facilitation strategies to prevent groupthink, and the influence of reflection and constructive feedback on overconfidence warrant further investigation.

There were a number of possible recommendations for practice arising from this research. This study suggests that in order to facilitate learning NTS though VP interaction for undergraduate nursing students, faculty can provide opportunities for reflection, supported by constructive feedback, to enable learners to reconceptualise experiences and feelings into learning. Additionally, faculty are advised to be conscious of the potential for groupthink and have the ability to maintain awareness in the classroom, whilst enabling a supportive and secure learning environment. Finally, faculty can be mindful that the level of complexity of the learning in the VP interaction fits with the level of experience of the learner.

Conclusion
Interactions with VPs in VSPR influence learning knowledge, attitudes and practice of NTS in undergraduate nursing students via authenticity in the VP interaction, socialisation to the professional role, vicarious learning and learning by making mistakes. This research highlights the importance of connection of the VP interaction to learning surrounding the activity to maximise learning outcomes. To manage potential limitations to learning from VP interactions including fear, overconfidence, groupthink and confusion; facilitation approaches, opportunities for reflection, constructive feedback and debriefing may be key. This study demonstrates learning NTS via interactions with VPs can change how students perceive practice, with learning transferable to the clinical setting to support safe and competent patient care.

Additional file

Additional file 1: Focus group and interview guide. (DOCX 13 kb)

Abbreviations
ISBAR: Introduction, Situation, Background, Assessment, Recommendation; MB: Margaret Bearman; MP: Monica Peddle; NTS: Non-technical skill; VP: Virtual patient; VPs: Virtual patients; VSPR: Virtual Simulated Patient Resource

Acknowledgements
Nil

Funding
Nil

Availability of data and materials
The authors declare that the data supporting the findings of this study are available within the article.

Authors’ contributions
MP gathered, analysed and interpreted the data regarding the experience of undergraduate nursing student interacting with the virtual patient. MB analysed and interpreted the data regarding the experience of undergraduate nursing student interacting with the virtual patient. LM and DN were involved in drafting the manuscript or revising it critically for important intellectual content. All authors read and approved the final manuscript.

Ethics approval and consent to participate
University Human Ethics Research Committee granted ethical approval (Ethics approval ID number: CF12/3958 – 20120018910). Reciprocal ethical approval was obtained at all study sites. In accordance with ethics approval, informed written consent was obtained prior to participation.

Consent for publication
Not applicable.

Competing interests
All authors declare that they have no competing interests.

Publisher’s Note
Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Author details
1School of Nursing and Midwifery, College of Science Health and Engineering, La Trobe University, Melbourne, Australia. 2Centre for Research in Assessment and Digital Learning (CRADLE), Deakin University, Melbourne, Australia. 3Monash Institute for Health and Clinical Education, Faculty of Medicine, Nursing and Health Sciences, Monash University, Melbourne, Australia.

Received: 23 August 2018 Accepted: 11 January 2019
Published online: 13 February 2019

References
5.4.2 Implications

Findings suggest that learning non-technical skills through virtual patients occurs by socialisation to professional role, learning through making mistakes, vicarious learning, authenticity and design. The findings also indicate that the learning surrounding the virtual patient encounter is important including alignment of virtual patients with other content, small group discussions enabling students to practise non-technical skills and the ability to develop reflective practice. Learning outcomes with virtual patients suggest it enabled students to appreciate the importance of non-technical skills and to change the way they perceived practice with application of skills learnt in the clinical setting. However, some students described conflict when transferring skills to practice. Importantly, this research also identified potential limitations to learning from virtual patients, particularly when negative patient outcomes are portrayed. Outcomes such as fear, confusion, overconfidence, groupthink and classroom barriers were identified.

The findings reported in this paper detail how nursing student learn non-technical skills from virtual patient interaction adding important and novel contributions to the field. While it is important to identify what nontechnical skills were learnt through the interactions with virtual patients it is imperative to clarify how the student learnt during these interactions. Understanding how nursing students learn non-technical skills will support the development of effective teaching and learning strategies to develop nursing students non-technical in the future (White, 2003) and enable customisation of resources and strategies for student needs (Abelsson & Bisholt, 2017).

5.5 Faculty perspective of developing non-technical skills using virtual patients

Understanding faculty perspectives of teaching and learning is important, as it can assist in understanding the nature of the education activity. Identifying key elements that can improve learning (Lindqvist & Reeves, 2007) and inform best practice (Richter & Schuessler, 2019). Developing greater empirical understanding of the faculty experience is important to identify particular attributes and skills of faculty required to facilitate learning non-technical skills through virtual patients as well as identifying obstacles and barriers (Richter & Schuessler, 2019). Adding to the body of knowledge surrounding effective strategies to develop non-technical skills required for registration will assist faculty in designing and facilitating other teaching and learning innovations (Richter & Schuessler, 2019). Additionally, it is identified that
perceptions and attitudes of faculty can make a difference in the implementation of simulation activities (Nehring & Lashley, 2010). Understanding faculty perspectives can develop insight into how to support and train faculty to facilitate learning non-technical skills though virtual patient interactions (Kim, Park, & O'Rourke, 2017; Richter & Schuessler, 2019).

Much of the current published research focuses on learners’ experiences and learning outcomes in simulation activities, with limited reporting of faculty perspectives (Lindqvist & Reeves, 2007), particularly in relation to virtual patients used to develop non-technical skills. This component of the case study explored faculty perspectives in developing non-technical skills, using virtual patients in undergraduate nursing students, to lead to improved insights and better learning experiences and outcomes.

A qualitative exploratory case study was used to elucidate faculty experiences and perspectives. The virtual patient from VSPR remained the case, however the individual faculty were the units of analysis. Qualitative data were gathered from individual interviews and a focus group. Systematic organisation, comparison and interpretation of the data were enabled by framework analysis. Seven themes with 13 sub-themes were recognised in the data.

The following paper, currently under review, presents the findings of another component of the exploratory case study that systematically examines the influence of virtual patients from VSPR on the development of knowledge, attitudes and practice regarding non-technical skills in undergraduate nursing students. This paper reports the faculty perspective when using virtual patients to develop non-technical skills in undergraduate nursing students.

5.5.1 Publication five

Background Virtual patients are important for simulation-based education, with faculty identifying multiple benefits in undergraduate health professional education. However, little is known about how faculty perceive virtual patient interactions promote learning, particularly with undergraduate nursing students to develop ‘non-technical skills’. 

Methods The purpose of this qualitative study was to examine faculty perspectives of how interactions with virtual patients support learning of ‘non-technical skills’ in undergraduate nursing students. A case study supported insight, discovery and interpretation of faculty perspectives of a specific case, virtual patients in the Virtual Simulated Patient Resource, using individual interviews and focus groups. Framework analysis enabled systematic organisation of data supporting its comparison and interpretation. Findings Twelve individual interviews and one focus group were conducted with faculty. Seven themes were identified: getting it wrong to get it right, embodying non-technical skills in educational practice, building a practice repertoire, privileging teaching and learning non-technical skills, socialisation to professional role, transfer of learning and authenticity. Conclusion Virtual patients privilege learning non-technical skills for students and faculty. However, to promote development of non-technical skills with virtual patient interactions, authentic situations depicting the imperfect reality of practice and opportunities ‘to get it wrong to get it right’ are important. These elements promote development of a practice repertoire to support students in responding to poor practice. To enable translation of negative patient outcomes experienced in virtual patient interactions into student learning, embodiment of non-technical skills in facilitation of learning by faculty is significant. Further, suggestions of transferring learning to different contexts of care, indicated by practice change following interactions with the virtual patient, supports patient safety.

Keywords Non-technical skills Patient safety Virtual patients Simulation

Taxonomy Case Study, Clinical Simulation in Nursing

Manuscript category Research articles

Manuscript region of origin Asia Pacific

Corresponding Author Monica Peddle

Order of Authors Monica Peddle, Margaret Bearman, Lisa McKenna, Debra Nestel

Submission Files Included in this PDF

File Name [File Type]
Letter Prof W Lauder NET Faculty perspectives.docx [Cover Letter]
Title page.docx [Title Page (with Author Details)]
Getting it wrong to get it right 10.5.19.docx [Manuscript (without Author Details)]
Table file.docx [Table]
COREQ Checklist Facilitator perspectives.docx [Supporting File]
Additional file 1.docx [Supporting File]

To view all the submission files, including those not included in the PDF, click on the manuscript title on your EVISE Homepage, then click 'Download zip file'.

Research Data Related to this Submission

There are no linked research data sets for this submission. The following reason is given: The data is included in the manuscript
Dear Professor William Lauder,

I am writing to submit a manuscript entitled “Getting it wrong to get it right: Faculty perspectives of learning non-technical skills through virtual patient interactions.” as a research article for publication in Nurse Education Today.

To meet practice requirements and implement safe and competent patient care, health professionals need to be introduced to and develop technical skills and non-technical skills prior to graduation. Our study sought to explore the faculty perceptions of using virtual patients to develop non-technical skills in undergraduate nursing students. Currently, there is limited literature regarding faculty perceptions when virtual patients are integrated into undergraduate nursing education to develop non-technical skills.

This manuscript presents the findings of a case study exploring faculty perspectives when using virtual patients in undergraduate nursing education to develop non-technical skills knowledge, attitudes and practice. A focus group and individual interviews were used with faculty who facilitated learning for first-year and third-year undergraduate nursing students at two universities in Australia. This manuscript present additional information to a previously published manuscript exploring the specific non-technical skills undergraduate nursing students learnt through interactions with virtual patients - Peddle, M., McKenna, L., Bearman, M., & Nestel, D. (2019). Development of non-technical skills through virtual patients for undergraduate nursing students: An exploratory study. Nurse Education Today, 73, 94-101.

The purpose of the research and findings discussed in the manuscript align with the aims and scope of Nurse Education Today as the research presents new thinking to support that advancement of education using evidenced based practice. The findings have strategic relevance for health professional education moving forward.

I confirm on behalf of all authors that this manuscript has not been published elsewhere and is not under consideration by another journal. All authors have made substantial contributions to conception, design, drafting the article and revising it critically for important intellectual content. All authors have approved the manuscript and agree with submission to Nurse Education Today. The authors have no conflicts of interest to declare.

Please address all correspondence to:

Ms Monica Peddle
Lecturer,
School of Nursing and Midwifery
College of Science Health and Engineering, La Trobe University.
Victoria, Australia. 3086
Phone: 61 3 94795903
Email: m.peddle@latrobe.edu.au

We look forward to hearing from you at your earliest convenience
Yours sincerely

Monica Peddle, RN, PhD Candidate, MEd.
“Getting it wrong to get it right”: Faculty perspectives of learning non-technical skills via virtual patient interactions.

Authors –

Monica PEDDLE, PhD Candidate, MEd, RN. (Corresponding author)
Lecturer
School of Nursing and Midwifery
College of Science Health and Engineering, La Trobe University
Contact details: email: m.peddle@latrobe.edu.au
Phone: 613 9479 5903

Margaret BEARMAN, PhD, BComp (Hons),
Associate Professor
Centre for Research in Assessment and Digital Learning (CRADLE),
Deakin University

Lisa MCKENNA PhD RN RM
Professor of Nursing
School of Nursing and Midwifery,
College of Science Health and Engineering, La Trobe University.

Debra NESTEL PhD FSSH
Professor of Simulation Education in Healthcare
Monash Institute for Health and Clinical Education
Faculty of Medicine, Nursing and Health Sciences, Monash University
Competing interests
All authors declare that they have no competing interests.

Funding
Nil

Authors’ contributions
MP gathered, analysed and interpreted the data. DN analysed and interpreted data, with all authors revising themes for consistency and fit. LMcK and MB were involved in study design and drafting the manuscript or revising it critically for important intellectual content. All authors read and approved the final manuscript.

Acknowledgements
Nil
Background

Virtual patients are important for simulation-based education, with faculty identifying multiple benefits in undergraduate health professional education. However, little is known about how faculty perceive virtual patient interactions promote learning, particularly with undergraduate nursing students to develop ‘non-technical skills’.

Methods

The purpose of this qualitative study was to examine faculty perspectives of how interactions with virtual patients support learning of ‘non-technical skills’ in undergraduate nursing students. A case study supported insight, discovery and interpretation of faculty perspectives of a specific case, virtual patients in the Virtual Simulated Patient Resource, using individual interviews and focus groups. Framework analysis enabled systematic organisation of data supporting its comparison and interpretation.

Findings

Twelve individual interviews and one focus group were conducted with faculty. Seven themes were identified: getting it wrong to get it right, embodying non-technical skills in educational practice, building a practice repertoire, privileging teaching and learning non-technical skills, socialisation to professional role, transfer of learning and authenticity.

Conclusion

Virtual patients privilege learning non-technical skills for students and faculty. However, to promote development of non-technical skills with virtual patient interactions, authentic situations depicting the imperfect reality of practice and opportunities ‘to get it wrong to get it right’ are important. These elements promote development of a practice repertoire to support students in responding to poor practice. To enable translation of negative patient outcomes experienced in virtual patient interactions into student learning, embodiment of non-technical skills in facilitation of learning by faculty is significant. Further, suggestions of transferring learning to different contexts of care, indicated by practice change following interactions with the virtual patient, supports patient safety.
**Introduction**

Virtual patients (VPs) are defined as “interactive computer simulations of real-life clinical scenarios for the purpose of healthcare and medical training, education, or assessment” (Ellaway, Poulton, Fors, McGee, & Albright, 2008, p. 1). Faculty highlight that VP interactions provide education approaches that are cost-effective, accessible on large a scale (Banski, Beilby, Quail, & Allen, 2018) with opportunities for objective assessment and identification of concepts where students are struggling (Lichvar, Hedges, Benedict, & Donihi, 2016). Research suggests faculty value VP interactions in health professional education as they are consistent, provide standardised and replicable experiences (Kleinheksel, 2017), promote learner engagement and achieve depth in classroom discussions (Lichvar et al., 2016).

While faculty perceive VPs as valuable, VPs do not teach non-technical skills (NTS) with a specific aim of improving patient safety. As this is imperative in undergraduate nursing education due to pressing needs for safer healthcare, it is important to understand how faculty view VPs teaching NTS. Understanding faculty perspectives can offer insights into how nursing students learn NTS through VPs to improve patient safety and may assist develop strategies to optimise their use.

The research question was - How do faculty perceive interactions with virtual patients support student learning and practice of non-technical skills? The purpose of this qualitative study was to examine faculty perspectives of how VP interactions support learning ‘NTS’ including teamwork, leadership, communication, decision-making, situation awareness, coping with fatigue and managing stress, in undergraduate nursing students. There is a lack of consensus on how to describe these essential cognitive and interpersonal skills critical for patient safety, however as the term, NTS, is accepted in clinical practice we use the term while acknowledging its limitations. We also assume that learners are interacting with the VP so hereafter do not add the word ‘interacting’ when referring to faculty and student engagement with them.

**Methods**

**The Virtual Simulated Patient Resource**

A web-based resource, Virtual Simulated Patient Resource (VSPR) ([www.vspr.net.au](http://www.vspr.net.au)), uses branching narrative VPs to develop knowledge, skills, attitudes and practice of NTS in undergraduate health professionals. A “choose your own adventure game” depicts the patient story over time. A video-vignette, depicting actors in realistic clinical settings, follows a pre-brief that orientates students to the patient and situation. As students select from choices that appear on the screen, a branching algorithm determines the next video in the sequence to
progress the simulation. Feedback is provided via visualisation of consequences of decisions, either positive or negative, on patient outcomes. VPs can be completed in small groups supported by facilitator-guided debriefing and as independent activities. A facilitator guide provides key information for each video-vignette and final summary for the VP scenario, however faculty determine the debriefing approach/es used.

Design
This paper reports one component of a multi-site case study. Other components of the project investigate what undergraduate nursing students learnt about specific NTS following VPs (Peddle, McKenna, Bearman, & Nestel, 2019) and how VPs developed NTS (Peddle, Bearman, McKenna, & Nestel, 2019). This aspect of the case study supported insight, discovery and interpretation of faculty perspectives of the VPs in the VSPR (Merriam, 2009). The VPs from VSPR were identified as the bounded case in this case study, with faculty comprising the units of analysis. University Human Ethics Research Committee granted ethical approval (Ethics approval ID number: CF12/3958 – 20120018910).

Research team
The primary author (MP) undertook this study during her PhD candidature, with supervisors as co-authors. MP led design and development of the resource and authored the VP scenarios. MP has undertaken qualitative research interviews and analysis in several studies. DN is an experienced qualitative researcher and participated in primary analysis of the transcribed data and ongoing refinement of themes. MB and LM are experienced qualitative researchers and contributed to refinement of themes.

While MP knew some participants, no formal relationship existed at the time of the research. Participants were orientated to the project in written invitations and at the opening of interviews and focus group. Whilst care was taken to welcome positive and negative comments from participants, the relationship of MP to the project may have influenced data obtained.

Population and sample
Faculty participants were identified via purposive convenience sampling from two nursing schools in Australia, using VSPR. Recruitment comprised invitations disseminated via email. MP undertook all recruitment from November 2014 to June 2017. Sixteen faculty consented to participate. One interview ceased as the participant had not facilitated sessions using the VPs.

Data collection
A semi-structured interview guide supported qualitative data collection with a focus group and individual interviews. The guide was piloted for acceptability, usability and question clarity. It
was amended to follow the conceptual organisation of the case study using categories developed by Flin, O'Connor, & Crichton (2013) and themes identified in Peddle, Bearman, & Nestel (2016) (Additional file 1). MP facilitated all interviews and focus group in-person with one interview conducted by phone. Written consent was obtained prior to participation. Audio-recordings were professionally transcribed.

Data analysis
Framework analysis, using deductive and inductive coding, was used to systematically organise data to support comparison and interpretation (Gale, Heath, Cameron, Rashid, & Redwood, 2013). The categories in the interview guide were used as theory-driven, a priori codes, entered as nodes in NVivo. Two authors (MP and DN) independently coded two interview transcripts to test applicability of codes to the data. Inductive data coding enabled recognition of data driven codes. MP coded remaining transcripts (n=10). An extended summary of each code was developed, with illustrative quotes selected from different units of analysis. Each code was examined for coherency, consistency and fit which led to codes being reorganised and retitled until consensus was reached.

Findings.
One focus group and twelve individual interviews were conducted with 15 faculty. Interviews ranged from 11-42 minutes while focus group duration was 48 minutes. Seven themes and 13 subthemes were identified (Table 1).

Table 1.

<table>
<thead>
<tr>
<th>Getting it wrong to get it right</th>
</tr>
</thead>
<tbody>
<tr>
<td>This theme refers to learning through errors and consequences of decisions (Table 2).</td>
</tr>
</tbody>
</table>

Faculty preferred students to get the scenario ‘wrong’ which triggered discussion, developing an understanding of practice. Opportunities to compare different outcomes and pathways were reported as beneficial, as students could see both sides. However, faculty highlighted there was an element of embarrassment for students when they got it wrong in front of peers and suggested completing VPs as a group activity subjected some students to group conformity. Many likened VPs to gaming, deliberately picking wrong answers to see how scenarios unfolded in positive and negative pathways.

Opportunities for students to make decisions and experience consequences of decisions, were reported as valuable. Outcomes reinforced how mistakes can happen in practice, at times with serious repercussion for patients and their families. The realism and opportunities presented enabled discussion of particular points of practice and contributing factors to
medical error, developing awareness of error in practice. Participants qualified while using scare tactics was not appropriate educational practice, turning negative experiences into learning was an important faculty role.

Table 2.

**Embodying NTS in educational practice**

This theme describes how faculty employed NTS consciously and unconsciously, to facilitate learning in VPs and support debriefing (Table 3).

**Modelling NTS in action**

Faculty described how they used specific skills to ensure simulations maximised students’ learning in small group activities. Faculty identified how they guided students to generate options, consider alternatives and select outcomes and ensured all students were heard. Faculty maintained standards and scope of practice and monitored student performance and engagement. They managed conflict, provided feedback and observed the environment to identify students not engaged or lacking confidence. Some participants were conscious of the application of NTS to facilitate learning, however others were not.

**Debriefing to make connections**

Facilitating discussion about practice and/or behaviour depicted in VPs was deemed noteworthy by faculty when compared to self-directed learning. They strongly believed learning achieved from VPs was only as good as the reflection during the simulation. Faculty thought discussions assisted students transform new experiences into learning by interrogating prior knowledge and experience. They identified how group discussions reinforced or corrected knowledge and clarified thinking, with opportunities for less confident students to hear others thoughts. Faculty discussed how students might not be able to make connections just by seeing bad outcomes from scenarios and may require discussion to make sense of the learning.

Many faculty reported using flexible approaches to debriefing, guided by the group and learning outcomes. Most identified a reactions phase followed by discussion of clinical/technical and non-technical aspects of VPs, in no particular order. Some participants favoured an ‘Advocacy Inquiry’ approach to investigate rationale and thinking behind decisions. They identified debriefing played a role in assisting students deal with negative outcomes obtained in VPs and how wrong decisions were not ‘brushed under the carpet’, but acknowledged, discussed and explored.

Table 3.
Building a practice repertoire

This theme explores how VPs enabled students to build a repertoire including developing a language, a stop and think approach and reflection-in-action (Table 4).

Language

Faculty qualified a large barrier in comprehension of NTS related to language and terms used, with VPs providing students the vocabulary needed. Faculty specified third-year students demonstrated a familiarity with NTS language.

Stopping and thinking

Faculty reported decision options in VPs forced students to stop, consider information presented, ask questions and critically think about available options, rather than “do what they always did” (I-5). They identified that students reflected on information in VPs, as well as projecting forward to predict potential outcomes of available options.

Reflective practice

Many faculty indicated VPs prompted students to reflect on their practice and understand decisions made, identify areas for improvement and question their judgement and processes of care. They reported reflection allowed ‘lightbulb’ moments for students, including the ability to be aware of and use the language of NTS, link NTS to practice and a means to put that skill set into action in clinical settings.

Table 4.

Privileging teaching and learning of NTS

This theme categorises how integration of VPs in curricula made NTS categories explicit for learners and faculty and how this supported learning NTS (Table 5).

Learning NTS

Faculty generally agreed that understanding of NTS by first-year students was limited and that they tended to focus on technical aspects of practice. Many suggested students did not begin to comprehend NTS until the end of second year, while third-year students have a deeper understanding of NTS with constructs more ingrained into their practice. Some faculty identified that student understanding of constructs of NTS appeared to decay after long breaks and refreshers were needed.
Faculty reported VPs developed student communication skills including active listening, speaking up and using structured handovers to effectively relay information. They described students reported using teamwork skills to work effectively with colleagues, manage conflict, and clarify roles. Faculty indicated VPs enabled learners to actively engage in decision-making by identifying important cues and data and improving analysis of information. VPs forced students to think ahead, project outcomes and consider outcomes when making decisions. Faculty described how after interacting with the VP, students were more aware of team leader role, that nurses could adopt this role and that learners developed understanding of accountability in nursing practice.

Faculty varied in their understandings and experience of NTS, with some well versed in the constructs and practice and others struggling to describe NTS and their relevance. Though, some faculty admitted that they personally selected a ‘wrong’ answer and had to go back and redo the scenario. Faculty reported VPs made them reflect on their education and how they were not taught NTS as these constructs were left to be developed in practice. They also described lack of awareness that NTS could be taught and appreciated opportunities of VPs to teach these complex topics. Some participants indicated VPs enabled them to develop deeper understanding and awareness of NTS, whereas others stated they were a good refresher.

**Offering variation in teaching**

Faculty appreciated the flexibility to integrate teaching NTS through VPs into curricula with most favouring using VPs in small group activities. They thought completing VPs in isolation would not maximise student learning of NTS, due to the complex behaviours and events. However, some valued a self-directed approach as this enabled students’ honesty in decision-making.

Some faculty provided critiques of the VP discussing that scenarios could not be too complex, or present too much new information as this may distract the students from focusing on learning NTS. The “choose your own adventure game” approach presented difficulties from a timing perspective when the scenario began to proceed down the ‘wrong’ pathway as this meant repeating VPs from the beginning. This limitation influenced facilitation of the activity, with faculty not adhering to the approach and instead verbally described outcomes.

Table 5.
Socialisation to role

This theme identifies how VPs supported preparation for practice by clarifying roles and priming students to follow the norms and expectations of behaviour (Table 6).

Faculty thought VPs brought a “level of practice” (I-6) and that “the scenarios are preparation for what actually happens in the clinical environment…they put the bridge between what happens in the labs and what actually happens in the clinical environment.” (I-5). VPs provided clarity about nursing roles by illustrating norms and expectations of behaviour including chain of command, responsibilities as a nurse and role modelling of professional practice, with emphasis on interprofessional collaborative practice. The interactions empowered students to be prepared for practice, giving real examples of what to expect on placement, exposing them to relevant experiences and situations prior to placement. Faculty described how students who have used this resource are more equipped than students who haven’t as “they are aware of what can go wrong in the clinical environment and they are more aware of their role” (I-6). Students reported feeling better equipped for entering the clinical environment, as they had a connection to it and were aware of what could go wrong.

Table 6.

Transfer of learning

Most faculty described how VPs developed elements of nursing practice that contributed to the student’s holistic professional performance. Faculty reported the interaction propelled students, particularly third-years, to emulate behaviours and strategies demonstrated in the VP in clinical practice. They conveyed these students’ engaged with patients and developed insight into teams and teamwork, which translated to greater confidence to enact roles in practice. Faculty specified feedback from third-year students after placement quantified they felt confident, took initiative and were engaged in practice. Some faculty reported noticeable changes in student performance in other simulation-based learning activities after VPs including students removing themselves from the immediate care situation to discuss and collaborate with others to formulate a plan.

Table 7.

Authenticity

In the ‘authenticity’ theme, faculty appreciated depiction of the imperfect reality of clinical practice and the ability of VPs to trigger emotional responses enabling students to connect with the ‘person’ (Table 8).
Imperfect reality
The situations and events portrayed appealed to faculty as they exhibited the imperfect reality of clinical practice. While faculty role model professional conduct and structured communication, this is not always present in clinical environments where students practise.

Connecting with the person
The human aspect of VPs enabled students and faculty to have emotional connections with the person. Faculty reported students reacted to VPs as though they were real, demonstrating reactions including shock, gasping and sitting on the edge of their seat. They expressed guilt from causing harm to the patient, fear of making choices that could result in poor patient outcomes and disbelief in how mistakes happen.

Table 8.

Discussion
The findings of this case study reinforce using VPs to socialise students to their professional role, offer variation in teaching and learning, clarifies the significance of authenticity in the interaction and the importance of enabling students to experience consequences of decisions made (Peddle et al., 2016; Peddle, McKenna, et al., 2019). The study also highlights the importance of depicting the imperfect reality of clinical practice and qualifies the importance of learners being able to “get it wrong to get it right”. Other findings from this study suggest VPs privilege teaching and learning NTS in the curriculum, for students and faculty, promoting development of a practice repertoire with a subsequent practice change that is transferable to different contexts of care. Finally, findings from this study indicate the embodiment of NTS in educational practice enables facilitators to maximise student learning. The findings from this research that extend the existing body of knowledge regarding VPs that aim to develop NTS are discussed in turn.

There has been a call for NTS to be explicitly taught and assessed in health professional curricula (Greig, Higham, & Vaux, 2015). It is suggested that the deficit of effective NTS in clinical practice is related to the lack of explicit content regarding NTS in health professional education, as well as lack of description of specific NTS required for safe and competent practice (Flin & Maran, 2015). In this case study, faculty reported VPs developed learner NTS in categories such as communication, teamwork, situation awareness, decision-making and leadership. This aligns with findings of other components of this research investigating what NTS are learnt through VPs (Peddle, McKenna, et al., 2019), and reinforces that explicit content can successfully develop NTS required for safe and competent practice and that VPs
are an appropriate method to promote knowledge, attitudes and practice of NTS. However, this case study highlighted that VPs privileged NTS for some faculty as well, assisting in developing, refining and refreshing their understanding of NTS. This finding suggests that VPs, aiming to develop NTS, may have value across the learning continuum in postgraduate or continuing professional education. Further research would be required to explore application of VPs across the learning continuum.

The clinical practice setting is affected by imperfect practice (Byrne, 2015) resulting from a combination of factors such as workloads, staff shortages, poor systems or individual deficits in professional behaviour and stress (Luparell, 2011). However, the context in which nursing students are educated depict an environment where exemplary professional behaviours are role modelled and best practice emulated. This unrealistic environment may present a skewed perception of clinical reality for students (Arnone & Fitzsimons, 2015). As a result, students may be unprepared for the rigours of the real practice environment where they may face unprofessional, uncivil or disrespectful colleagues (Luparell, 2011). Additionally, research identifies, for students to speak up and respond to poor practice, it helps if they have prior experience of such challenging situations to develop self-confidence and an understanding of consequences that may follow (Ion, Smith, Nimmo, Rice, & McMillan, 2015). In this case study, faculty described how depiction of unprofessional behaviour and poor practice in VPs better equipped the students for the reality of the practice setting and “how it is out there” (I-2). The findings suggest that depiction of the imperfect reality of the real clinical practice setting in VPs, may better prepare students to recognise and respond to poor practice and unprofessional behaviours. However, the tension between presenting clinical practice as fraught with danger and enabling student to experience the imperfect reality of real clinical practice requires further investigation.

A practice repertoire describes the shared methods, language, skills, behaviours, ways of working, values and expertise as part of the shared basic characteristics of a group that are an important component of professional practice (Woods, Cashin, & Stockhausen, 2016). Prior research has linked development of components of a practice repertoire to clinical experience (Kotecki, 2002). However, our findings indicate VPs can promote development of a practice repertoire associated with NTS, commensurate with the level of experience of the undergraduate nursing student. Faculty observed students using this repertoire to implement NTS to address situations in subsequent simulations and described how students reported it improved their day-to-day practice, supporting safe and competent care. An area highlighted in this case study as important included development of language surrounding NTS. Having a language relevant to an area of practice can have valuable impacts on aspects of practice (Paradis, Pipher, Cartmill, Rangel, & Whitehead, 2017), enabling students to make sense of
the concepts and assist application, recognition and critique of NTS in practice. Building a practice repertoire, including development of language, would further support students to socialise to the profession of nursing and understand what it means to be a member of that group.

An interesting finding in this case study is the reported change in students’ approaches to practice. Faculty reported VPs developed a “stop and think” (I-5) approach in students, rather than “do what they always did” (I-5). VPs enabled students to develop the ability to stop, review information available, question uncertainties and think critically about options before acting. This aligns with findings in other components of the research investigating how students learn via VPs which identifies the interactions changed the way student perceive practice (Peddle, Bearman, et al., 2019). This change in practice was evident in the clinical performance of students in simulation activities following VPs with some faculty reported demonstrable difference in student behaviours including stopping, stepping back, collaborating with colleagues and considering the situation with the team prior to acting. This change in practice suggests that learning from VPs is transferrable from one context to another. Further research would be required to substantiate this premise.

Error can be the result of time pressures, frequent demands and interruptions, misreading cues and errors in combining, integrating or weighing up cues (MacNeela, Scott, Clinton, Pontin, & Sellman, 2016). Whilst error in clinical practice can have significant consequences, in education “it should be recognised that getting it wrong is a part of learning and of eventually getting it right” (Heelan, Halligan, & Quirke, 2015). Learning via error is suggested to promote deep learning supporting knowledge retention and transfer of learning to other practice contexts (Bearman, Greenhill, & Nestel, 2018). However, the ability to provide constructive and non-judgemental feedback on performance is critical to promote learning (Heelan et al., 2015). In this case study, the opportunity to “get it wrong” enabled learners to experience consequences of actions and decisions. Other components of this research investigating how students’ learn via VPs, supports the value of students’ experiencing consequences of actions and learning via error (Peddle, Bearman et al., 2019). However, faculty perceived their role to be critical in translating negative patient outcomes and errors into learning. These findings suggest the combination of heightened awareness of students, the learning experience associated with eventually ‘getting it right’ supported by constructive and non-judgemental feedback, may lead to behaviour change in students to promote patient safety practices.

Finally, this case study suggests the embodiment of NTS by faculty in their educational practice supports learning. Faculty described using strategies and techniques aligning with categories and elements of NTS to facilitate learning. Some described how they consciously
used NTS, however for others application of the NTS to achieve outcomes appeared an unconscious action. These findings suggest that developing NTS in faculty may have a consequential effect of improving learning experiences.

**Strengths and limitations**

This research adhered to case study methods and used theoretical suppositions to guide data analysis. The research focused on the case obtaining a detailed, in-depth understanding of faculty experiences using a focus group and individual interviews. Qualitative data were strengthened through purposively sampling facilitators from two educational facilities. The interview schedule was piloted, with feedback on style and questions enabling revision to questions and techniques. One interviewer completed all the interviews. Themes and sub-themes were identified, created and labelled by MP and DN with data examined for coherency, consistency and fit by all authors. Conflicts resolved through discussion resulted in revisions to themes.

Caution must be exercised as research participants may not be representative of the wider population and whilst the research was conducted in naturalistic settings, the findings are not generalisable in the conventional sense. It is important to note that the primary author led the design and development of the VSPR and had prior professional relationships with some participants, which may have influenced the data obtained in the research and subsequent analysis.

The focus of this research was undergraduate students. Further research is required to explore application of VPs across the learning continuum in postgraduate and continuing professional development. Additionally, application of NTS by faculty to maximise learning outcomes poses new concepts in educational practice warranting further investigation. Finally, further research would assist to clarify student abilities to modify practice following interactions with VP.

**Conclusion**

This case study advocates that the ability to privilege NTS in curricula via VPs promotes learning NTS for both students and faculty. Additionally, depiction of the imperfect reality of clinical practice better prepares students for the rigours of clinical practice and promotes development of students to recognise and respond to poor practice. This research highlights the significance of ‘getting it wrong to get it right’ in education in supporting the development of a student practice repertoire that may be transferrable to different contexts. Importantly, the embodiment of NTS by faculty in facilitating the learning experience may promote learning and maximise learning outcomes related to NTS to support patient safety.
References


Table 1. Themes and subthemes; how VPs support learning NTS. Themes identified with an * were a priori codes.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Sub-theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Getting it wrong to get it right</td>
<td></td>
</tr>
<tr>
<td><strong>Embodying NTS in educational practice</strong></td>
<td>Modelling NTS in action</td>
</tr>
<tr>
<td></td>
<td>Debriefing to make connections</td>
</tr>
<tr>
<td><strong>Building a practice repertoire</strong></td>
<td>Finding the right words</td>
</tr>
<tr>
<td></td>
<td>Stopping and thinking</td>
</tr>
<tr>
<td></td>
<td>Reflection-in-action</td>
</tr>
<tr>
<td><strong>Privileging teaching and learning NTS</strong></td>
<td>Developing NTS</td>
</tr>
<tr>
<td></td>
<td>Offering variation in teaching</td>
</tr>
<tr>
<td><strong>Socialisation to professional role</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Transfer of learning</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Authenticity</strong></td>
<td>Imperfect reality</td>
</tr>
<tr>
<td></td>
<td>Connecting with the person</td>
</tr>
</tbody>
</table>

Table 2. Getting it wrong to get it right

<table>
<thead>
<tr>
<th>Theme</th>
<th>Quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Getting it wrong to get it right</td>
<td>“That reality aspect of it - and I think that's what a lot of other students are saying, is the fact that they actually get to see that mistakes will happen or mistakes can happen. That then makes them - their awareness is really heightened when they're going out onto placement.” (FG-P2)</td>
</tr>
<tr>
<td></td>
<td>“So nobody makes the perfect decision, and even sometimes you make the right decision and it doesn't go the right way too. But absolutely, I think it's important that they see what can happen, but also - Yes, I believe that they learn from their mistakes, yes.” (I-9)</td>
</tr>
</tbody>
</table>

Table 3. Embodying NTS in education practice

<table>
<thead>
<tr>
<th>Theme</th>
<th>Quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modelling NTS in action</td>
<td>“So I guess the best thing about that is, from your students that are really engaged in the content, it forces group discussion and going, &quot;Okay, well why do you want to go with this?&quot;&quot; you know, &quot;Give me your rationale&quot; and, you know, &quot;What did you see? What did you hear that wants you to go with that?&quot;”, you know, and put it in some context for us. So it really forces those discussions. I wouldn't say it's always been polarising, but there's almost always been someone that's disagreed with the majority.” (I-1)</td>
</tr>
<tr>
<td></td>
<td>The connection with prior learning and knowledge “can [be] explicate[d] when you've got a facilitator, but a student doing that as a self-directed isn't going to necessarily make that connection as strongly.” (FG-P1)</td>
</tr>
</tbody>
</table>
“Conflict is an interesting one because that's when you sometimes have stronger personalities that come over the top of others - How do you manage people who've got different points of view than what you have?” (I-10)

“Recognising students in the class that aren't confident and if they'd engage in it well or not if they're not confident, you know, …they might not get any benefit from it.” (I-8)

Debriefing to make connections

“But when it came to giving a rationale, they really struggled why they would have done that over the alternative. That's where, the reflection really helped them in the group discussion because then they were able to go okay, … you'd do this because of this reason... So they started having a better understanding about their own rationales.” (I-8)

“There needs to be debriefing afterwards or thinking about, Was there something I could have done better or not. …I think seeing negative outcomes [is not detrimental] depending on how it is handled by the faculty. I don't think it's seeing the negative outcomes, it's the discussion afterwards [that's important].” (I-8)

Table 4. Building a practice repertoire

<table>
<thead>
<tr>
<th>Theme</th>
<th>Quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language</td>
<td>“So I think students' understanding of non-technical skills sometimes comes with what the language around that might mean. So, they might understand what the skill is, but not be able to attach a word to it… I mean these scenarios in particular provide them with a language to be able to connect with the theory…” (I-9)</td>
</tr>
<tr>
<td>Stop and think</td>
<td>“They could see something and they could stop and question and we could discuss what was going on”. (I-5). “So not to look at your general practice and not what you always did but to think about it.” (I-5)</td>
</tr>
<tr>
<td>Reflective practice</td>
<td>“I suppose - especially if they made her fall - reflecting on what the things were that they did wrong, and then not do that out on placement. And see what the good things were within the scenario, that you should tick off and what processes we should take to maintain patient safety. To reflect upon that scenario, what was the good aspects and what was maybe the negative, to then take on with every patient that they look at?”(I-7)</td>
</tr>
</tbody>
</table>

Table 5. Privileging teaching and learning NTS

<table>
<thead>
<tr>
<th>Theme</th>
<th>Quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning NTS</td>
<td>“The [third-year] students know it, just like when you have the discussion with them about non-technical skills, they're actually able to tell you what the vast majority of non-technical skills are … So it's stuff that they already know, but because they don't think like that very often, they're not good at doing it.” (I-8)</td>
</tr>
<tr>
<td></td>
<td>“The term itself, 'non-technical skills', I have become more aware of it using the VSPR project. It articulates… very well some of those things we were aware they existed, but as an educator … it's something that you know you have developed over time but you didn't know it was something you can actually teach someone else. You think the student will just pick it up with experience.” (I-5)</td>
</tr>
<tr>
<td></td>
<td>“Which fits really nicely with that whole novice to expert Dreyfus model that you know, they're rule bound, they haven't got discretionary ability at this point in time. They're basing themselves on rules.” (FG-P1)</td>
</tr>
<tr>
<td></td>
<td>“I think it makes them have to make a choice, feel responsible for the outcome and the process. I guess, take ownership of the situation a little bit. Reflect and think about...” (I-10)</td>
</tr>
</tbody>
</table>
which one - which path and the process of beyond that point as well, so if I chose this, what might then happen?” (I-7)

“But, yeah, managing conflict because they get to hear an alternative point of view and get the opportunity to have a rebuttal, … but certainly they're getting those listening skills and actually trying to figure out what is the point the other person is trying to get across and analysing it and figuring it out for themselves if they're going to change their mind or not.” (I-10)

Offering variation in teaching approaches

“I just think they're incredible. I love using them. I just really enjoy using them as a faculty… But I am surprised at how the students do say, 'they're really good. It's not just something we've got to upload … They're really good, you'll really enjoy it.” (I-9)

“So some of those vignettes at the end were quite complex with some of the health information that they gave and I felt they needed a little context for that depending on what year level or scope of practice they were working within or towards.” (I-1)

“I was aware if I go down that pathway I have to come back to the start and with the time allocation I can’t do that. So that I had to explain that this is the wrong pathway. But I really wanted to show them this is what happens but the time limit ….. that was just one technical issue”. (I-6)

Table 6. Socialisation to role

<table>
<thead>
<tr>
<th>Theme</th>
<th>Quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Socialisation to professional role</td>
<td>“So each profession had their own distinct role, which was quite evidently portrayed in the video. So the nurse’s role was quite clearly defined, the doctor’s was quite clearly defined, the patients themselves represented what to expect of a patient.” (I-6)</td>
</tr>
<tr>
<td></td>
<td>“That was quite interesting, … I was naïve to think people knew what a role of a doctor was and knew what a role of the nurse was and so forth.” (I-7)</td>
</tr>
</tbody>
</table>

Table 7. Transfer of learning

<table>
<thead>
<tr>
<th>Theme</th>
<th>Quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transfer of learning</td>
<td>“But if they talk about the clinical placement they might make reference back to what they've watched, what they've learnt … [Student feedback] “It was great to practice that team base, that team work and understand the roles within that team, because when I was put in that situation, I had a greater understanding, and felt confident that I could do that.”(I-9)</td>
</tr>
<tr>
<td></td>
<td>“It appears to have changed the approach of students in the immersive simulations for the better… When things started to change, rather than just reacting, they were stepping away and having discussions with each other on how to do things and, you know, who they should call etcetera. That was a noticeable difference after doing the virtual scenarios.” (I-8)</td>
</tr>
</tbody>
</table>
Table 8. Authenticity

<table>
<thead>
<tr>
<th>Theme</th>
<th>Quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imperfect reality</td>
<td>“… it would bridge the gap between realistic clinical practice and the unrealistic environment in the lab. [In the lab] we are really quite professional, … communicating with them effectively and giving them clear instructions. Which sometimes doesn’t happen when they go out in the clinical environment. … some of the students get disappointed when they get on placement and they find that the environment is not exactly as we trained them. And they wouldn’t know how to respond to that environment.” (I-5)</td>
</tr>
<tr>
<td>Connecting with the person</td>
<td>“In terms of their body language, … you can feel an alteration of energy in the room… When it’s playing there are visible reactions and changes in their body language…there’d be ‘oh, wow’, or they take a deep breath. They were clearly having an emotional reaction of some description.” (I-9)</td>
</tr>
</tbody>
</table>
# COREQ Checklist

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>Guide questions/description</th>
<th>Section: page number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Domain 1: Research team and reflexivity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Personal Characteristics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Interviewer/facilitator</td>
<td>Which author/s conducted the interview or focus group? MP conducted all interviews and focus groups.</td>
<td>Research team: p 2</td>
</tr>
<tr>
<td>2.</td>
<td>Credentials</td>
<td>What were the researcher’s credentials? E.g. PhD, MD MP is a PhD candidate conducting this study as part of her thesis. All other researchers are PhD prepared and are experienced qualitative researchers.</td>
<td>Research team: p 2</td>
</tr>
<tr>
<td>3.</td>
<td>Occupation</td>
<td>What was their occupation at the time of the study? MP was on 6 months research residency leave from her substantive position.</td>
<td>Research team: p 2</td>
</tr>
<tr>
<td>4.</td>
<td>Gender</td>
<td>Was the researcher male or female? Research team: p 2</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Experience and training</td>
<td>What experience or training did the researcher have? MP has undertaken qualitative interviews and analysis in several research studies. DN is an experienced qualitative researcher and participated in the primary analysis of the transcribed data and ongoing refinement of themes. MB and LMcK are experienced qualitative researchers and contributed to the refinement of themes in the study.</td>
<td>Research team: p 2</td>
</tr>
<tr>
<td></td>
<td><strong>Relationship with participants</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Relationship established</td>
<td>Was a relationship established prior to study commencement? While the researcher knew some participants, no formal relationship existed at the time of the research.</td>
<td>Research team: p 2</td>
</tr>
<tr>
<td>7.</td>
<td>Participant knowledge of the interviewer</td>
<td>What did the participants know about the researcher? E.g. personal goals, reasons for doing the research</td>
<td>Research team: p 2</td>
</tr>
<tr>
<td>8.</td>
<td>Interviewer characteristics</td>
<td>What characteristics were reported about the interviewer/facilitator? E.g. Bias, assumptions, reasons and interests in the research topic The primary author (MP) is a PhD student undertaking this study as part of their candidature, with supervisors as co-authors. The primary author led the design and development of the resource and authored the VP scenarios that are the focus of this study.</td>
<td>Research team: p 2</td>
</tr>
<tr>
<td></td>
<td><strong>Domain 2: study design</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Theoretical framework</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Methodological orientation and Theory</td>
<td>What methodological orientation was stated to underpin the study? E.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis An intrinsic exploratory case study supported insight, discovery and interpretation of faculty perspectives of a specific case, the VPs in the VSPR</td>
<td>Design: p2</td>
</tr>
<tr>
<td></td>
<td><strong>Participant selection</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Sampling</td>
<td>How were participants selected? E.g. purposive, convenience, consecutive, snowball Faculty participants were identified via purposive and convenience sampling.</td>
<td>Population and sample: p2</td>
</tr>
<tr>
<td>11.</td>
<td>Method of approach</td>
<td>How were participants approached? E.g. face-to-face, telephone, mail, email Recruitment comprised invitations disseminated via email.</td>
<td>Population and sample: p2</td>
</tr>
<tr>
<td>12.</td>
<td>Sample size</td>
<td>How many participants were in the study? Sixteen participants were in the study.</td>
<td>Population and sample: p2</td>
</tr>
</tbody>
</table>
### Non-participation

How many people refused to participate or dropped out? Reasons?

Population and sample: p2
No participants refused or withdrew from the study. One interview was ceased when it was established the participant had not worked with the case, the VP from VSPR, under research.

### Setting

| Setting of data collection | Where was the data collected? e.g. home, clinic, workplace | Data collection: p2
Data was collected in person in a private room with one interview conducted over the phone. |
|----------------------------|-------------------------------------------------|-------------------------------------------------|
| Presence of non-participants | Was anyone else present besides the participants and researchers? | Data collection: p4
No one else was present in the room. |
| Description of sample | What are the important characteristics of the sample? e.g. demographic data, date | Population and sample: p2
Recruitment occurred from November 2014 to June 2017.
Demographic data - 12 females and 2 males, which is representative of the gender distribution of the wider nursing population.
Four participants had less than 2 years’ experience in education. Three participants had 2-5 years’ experience. Five participants had over 5 years’ experience in education. Four participants had over 10 years’ experience in education. |

### Data collection

<table>
<thead>
<tr>
<th>Interview guide</th>
<th>Were questions, prompts, guides provided by the authors? Was it pilot tested?</th>
<th>Appendix 1</th>
</tr>
</thead>
</table>
| Repeat interviews | Were repeat interviews carried out? If yes, how many? | Data collection: p2
No repeat interviews. |
| Audio/visual recording | Did the research use audio or visual recording to collect the data? | Data collection: p2
Interviews and focus group were audio recorded. |
| Field notes | Were field notes made during and/or after the interview or focus group? | Data collection: p3
Field notes were made after the interview and focus group. |
| Duration | What was the duration of the interviews or focus group? | Findings: p 3
Interviews and focus group ranged from 11 to 48 minutes. |
| Data saturation | Was data saturation discussed? | No
The application of the term saturation beyond the grounded theory approach is a topic of debate Bowen GA. Naturalistic inquiry and the saturation concept: a research note. Qualitative Research 2008;8(1):137-52. |
| Transcripts returned | Were transcripts returned to participants for comment and/or correction? | No
Data validation via member checking was not a feature of the research as the focus was on the immersion in the data and recognition of important themes. |

### Domain 3: analysis and findings

#### Data analysis

| Number of data coders | How many data coders coded the data? | Data analysis: p 4
Two authors independently coded two transcripts with MP coding all further transcripts. |
| Description of the coding tree | Did authors provide a description of the coding tree? | Data analysis: p 4 |
| Derivation of themes | Were themes identified in advance or derived from the data? | Data analysis: p 4
A prior codes were set using themes identified in an integrative review by Peddle at al (2016) and categories developed by Flin et al. (2013) |
<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>27.</td>
<td>Software</td>
<td>What software, if applicable, was used to manage the data?</td>
<td>Data analysis: p 4 NVivo was used to manage data.</td>
</tr>
<tr>
<td>28.</td>
<td>Participant checking</td>
<td>Did participants provide feedback on the findings?</td>
<td>No Data validation via member checking was not a feature of the research, as the focus was on the immersion of the researchers in the data and recognition of important themes.</td>
</tr>
</tbody>
</table>

**Reporting**

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>29.</td>
<td>Quotations presented</td>
<td>Were participant quotations presented to illustrate the themes / findings? Was each quotation identified? e.g. participant number</td>
<td>Tables 2-9 present the quotes to support the themes identified in the data. Each quotation is identified.</td>
</tr>
<tr>
<td>30.</td>
<td>Data and findings consistent</td>
<td>Was there consistency between the data presented and the findings?</td>
<td>Findings: p 6-16</td>
</tr>
<tr>
<td>31.</td>
<td>Clarity of major themes</td>
<td>Were major themes clearly presented in the findings?</td>
<td>Table 1</td>
</tr>
<tr>
<td>32.</td>
<td>Clarity of minor themes</td>
<td>Is there a description of diverse cases or discussion of minor themes?</td>
<td>Table 1 Findings: p 6-16</td>
</tr>
</tbody>
</table>

Additional file 1. Individual Interview Questions.

Now that you have utilised the VSPR program, I’d like to ask you some questions. Please be honest in your responses. I welcome positive and negative comments equally.

VSPR is a web based resource that consists of six modules and five play your own adventure game type simulation scenarios. This resource explores that application of NTS including, teamwork, communication, leadership, situational awareness and decision making in health professional practice. The resource contains modules and scenarios. We will be exploring the scenarios today. (VISUALS)

**STARTER QUESTIONS**

Can you provide some background to your role and experiences?

I would like to start by getting you to describe your understanding of NTS?
Can you describe the role of NTS in patient care?
What is your perception of student understanding of these?

**QUESTIONS**

1. What were your thoughts, feelings and observations at the time when working through the VSPR scenario to integrate it in your subject?
2. Can you describe you observations of the students as the videos were playing?
3. Do you think the VSPR scenarios contributed to your understanding of NTS and their role in patient care?
4. How would they develop understanding of NTS of the students?
5. Having viewed the virtual simulated patient scenarios, did they feel real and authentic?
6. Is there a relation to the clinical setting?
7. How do you think the student perceive the VSPR scenarios?
8. Thinking about student’s clinical placements, would the VSPR scenarios play a role in student preparation?
9. What would be most helpful for student’s clinical placements from VSPR scenario? Would anything be unhelpful for their clinical placements?
10. Do you think students are able to transfer learning to the clinical setting?
11. Do they experience challenges with transferring NTS in their clinical placements? If so, which ones?
12. Do the scenarios help in socialising students to their professional roles?
13. What is helpful about the VSPR scenarios that you think promotes learning? Why?
14. What do you think the two options that appear on the screen after the videos prompt in the students?
15. Do the negative outcomes of VSPR promote or hinder learning?
16. What is the role of debriefing in the VSPR learning?
17. Did anything surprise you about VSPR?
18. Is there anything else that we should have included?

**FINAL QUESTION**

Ask each participant to give a final summary statement – What is the role of VSPR scenarios in student learning regarding NTS.
### 5.6 Synthesis of case study findings

The following tables synthesise the data obtained in the exploratory case study and present the findings for each unit of analysis in a systematic style.

Table 5.1: What students learnt – specific non-technical skills

<table>
<thead>
<tr>
<th></th>
<th>Reported by first-year students</th>
<th>Reported by third-year students</th>
<th>Reported by faculty</th>
<th>Non-technical skills utilised in teaching and learning by faculty</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Communication skills</strong></td>
<td>• Importance of communication</td>
<td>• Importance of communication</td>
<td>• Active listening</td>
<td>• Facilitated group discussions to reinforce knowledge, clarify thinking and correct knowledge</td>
</tr>
<tr>
<td></td>
<td>• Taking communication skills for granted</td>
<td>• Taking communication skills for granted</td>
<td>• Speaking up</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Communication with the patient</td>
<td>• Communication strategies in practice</td>
<td>• Using structured handovers to effectively relay information</td>
<td></td>
</tr>
<tr>
<td><strong>Teamwork</strong></td>
<td>• Working as a team</td>
<td>• Working as a team</td>
<td>• Work effectively with colleagues</td>
<td>• Ensured all students were heard</td>
</tr>
<tr>
<td></td>
<td>• Teamwork skills</td>
<td>• Teamwork skills</td>
<td>• Manage conflict,</td>
<td>• Managed conflict, provided feedback and observed the environment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Patient as a member of the team</td>
<td>• Clarify roles</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Teamwork in action</td>
<td>• Team decision-making</td>
<td></td>
</tr>
<tr>
<td><strong>Leadership</strong></td>
<td>• Guidelines and protocols</td>
<td>• Guidelines and protocols</td>
<td>• Aware of the role of team leader and that a nurse could adopt this role</td>
<td>• Maintained standards and scope of practice and monitored student performance and engagement</td>
</tr>
<tr>
<td></td>
<td>• Accountability</td>
<td>• Situation leadership</td>
<td>• Responsibility and accountability</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Non-technical skills utilised in teaching and learning by faculty</th>
<th>Reported by faculty</th>
<th>Reported by third-year students</th>
<th>Reported by first-year students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decision-making</td>
<td>Stop and think, The decision-making process, consequences of decisions, Decisions from the driver’s seat, Making decision points more grey</td>
<td>Identifying important cues and data, Improving analysis of information, Critical thinking and Consideration of options</td>
<td>Stop and think, The decision-making process, consequences of decisions, Decisions from the driver’s seat</td>
</tr>
<tr>
<td>Situation awareness</td>
<td>Increased level of awareness, Gathering data, Managing distractors</td>
<td>Student more aware in practice</td>
<td>Increased level of awareness, Gathering data, Managing distractors, The deteriorating patient</td>
</tr>
<tr>
<td>Managing stress</td>
<td>Competing demands, Experiencing fatigue and stress in practice</td>
<td>Competing demands</td>
<td></td>
</tr>
</tbody>
</table>

**5.6.1 What students learnt – other professional skills**

Table 5.2: What students learnt – other professional skills

<table>
<thead>
<tr>
<th>Advocacy</th>
<th>Reported by first-year students</th>
<th>Reported by third-year students</th>
<th>Reported by Faculty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advocacy</td>
<td>Advocacy for patients</td>
<td>Advocacy for patients and colleagues</td>
<td>n/a</td>
</tr>
</tbody>
</table>
### 5.6.2 How students learnt

Table 5.3: How the students learnt

<table>
<thead>
<tr>
<th>Theme</th>
<th>Reported by first-year students</th>
<th>Reported by third-year students</th>
<th>Reported by Faculty</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Complementary role of NTS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Empathy</td>
<td>Recognising importance of empathy</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Standards for practice</td>
<td>Performing to a standard</td>
<td>n/a</td>
<td>Maintaining standards</td>
</tr>
<tr>
<td>Complementary role of NTS</td>
<td>Complementary role of non-technical skills with technical skills</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Theme</td>
<td>Reported by first-year students</td>
<td>Reported by third-year students</td>
<td>Reported by Faculty first-year students</td>
</tr>
<tr>
<td>-------</td>
<td>---------------------------------</td>
<td>---------------------------------</td>
<td>---------------------------------------</td>
</tr>
</tbody>
</table>
| **Authenticity** | • Authentic character, situations and environments that were familiar  
• Imperfect reality of clinical practice  
• Variability  
• Present risks in patient care | • Authentic character, situations and environments that were familiar  
• Imperfect reality of clinical practice  
• Variability  
• Present risks in patient care  
• Believable patient outcomes | • Imperfect reality of clinical practice  
• Emotional connections with the person | |
| **Learning through mistakes** | • Visualise poor patient outcomes  
• Galvanised into action  
• Managing mistakes and errors in practice  
• Think about decision and consequences | • Visualise poor patient outcomes  
• Galvanised into action  
• Managing mistakes and errors in practice  
• Think about decision and consequences | • Reinforced how mistakes can happen  
• Turning negative experiences into learning  
• Getting it wrong to get it right | |
| **Vicarious learning** | • Learning via experiences of others  
• Present in the care interaction  
• Professional behaviour  
• Emotional burden of practice | • Learning via experiences of others  
• Present in the care interaction  
• Professional behaviour | NA | NA |
| **Design** | • Beneficial organisation and visualisation  
• Repetition  
• Real human reactions | • Beneficial organisation and visualisation  
• Repetition  
• Real human reactions | • Variety of levels of complexity  
• Suit students’ learning needs  
• Visualisation of non-technical skills in action  
• Pausing mid-simulation  
• Flexibility of access | |
<table>
<thead>
<tr>
<th>Theme</th>
<th>Reported by first-year students</th>
<th>Reported by third-year students</th>
<th>Reported by Faculty first-year students</th>
<th>Reported by faculty third-year students</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Learning surrounding VPs</strong></td>
<td><strong>“We all got to work together.”</strong></td>
<td><strong>Discussions are valuable</strong></td>
<td><strong>Discussions are valuable</strong></td>
<td><strong>Discussions make connections</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Practise NTS</strong></td>
<td><strong>Practise NTS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Reflect on learning and practice</strong></td>
<td><strong>Reflect on learning and practice</strong></td>
<td></td>
<td><strong>Reflection in action</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Reflection on practice</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Reinforced other learnt concepts</strong></td>
<td><strong>Reinforced other learnt concepts</strong></td>
<td><strong>Reinforced other learnt concepts</strong></td>
<td><strong>VPs related to learning completed in workshops, lectures and laboratories</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Integrate learning</strong></td>
<td><strong>Integrate learning</strong></td>
<td><strong>Integrate learning</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Cohesive learning</strong></td>
<td><strong>Cohesive learning</strong></td>
<td><strong>Cohesive learning</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>“Connects with the content.”</strong></td>
<td></td>
<td><strong>First-year students focus more on technical students</strong></td>
<td><strong>Third-year student had a deeper understanding of NTS</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Reinforced other learnt concepts</strong></td>
<td><strong>Clearer understanding of NTS</strong></td>
<td><strong>Concepts ingrained into practice</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Integrate learning</strong></td>
<td><strong>Cohesive learning</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>We’re all involved in patient safety”</strong></td>
<td><strong>Link non-technical skills with patient safety</strong></td>
<td><strong>Clear link of non-technical skills with patient safety</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Limited understanding of NTS</strong></td>
<td><strong>Clearer understanding of NTS</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Changing the way students perceive practice</strong></td>
<td><strong>Link non-technical skills with patient safety</strong></td>
<td><strong>Clear link of non-technical skills with patient safety</strong></td>
<td><strong>First-year students focus more on technical students</strong></td>
<td><strong>Third-year student had a deeper understanding of NTS</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Limited understanding of NTS</strong></td>
<td></td>
<td><strong>Clearer understanding of NTS</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Engaged with patients</strong></td>
<td><strong>Engaged with patients</strong></td>
<td><strong>Confident,</strong></td>
<td><strong>Engaged in practice</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Developed insight into teams and teamwork,</strong></td>
<td></td>
<td><strong>Took initiative</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Greater confidence to enact roles in practice</strong></td>
<td></td>
<td></td>
<td><strong>Demonstrable changes in student practice in other simulation based learning</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Practice repertoire including language</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Solid foundation and introduction</strong></td>
<td></td>
<td><strong>Confident,</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Transfer conflict</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Shortcuts in practice,</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Practice not evidenced based</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Gaps regarding NTS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Engaged with patients</strong></td>
<td></td>
<td><strong>Confident,</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Developed insight into teams and teamwork,</strong></td>
<td></td>
<td><strong>Took initiative</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Greater confidence to enact roles in practice</strong></td>
<td></td>
<td></td>
<td><strong>Demonstrable changes in student practice in other simulation based learning</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Practice repertoire including language</strong></td>
<td></td>
<td><strong>Confident,</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Solid foundation and introduction</strong></td>
<td></td>
<td><strong>Confident,</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Transfer conflict</strong></td>
<td></td>
<td><strong>Confident,</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Shortcuts in practice,</strong></td>
<td></td>
<td><strong>Confident,</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Practice not evidenced based</strong></td>
<td></td>
<td><strong>Confident,</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Gaps regarding NTS</strong></td>
<td></td>
<td><strong>Confident,</strong></td>
<td></td>
</tr>
</tbody>
</table>

Page | 166
<table>
<thead>
<tr>
<th>Theme</th>
<th>Reported by first-year students</th>
<th>Reported by third-year students</th>
<th>Reported by Faculty first-year students</th>
<th>Reported by faculty third-year students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential limitations to learning</td>
<td>Fear</td>
<td></td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>Overthinking, hesitation or second-guessing oneself in practice.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overconfidence</td>
<td>Correct overconfidence</td>
<td>Develop overconfidence</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Barrier of the classroom</td>
<td>Sort of set-up/contrived</td>
<td>Sort of set-up/contrived</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Confusion</td>
<td>Lack of understanding terminology</td>
<td>Lack of viable options</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Groupthink</td>
<td>Choosing to remain quiet</td>
<td>Choosing to remain quiet</td>
<td>Embarrassment when students got it wrong</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conform</td>
<td>Conform</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NA – not applicable
5.7 Implications

The outcomes of this component of the case study identify new findings that add to the body of knowledge surrounding use of virtual patients. In this study virtual patients enabled explicit content in curricula to facilitate non-technical skills to be learnt for students and faculty. The interactions provided opportunities for vicarious learning and role modelling that had a major influence on students’ clinical performance (Bandura 1977) that was transferable to different contexts of care. This change in practice was facilitated by the development of a practice repertoire for students that included language that supported socialisation to the role and being a member of a group. Additionally, the ability of the student to experience poor practice prior to entering clinical practice also prepared them to recognise and respond to unprofessional behaviours in the clinical setting. Learning by error was deemed important in the learning experience, with findings suggesting their learning by error could facilitate learning transfer. However, faculty qualified that translating negative patient outcomes to learning was an important role for faculty and that the embodiment of non-technical skills in the education practice of faculty was an important skill to maximise learning outcomes. Therefore, having faculty present during virtual patient activities greatly contributed to student outcomes.

5.8 Summary

This chapter presented the findings of the qualitative exploratory case study that documented the virtual patient from VSPR as the bounded case and the units of analysis as firstly, the year level of the student and then individual faculty. The themes and categories identifying the specific non-technical skills developed using virtual patients and how this learning occurred in undergraduate nursing students were identified and discussed in relation to the relevant literature. Additionally, the faculty themes related to the perspectives of developing non-technical skills using virtual patients were identified. This case study has identified important findings that add to the body of knowledge and the factors to be considered to inform best practice guidelines. In the next chapter, the findings are integrated, with the significance discussed in detail using the existing literature. The implications for practice, study limitations and recommendations are also presented.
Chapter 6  Discussion

6.0  Introduction

This chapter draws together study findings to answer the research questions. The purpose of the chapter is to give meaning to the cumulative results and their significance in relation to the existing literature. Further, it identifies new findings identified from the research that add to the body of knowledge surrounding virtual patient and non-technical skills and discusses implications for future practice. Finally, it summarises the strengths and limitations of the research and outlines future directions.

The purpose of this research was to add to the body of knowledge regarding undergraduate health professional education, virtual patients and knowledge, attitudes and practice of non-technical skills. The findings enable a better understanding of the factors contributing to the development of knowledge, skill, attitudes and practice regarding non-technical skills in undergraduate nursing students. This chapter further presents a discussion of significant factors to be considered in the development of future undergraduate health professional curricula, along with the integration of virtual patients to promote safe and competent undergraduate health professionals.

The guiding questions underpinning this research were:

1. How do standards utilised by the Australian Health Professional Registration Agency (AHPRA) to govern registration for practice address non-technical skills required by health professional in patient care situations in acute, secondary and tertiary healthcare?

2. What specific non-technical skills do undergraduate nursing students learn following interactions with the virtual patient?

3. How do interactions with virtual patients influence learning non-technical skills in undergraduate nursing students?

4. How do faculty perceive interactions with virtual patients support student learning and practise of non-technical skills?
6.1 Summary of key findings

This research confirms that categories and elements of non-technical skills as described by Flin et al. (2013) are a requirement of health professional practice for registration with AHPRA. Therefore, to ensure graduates are prepared to meet the competency standards for registration, curricula should include non-technical skills content, practice and assessments. However, the student researchers personal experience and the findings from the literature indicated minimal advancements regarding the integration of specific non-technical skills content and learning in undergraduate nursing curricula.

This thesis has specifically focused on development of non-technical skills in undergraduate nursing students, through interaction with virtual patients from VSPR, and how interacting with the virtual patient developed these skills, knowledge and attitudes. In this case study, undergraduate nursing students identified that interactions with virtual patients developed their knowledge and skills of communication, situation awareness, teamwork and decision-making skills. To a lesser extent, students reported developing awareness of leadership skills, while managing stress and coping with fatigue were only minimally described. Students also reported developing professional skills including humanistic attributes of duty, advocacy and empathy. These findings from phase two of the case study are applicable to a wider international audience as they provide recommendation for factors to consider to maximise non-technical skills outcome from virtual patients.

The findings strengthen research that indicates interactions with virtual patients develop knowledge, skills and attitudes of non-technical skills in undergraduate health professionals through socialisation to professional role and authenticity in the virtual patient interaction (Peddle, Bearman, McKenna, & Nestel, 2019; Peddle et al., 2016; Peddle, McKenna, Bearman, & Nestel, 2019). However, this research has emphasised the importance of depicting the imperfect reality of the clinical practice to ensure students are prepared for the realities of practice. The ability of the virtual patient to privilege non-technical skills in curricula for undergraduate nursing students and for faculty, can change the way undergraduate nursing students perceive clinical practice, thereby promoting development of a practice repertoire with a subsequent practice change transferred to different contexts of care. Findings support the importance of learning through making mistakes and enabling students to experience consequences of their decisions (Peddle, McKenna, et al., 2019), with findings highlighting that learners may need to ‘get it wrong to get it right’. The research also reveals the potential risks to learning and practise of non-technical skills associated with learning by mistakes for undergraduate nursing students including fear, overconfidence, confusion and groupthink.
The case study highlighted the use of non-technical skills by educators to facilitate learning. The use of non-technical skills by faculty during facilitation supports improved learning experiences and outcomes for students. However, the ability of faculty to employ non-technical skills in their educational practice varied with their level of expertise and familiarity with non-technical skills. Whilst there are references discussing the use of specific non-technical skills such as situation awareness in teaching (Sherin, Jacobs, & Philipp, 2011), no references could be found that describe the use of the suite of non-technical skills in facilitating learning, particularly in health professional education using simulation.

Finally, this research presented evidence that consideration of the prior experience of the learner and faculty is required to maximise learning non-technical skills via interactions with virtual patients. First-year students are novice learners, hence they experienced confusion and frustration when the learning experience deviated from the rule-bound principles they knew (Benner, 1984). These students appreciated role modelling of specific behaviours in practice. Accordingly, third-year students, as they move towards being advanced beginners, were able to perceive the virtual patient situation differently based on their prior concrete experiences (Benner, 1984., Waldner & Olson, 2007). Third-year students used the virtual patient scenarios to benchmark, assess and refine their own practice.

6.2 Competency standards and non-technical skills in Australian health professional practice

All non-technical skills categories were found to be addressed in the professional standards documents with communication, leadership, decision-making and team working well referenced. Less reference was made to situation awareness, and minimal reference was made to managing stress and coping with fatigue. Professions involved principally in acute patient care in secondary and tertiary settings, where most undergraduate nursing students will practice on graduation, have a higher percentage of statements within standards documents related to non-technical skills categories and elements. Therefore, it is important to ensure that undergraduate nursing students are adequately prepared for the rigours of clinical practice in acute care settings with a practice repertoire that includes non-technical skills.

While it was encouraging to note that competencies associated with effective interprofessional practice occurred in the standards documents, unfortunately those of the RN also had omissions and gaps across categories and elements of non-technical skills. These gaps and omissions may represent barriers for nurses to intentionally and effectively work together to
implement quality and safer healthcare (Reeves, 2012; Schmitt, Blue, Aschenbrener, & Viggiano, 2011). These barriers are further complicated by the lack of a common language or taxonomy used within standards documents. Having a shared interprofessional language and taxonomy across all standards documents may provide a shared baseline to further facilitate and foster collaborative education and practice (Englander et al., 2013).

The ‘coping with fatigue’ and ‘managing stress’ categories were mostly absent from the standards documents reviewed in this study, yet important across all professions to ensure staff retention and both safe and quality patient care. Retention and burnout in nursing is a significant factor for staff attrition (Goodare, 2017). Positively, findings indicate that regulatory bodies in Australia are responding to emerging drivers in practice to support the development of a flexible and responsive health workforce and including frameworks to support practitioner health and wellbeing (New Professional Performance Framework for Patient Safety https://www.medicalboard.gov.au/News/2017-11-28-media-release-professional-performance-framework.aspx).

Importantly, this research has established the presence of non-technical skills statements within the standards documents signifying the need for content, practice and assessment of non-technical skills as a component of undergraduate health professional curricula. These findings validate the importance of developing and investigating outcomes from innovative teaching and learning resources, such as the virtual patients from VSPR. A resource specifically designed to develop knowledge, attitudes and practice of non-technical skills in undergraduate health professionals. These findings present new and vital information for health professional education designers and course accreditation bodies.

6.3 Non-technical skills categories and elements

Overall, students and faculty reported interactions with virtual patients assisted in developing the different categories and elements of non-technical skills to varying degrees. Students and faculty identified that the most common non-technical skills developed through interactions with virtual patients were communication, situation awareness, team working and decision-making skills. To a lesser extent, students reported developing awareness of leadership skills, while managing stress and coping with fatigue were only minimally described. Students also reported developing other cognitive, social and interpersonal skills including professional attributes of duty, advocacy and empathy. The following sections outline the specific skills developed though virtual patient interactions according to the non-technical skills categories as identified by Flin et al. (2013) as well as other cognitive, social and interpersonal skills developed as identified in the research.
6.3.1 Communication

Faculty and students across both year levels, identified the development of particular communication strategies following interactions with the virtual patient, such as speaking up, articulating problems, documentation and active listening. In this case study, students appreciated role modelling of positive behaviours including effective communication skills in professional practice, approaches used to communicate with the patient, and the development and application of structured handover approaches, such as Introduction, Situation, Background, Assessment and Recommendations (ISBAR), to relay information in practice. Whereas faculty also appreciated the role of depicting poor practice and miscommunication, demonstrating what not to do in practice.

Virtual patients have previously been linked to developing communication skills in undergraduate nursing students (Foronda et al., 2014; Kidd, Knisley, & Morgan, 2012; McCallum, Ness, & Price, 2011; Sanders et al., 2008; Sweigart & Hodson-Carlton). Previous studies have identified that virtual patients assist nursing students in developing confidence to speak up about medical error (Robb et al., 2015) and plan team communication in error disclosure (Caylor et al., 2015). The ability of the virtual patients to build nursing student confidence in communication with patients is verified by Oden, Nelson, and Lee (2018) and Quail et al. (2016). Additionally, the ability of virtual patients to improve communication performance with team members is substantiated by research reported by Nicely (2015) and Wong et al. (2016) with improvement in using ISBAR reported by Foronda et al. (2014).

Findings of this case study extend this evidence base and demonstrate that virtual patients can be used to develop other specific elements of communication skills including articulating problems, documentation and active listening identified as essential for safe patient care. Moreover, the ability of students to transfer elements of communication skills learning to the clinical setting with a subsequent change in practice is a significant finding of this research. There are minimal reports of students being able to transfer communication skills learnt from virtual patients to the clinical setting. Research reported by Albright, Bryan, Adam, McMillan, and Shockley (2018) indicated that many participants, including nurses, nurse practitioners and doctors, appeared to transfer communication skills to their job and alter interactions with patients as a result of the virtual patient interaction. It is suggested that the dissonance between the portrayed virtual patients and the reality of the clinical practice environment may limit the ability of students to transfer learning (Brown, 2010). Therefore, the ability of the virtual patients from VSPR to depict the imperfect reality of clinical practice may support the ability of student to transfer learning to practice. Further research would be required to substantiate the self-reports from participants regarding the transference of communication skills to practice.
6.3.2 Situation awareness

Some students stated that following the virtual patient interaction they were conscious of being more aware in practice and knowing what was going on around them. As the students had more clarity about what to look for in the clinical setting and were able to gather all relevant data, they improved their ability to identify patient deterioration via recognition of changes, trends and patterns. While there is literature that reports the ability of face-to-face mannequin based simulation to develop situation awareness skills (Cooper et al., 2010; Endacott et al., 2015), and one study identifies that virtual patients can improve students ability to pick up cues (Breen & Jones, 2015), this is the first time virtual patients have been linked to the development of situation awareness in nursing students. Resources, such as virtual patients with the capacity to develop critical situation awareness skills, would be a valuable addition to undergraduate nursing education. This area would benefit from more virtual patient specifically-focused research.

6.3.3 Teamwork

Findings of this case study reinforce findings reported in the literature that virtual patients can develop teamwork in nursing students (Caylor et al., 2015; Wong et al., 2016). This includes specific team skills such as discussion before action, questioning of others, listening and considering alternative actions (Rogers, 2011), collaboration (Breen & Jones, 2015; Nicely, 2015), team communication (Foronda et al., 2014; Wong et al., 2016), role clarification (Breen & Jones, 2015; Caylor et al., 2015; Nicely, 2015; Wong et al., 2016) and team leadership (Kalisch, Aebersold, McLaughlin, Tschannen, & Lane, 2015). However, this research also identified the ability of virtual patients to develop the capacity of nursing students to include the patient as a member of the team. The ability of nursing students to actively include the patient as a member of the team can support person-centred care and shared decision-making (Casimiro, Hall, Kuziemsky, O'Connor, & Varpio, 2015).

6.3.4 Decision-making

The findings of this case study related to decision-making in nursing students support research undertaken by Sunnqvist et al. (2016), who also demonstrated that virtual patients develop the ability of nursing students to make good clinical decisions by developing problem solving and critical thinking skills. Additionally, McCallum et al. (2011) identified that virtual patient prepared students to enter clinical practice, ready to make decisions. However, undergraduate nursing students rarely get to experience the responsibility and consequences of decisions made. The
findings of this study suggest that these experiences are important for student learning and preparation to make decisions in the clinical setting. Importantly, this research highlights that nursing students across different year levels learn differently and therefore require different levels of complexity and control in the learning resources developed (O'Shea, 2003).

6.3.5 Leadership

The literature reinforces the ability of virtual patients to assist development of leadership skills and awareness of the role of leadership in nursing students (Breen & Jones, 2015) to maintain patient safety. Additionally, virtual patients are associated with understanding collaborative leadership (Wong et al., 2016). However, the findings of this case study also suggest that virtual patients can develop specific skills in nursing students required to manage clinical situations supporting their abilities to be situational leaders in practice. Nursing students are described as being less comfortable in the team leader role (Endacott et al., 2015). The ability of the virtual patient to develop delegation skills and establish role clarity would support the ability of nursing students to effectively manage clinical situations in practice (Endacott et al., 2015). Additionally, the expansion of the perspectives of the nursing students following interactions with the virtual patient, to appreciate that a team leader should be the member of the healthcare team who is the most appropriate, supports effective teams to deliver safe patient care.

6.3.6 Managing stress and coping with fatigue

Some students in the current study identified sources of stress in practice and potential impact of fatigue on practice. However, signs and symptoms of stress and fatigue and coping strategies were absent from focus groups and interviews. It is difficult to parse out why concepts like stress, fatigue and coping were absent from the focus group discussions and whether it was because the virtual patient scenarios did not emphasise the topics of fatigue and stress or that virtual patients may be less suitable to develop these non-technical skills in undergraduate nursing students. The ability of virtual patients to develop nursing students' skills to cope with fatigue and manage stress is also not reported in the literature. Interestingly, these elements were also absent from the competency standards for registration. Targeted research is required to determine the suitability of virtual patients to develop awareness of managing stress and coping with fatigue. Additionally, further lobbying for the inclusion of specific criteria related to stress and fatigue in the standards documents may support the health and wellbeing of the nursing workforce.
6.3.7 Professional traits

The ability of the virtual patient to highlight how technical and non-technical skills complement each other in professional practice and safe patient care is important. This realisation would promote the value of non-technical skills as equivalent to technical skills and enable students to develop a balanced practice repertoire essential for safe patient care. Additionally, the development of professional traits such as empathy, duty and advocacy for patients would support the ability of students to develop therapeutic interpersonal relationships to maximise patient outcomes (Kornhaber, Walsh, Duff, & Walker, 2016). Whilst the ability of virtual patients to enable empathic responses and develop an appreciation of the importance of empathy in practice have been reported in medical students (Deladisma et al., 2007; Liaw et al., 2000; Stevens et al., 2006), this is the first time the ability of virtual patient to develop empathy has been reported in nursing students.

Interestingly, the ability of the virtual patients to develop advocacy for colleagues was an unexpected finding. Third-year students identified the development of advocacy for colleagues. Such development aligns with the ability of team members to look out for and help each other, particularly when the workload is unevenly distributed among team members (Driskell, Salas, & Driskell, 2018). Further, the ability of nursing students to develop an “assertive advocacy voice” may contribute to effective decision-making in teams (Barton, Bruce, & Schreiber, 2018, p. 135). Therefore, future research is required to explore the development of advocacy for colleagues and its influences on teamwork and decision-making.

6.4 Implications for learning non-technical skills in undergraduate nursing education

The findings from the current study support the premises that explicit content in undergraduate curricula can successfully develop non-technical skills required for safe and competent practice and that virtual patients are an appropriate method to promote knowledge, attitudes and practice of non-technical skills (Greig, Higham, & Vaux, 2015; Youngson, Paterson-Brown, & Russ, 2015). However, there are new and important findings from the research to be considered when implementing education regarding non-technical skills in undergraduate nursing curriculum around the world.

Many students in this study reported they felt they had already mastered communication skills and therefore paid little attention to these skills in practice. Other studies with students and faculty reported, students had become complacent regarding these skills, often taking them
for granted as they were used every day (Daff, 2012; Tremayne, 2007). Communication skill decay is a real risk for students in clinical practice when faced with other competing interests and lack of standardisation of learning experiences (Kieran, Jensen, & Rosenbaum, 2018; Schopper, Rosenbaum, & Axelson, 2016). Additionally, skill decay is exacerbated by time away from the clinical setting, the degree of mastery of the task before time away and individual elements of the task (D'Angelo, Ray, Jenewein, Jones, & Pugh, 2015). Of concern, these communication skills are central to nursing (Trifković, Lorber, Denny, Denieffe, & Gönc, 2017).

The findings of this case study suggest that timely opportunities to practise communication skills ensure accurate, adequate and appropriate information is exchanged at the correct time and prevents communication skill decay (Haq, Steele, Marchand, Seibert, & Brody, 2004; Saperstein, Reed, Smith, & Andrew, 2017). Additionally, repeated practice aligns with the premise of overlearning which minimises skill decay whilst away from practice (D'Angelo et al., 2015). Students and faculty highlighted that using the virtual patients as a refresher after long breaks and prior to clinical practice would support remediation of communications skills, thereby improving student performance in the clinical setting. Virtual patients’ ability to maintain focus on effective communication skills in undergraduate nursing students would prohibit the decay of effective communication skills and assist with improving skill performance (Hulsman, Ros, Winnubst, & Bensing, 1999).

The recognition of teamwork in the clinical setting from first-year students was absent. As novice learners, their exposure to, inclusion in, or experience with teamwork in the clinical setting and curriculum were lacking (Bogossian et al., 2014; Endacott et al., 2015). Bogossian et al., (2014) explored final year nursing students’ ability to use teamwork skills to manage deteriorating patients. Findings indicated that teamwork was low, which reflected the lack of exposure to teamwork in curricula or inclusion in teamwork in the clinical setting. Additionally, Endacott et al. (2015) examined the teamwork skills of RNs and nursing students whilst managing a deteriorating patient. Findings from this study also suggested that previous experience, or lack of it, influenced the performance of participants in teamwork. Further, the inclusion of the patient as a member of the team in these situations is important. The patient as a member of the team is minimally reported in nursing literature. Whilst patient participation in decisions about their care is recognised to improve health outcomes and strengthen and build trust in teams, there are limited opportunities provided by teams to enable patients to meaningfully participate (Redley et al., 2018; Vaismoradi, Jordan, & Kangasniemi, 2015). Arguably, the patient has the most important role in the healthcare team (Frosch, 2015). These findings emphasise the need to provide early, explicit opportunities for first-year nursing students to experience teamwork in action in everyday clinical situations, such as those depicted in the virtual patient, rather than time-pressure events, such as medical emergencies,
which can act as barriers to learning (Endacott et al., 2015). Additionally, educational resources aimed at developing teamwork skills in nursing students need to provide the ability to empower patients in teams, support positive patient outcomes and ensure patients actively participate in their care (Habets, Beurskens, van Bokhoven, & van Dongen, 2016).

Decision-making is fundamental to nursing practice to support effective management of patient care (Bucknall et al., 2016). In clinical practice, decision-making is often undertaken in time sensitive, uncertain situations (Johansen & O'Brien, 2016). However, undergraduate nursing students rarely experience the obligation and liability of making decisions in practice (Kumaran & Carney, 2014) in time-sensitive situations. A lack of experience in accountability and responsibility has been identified as significant stressors for new nursing graduates (Christensen et al., 2016; Kumaran & Carney, 2014). It is important that students are given access to real situations to experience accountability and responsibility (Perry, Henderson, & Grealish, 2018). The ability of the virtual patient to situate the student in the driver's seat enables a degree of autonomy for students. They create a sense of authority in patient care with the learner having the power to make decisions and feelings of being accountable for patient outcomes.

Situation awareness in nursing students is crucial; however, it is an underdeveloped concept in nursing curricula with low levels of situation awareness reported in final year nursing students (Bogossian et al., 2014; McKenna et al., 2014; O'Meara et al., 2015). This lack of situation awareness can influence timely clinical decision-making, situational management and quality patient outcomes (McKenna et al., 2014). Importantly, lack of situation awareness can lead to poor recognition of early warning signs, delayed escalation and ineffective decision-making (Stayt, Merriman, Ricketts, Morton, & Simpson, 2015). Virtual patients have the capacity to enhance situation awareness in practice and improve students' abilities to identify deteriorating patients. However, consideration needs to be made by faculty in pre-briefing, as students reported that their awareness was heightened when entering the virtual patient interaction, as they knew something would happen. Whether the increased situation awareness resulted from the virtual patient interaction or the actual experience of participating in the simulation cannot be determined from this case study.

Clinical leadership is a phenomenon that focuses on clinical patients and healthcare teams rather than nursing executive leadership (Reem, Kitsantas, & Maddox, 2014). It is a factor of quality patient care (Ha & Pepin, 2018). In traditional undergraduate nursing programs, students have limited opportunities and resources to practice leadership (Démeh & Rosengren, 2015) with minimal reporting of curriculum-based clinical leadership activities (Ha & Pepin, 2018). The literature suggests that it can take up to six months or more for graduates
to develop confidence in leadership skills and apply these in practice (Reem et al., 2014). Using virtual patients can highlight the critical skills required and suitable professionals to uphold clinical leadership roles, on entry into the program and in later years to purposefully develop leadership skills over time (Ha & Pepin, 2018).

The non-technical skills of managing stress and coping with fatigue were not well identified by students in this case study. Whilst many professional organisations have released documents and guidelines to support health professional wellbeing, it is important to continue to develop and investigate innovative resources to develop strategies to manage stress and cope with fatigue in health professionals during their undergraduate education. It is essential to continue to innovate, create and investigate opportunities for students to develop effective coping mechanisms to manage the demands of nursing (Rella, Winwood, & Lushington, 2009).

The findings of this research reinforce the ability of virtual patients to be an effective tool to showcase therapeutic relationship-building to develop compassion and empathy (Bearman, Palermo, Allen, & Williams, 2015; Peddle et al., 2016; Richardson, Percy, & Hughes, 2015). However, the findings from this case study also identify the ability of the virtual patient interaction to develop advocacy and “speaking on behalf of the patient” (Kalaitzidis & Jewell, 2015, p. 314). However, the advocacy developed in this study was not only for patients but colleagues as well. The concept of advocacy for colleagues is encompassed in the backup behaviours element for effective teams where team members help and look out for each other (Barton et al., 2018). The ability of the virtual patient to enable undergraduate nursing students to appreciate and value advocacy for patients and colleagues is an important contributor to working effectively in teams. Specific research is needed to explore the role of advocacy for colleagues in effective teams.

6.5 Learning non-technical skills

6.5.1 Learning through mistakes – Getting it wrong to get it right

A noteworthy finding in this case study that adds to the body of information surrounding virtual patients proposes that vicariously experiencing and exploring mistakes in interactions with virtual patients facilitates learning non-technical skills. This finding was recognised in all three units of analysis supporting data triangulation. First-year students, for example, described strong emotional reactions to negative outcomes and errors, such as guilt, terror and fear. However, third-year students qualified that the practice, situation and poor patient outcomes were realistic and feasible. Students indicated interactions with virtual patients placed them in
the clinical situation, involved them in the patient care situation, and thus enabled them to experience the emotional burden of practice. Students identified that this interaction triggered their reflection on how they may think, respond and act in future clinical situations and helped them to see patient safety as everyone’s responsibility. Faculty reported that experiencing error in virtual patient interactions reinforced the reality of error in clinical practice and heightened awareness of students that errors can and do happen in practice.

This study has also highlighted several new findings associated with learning by mistakes that could negatively influence learning, causing students to be scared or “freak-out” about possibilities of harming patients in practice, to develop overconfidence in practice or groupthink. Learning by mistake has been previously discussed in simulation literature with Ziv, Ben-David, and Ziv (2005) extolling the virtues of learning from/by/through mistakes following constructive feedback and further opportunities to practise are a powerful learning experience for students. Additionally, the risk of developing overconfidence in undergraduate health professionals in simulation is only beginning to emerge in the literature. In a study reported by Massoth et al. (2019) exploring the experience of medical students in high and low fidelity simulations, findings suggested that high fidelity simulation can lead to undesirable outcomes including overconfidence. However, such findings in nursing exploring the links of making mistakes in simulation with overconfidence is limited. Existing literature describes the influence of simulation on self-efficacy but does not report the risk of overconfidence. Other literature reports on the influence of realism on clinical judgement confidence and overconfidence. Conversely, Yang, Thompson, and Bland (2012) suggest that improved realism in simulation can actually lead to reduced confidence. However, the concepts of groupthink and freaking-out in clinical practice as phenomena to be considered when there are opportunities for making mistakes in simulation with undergraduate nursing students are not reported in existing literature.

Whilst error in clinical practice can have significant consequences, in education “it should be recognised that getting it wrong is a part of learning and of eventually getting it right” (Heelan, Halligan, & Quirke, 2015, p. 472). The findings of this research suggest that making mistakes promoted deep learning, supported knowledge retention and recall in practice which facilitated learning transfer to other contexts of care (King, Holder, & Ahmed, 2013). In this case study, students articulated how they were able to recall the virtual patient in the clinical practice environment and articulated changes in performance from one clinical context to another. Additionally, findings highlighted that experiencing consequences of error can encourage and motivate learning (Fischer et al., 2006; King et al., 2013; Reime et al., 2016) and support skills retention and increased awareness of clinical errors in practice (Gardner, Abdelfattah, Wiersch, Ahmed, & Willis, 2015; Reime et al., 2016; Ziv et al., 2005). Following the virtual
patient interaction, students were able to recognise and appreciate the importance of non-technical skills in practice, which further motivated learning resulting in a reported heightened awareness in practice. This case study has clarified that the opportunity to “get it wrong” enabled learners to experience consequences of actions and decisions and that learners may have to get it wrong to get it right.

Though vicarious learning has been linked to peer observation of face-to-face simulation, these findings present new information for consideration when learning non-technical skills through virtual patients. Vicarious learning proposes it is possible to learn through another’s firsthand experience (Roberts, 2010) and is deemed beneficial to learning in health professional education (Livsey & Lavender-Stott, 2015). Vicarious learning presents opportunities for learning without the learner performing live in the situation (Riles, 2014). Risks to patients are minimised, and students reported that experiencing errors through the virtual patient was superior than experiencing them in practice. This experience of learning through another’s firsthand action enables coding of observed behaviours to be used to guide future action (Bahn, 2001), motivates students to adopt the behaviours and facilitates repetition of the behaviour in similar situations. These findings suggest that vicarious learning is promoted through using an instructional video storytelling approach that depicts meaningful student roles and responsibilities and health professional interactions and rich, authentic learning experiences enabling student autonomy and ownership of learning (Kearney & Schuck, 2006), especially when students are given an opportunity to make decisions, experience consequences and discuss outcomes.

It is important to acknowledge that using virtual patients did invite some unintended feelings for learners. While interactions with the virtual patients made real for learners the possibilities of making mistakes in practice, they also sparked feelings of guilt, terror and fear. Feelings that align with those reported as a consequence of medical error in clinical practice (Bari, Khan, & Rathore, 2016). Mistakes can produce strong emotional responses in students (Fischer et al., 2006; King et al., 2013; Reime et al., 2016). Experiencing negative consequences can be traumatic for some learners, leading to defensive practice (Allan et al., 2016; Bari et al., 2016), fear of failure in practice and hesitation in initiating patient care (Lean, Moizer, & Newbery, 2014; Steven, Magnusson, Smith, & Pearson, 2014). Some practitioners report avoiding similar situations in future and keeping errors to themselves (Bari et al., 2016).

Moreover, this research identifies that following interactions with virtual patients, students may miscalibrate their own sense of accuracy and competency developing overconfidence (Berner & Graber, 2008, p. S9). An outcome often cited from simulation-based learning is improved self-confidence (Alanazi, Nicholson, & Thomas, 2017). Although overconfidence has been
reported following virtual patient interactions to develop diagnostic skills in medical students (Hege, Kononowicz, Kiesewetter, & Foster-Johnson, 2018), this is the first-time overconfidence has been reported in nursing students following virtual patient interactions. Practitioners who are overconfident are less likely to consult, use or refer to protocols and guidelines (Harris et al., 2017, p. 2). These practitioners are more likely to make mistakes (Clarke, 2016) and diagnostic errors (Berner & Graber, 2008; Jarrell, Doleck, Poitras, Lajoie, & Tressel, 2015). Evidence suggests that overconfident practitioners may have serious professional and malpractice consequences (Treadwell, 2015).

Therefore, when using virtual patients to develop non-technical skills, especially when virtual patients depict error and adverse events resulting in serious harm or death to patients, consideration is needed by faculty to provide opportunities for reflection to promote learning and reduce risks of defensive practice and overconfidence. Reflection enables re-contextualisation of the experience and facilitation of learning (Allan et al., 2016) to translate the experience of “getting it wrong” into positive learning about non-technical skills. Further, the ability to provide constructive and non-judgemental feedback on performance is important to promote learning (Heelan et al., 2015). In this case study, faculty perceived their role to be critical in translating negative patient outcomes and errors into learning and to better align students perceived competency with actual competency. Providing opportunities for constructive feedback and reflective practice improves self-awareness and enables learners be better calibrated to their personal performance (Berner & Graber, 2008). Additionally, this study highlights the need for faculty development when using virtual patients to maximise learning opportunities.

6.5.2 Groupthink

This research shows that a potential limitation to learning non-technical skills is “groupthink”. Groupthink is when humans influence or bias each other’s decision-making (Kaba, Wishart, Fraser, Coderre, & McLaughlin, 2016). In this research, learners reported changing their minds based on other people’s responses, especially when there was tension in the group. Some students stated that they chose to remain quiet when there were dissenting opinions. Others, who voiced correct responses and were overruled, chose to withdraw from the group. Groupthink can prevent individuals from raising issues that may upset or go against others’ thinking (Pierce & Horkings, 2016). This phenomenon can lead to group members imposing self-censorship and not considering all options with poorer decisions as a result (Kaba et al., 2016). Groupthink can stifle innovation and reduce individual effort to solve problems (Pierce & Horkings, 2016).
One strategy to prevent groupthink includes encouraging interaction amongst group members that supports debate and an openness to new ideas (Høyrup, 2004). Therefore, when facilitating learning non-technical skills through virtual patients, it is vital to ensure an environment of “free expression and consideration of new ideas” (Pierce & Horkings, 2016, p. 6). Learners are more likely to engage in open discussion and share ideas if they perceive the environment as psychologically safe without fear of repercussions (Roussin, Larraz, Jamieson, & Maestre, 2018) which supports participation, minimises disengagement and enhances learning (Rudolph, Raemer, & Simon, 2014). Another approach to prevent groupthink is challenging assumptions (Høyrup, 2004). Faculty need to pose questions to surface assumptions, place them under safe critical examination and identify those that are true and those which are inaccurate, unfair and detrimental (Høyrup, 2004). Additionally, providing opportunities for each group member to share his/her point of view can support open enquiry and prevent groupthink (Feather, Carr, Reising, & Garletts, 2016). Finally, managed conflict that focuses on the issues is suggested to prevent groupthink as dissenting views are considered and examined whilst avoiding forced consensus (Allen, Reiter-Palmon, Crowe, & Scott, 2018).

6.5.3 Authenticity – imperfect reality

In this study, students reported that authenticity in the virtual patient, including realistic characters, behaviours, environments, and events enabled them to immerse and engage in the learning experience. Students endorsed the scenarios as credible as the virtual patients depicted the variability of clinical practice and were relatable and familiar. This authenticity highlighted the genuine risks in clinical practice, reinforcing that medical errors can and do happen and the potential effect on patient outcomes.

Importantly, students and faculty valued the depiction of the imperfect reality of clinical practice. Workloads, staff shortages, poor systems or individual deficits in professional behaviour and stress (Luparell, 2011; Siviter, 2010) can result in imperfect practice (Byrne, 2015; Siviter, 2010) such as short-cuts, not adhering to guidelines or unprofessional behaviour. However, learning environments in undergraduate nursing education role model exemplary professional behaviours and best practice. This unrealistic environment with its discrepancies between the learning and practice environments may present difficulties for learning (Haraldseid, Friberg, & Aase, 2015) and skewed perceptions of clinical reality for students (Arnone & Fitzsimons, 2015). As a result, students may be unprepared for the rigours of the real practice environment where they may face unprofessional, uncivil or disrespectful colleagues (Luparell, 2011). Additionally where they have supervisors who, due to heavy
workloads and continuous student supervisory loads, demonstrate little interest in facilitating learning or teaching of undergraduate students (Parker & Grech, 2018). Research identifies, for students to speak up and respond to poor practice, it helps if they have prior experience of such challenging situations to develop self-confidence and an understanding of the consequences that may follow (Ion, Smith, Nimmo, Rice, & McMillan, 2015).

In this case study, faculty described how the depiction of unprofessional behaviour and poor practice in virtual patient interactions better equipped the students for the reality of the practice setting and “how it is out there”. However, faculty also expressed caution associated with presenting nursing practice as fraught with danger and using scare tactics in education. The use of scare tactics has been identified as a barrier to professional socialisation (Del Prato, 2013). The findings suggest that the depiction of the imperfect reality of the real clinical practice setting in virtual patient interactions may better prepare students to recognise and respond to poor practice and unprofessional behaviours, but needs careful deliberation.

**6.5.4 Clinical practice**

An interesting finding in this case study is the reported change in the students’ perceptions and approach to practice. Faculty reported that virtual patient interactions developed a “stop and think” approach in students, rather than “do what they always did”. Students highlighted that interactions with virtual patients supported framing future behaviours, “I’m going to use that”, to guide practice. Some students also reported that interactions with virtual patients enabled them to develop the ability to stop, review information available, question uncertainties and think critically about options before acting. Third-year students described application of situation awareness skills in practice to identify deteriorating patients. This change in practice was evident in the clinical performance of students in immersive, mannequin-based simulation activities following virtual patient interactions. Some faculty reported a demonstrable difference in student behaviours including stopping, stepping back, collaborating with colleagues and considering the situation with the team prior to acting. Additionally, faculty and third-year students described reported changes in clinical practice following virtual patient interactions.

A practice repertoire is an important component of professional practice, as part of the shared basic characteristics of a group and can include language, skills, behaviours, ways of working, values and expertise (Snyder & Wenger, 2010; Woods, Cashin, & Stockhausen, 2016). Such practice repertoire enables students to apply their knowledge and skills in interactions with others (Eklund, Ruud, & Grov, 2016). Development of components of a practice repertoire has been linked to clinical experience (Kotecki, 2002), however this case study demonstrates that a practice repertoire associated with non-technical skills can be developed through interactions.
with virtual patients. Faculty described how students used this repertoire to address situations and improve their day-to-day practice which supported safe and competent care. An area highlighted in this case study as important in the practice repertoire of students included the development of language surrounding non-technical skills. Barton and Tusting (2005) state that language is a component of the practice repertoire. Having a language relevant to an area of practice can have valuable impact on aspects of practice (Paradis, Pipher, Cartmill, Rangel, & Whitehead, 2017), enabling students to make sense of the concepts and assist application, recognition and critique of non-technical skills in practice.

While there is substantive literature regarding simulation and learning outcomes, there is limited evidence regarding learning transfer to the workplace (Boet et al., 2014) or development of a practice repertoire. The evidence of learning transfer from simulation to other contexts of care, including clinical practice, is beginning to emerge with research findings indicating coaching in non-technical skills improves medical resident performance in a simulated operating room (Yule et al., 2015). Additionally, a systematic review examining the efficacy of simulation-based team training of non-technical skills for trauma teams indicated an improvement in team behaviour in the clinical setting (Gjeraa, Møller, & Østergaard, 2014). Similarly, evidence regarding learning transfer is beginning to emerge in the nursing literature with authors describing changes in practice based on student’s self-reports (Reime et al., 2016; Stayt et al., 2015). This study reports observed changes in performance of nursing students using non-technical skills across different clinical contexts following virtual patient interactions.

### 6.5.5 Faculty embodiment of non-technical skills in education

Faculty described using strategies and techniques aligned with categories and elements of non-technical skills to facilitate learning. Some faculty described how they consciously used non-technical skills to manage conflict, provide feedback and monitor the learning environment. Others described how they used non-technical skills to ensure all students were heard, generated options, considered alternatives and made decisions. However, application of the non-technical skills to achieve these outcomes appeared an unconscious action in some faculty. Literature highlights the need for faculty to be specially trained in simulation, as facilitation of simulation experiences requires a distinctive and particular set of skills (Saylor, Wainwright, Herge, & Pohlig, 2016). There is little documentation of the need to train faculty to consciously use non-technical skills to facilitate learning in simulation activities including debriefing (Cheng et al., 2015). However, the skills identified as effective in facilitating simulation activities align with the categories and elements of non-technical skills. An example of the leadership category is the way faculty members prioritize topics in debriefing, transition...
between topics, and redirect when conversations veer away from the intended path” (Cheng et al., 2015, p. 218). This aligns with the leadership category and its elements, including using authority, maintaining standards, planning and prioritising, and managing workload and resources (Flin et al., 2013). Additionally, an example of team working category is “dealing with potentially difficult situations” (Cheng et al., 2015) including supporting others, solving conflicts, exchanging information and coordinating activities (Flin et al., 2013).

This case study reveals the importance of faculty using non-technical skills in their educational practice to support translation of virtual patient interactions to learning. Additionally, findings suggest that the ability of faculty to consciously use non-technical skills in education practice to facilitate learning and maximise student-learning experiences varied in relation to their knowledge and expertise in non-technical skills. Faculty who declared limited understanding of non-technical skills were not aware of using these skills to facilitate learning. This case study highlighted that virtual patient interactions privileged non-technical skills for faculty as well and assisted them in developing, refining and refreshing their understanding of non-technical skills. This finding suggests that virtual patient interactions aiming to develop non-technical skills may have value across the learning continuum. Further research would be required to explore the application of virtual patient interactions across the learning continuum and the relationship between non-technical skills and facilitation of learning in interactions with VP.

6.6 Variation across units of analysis

This case study has clarified that first- and third-year nursing students learnt differently. Additionally, variance in the non-technical skills expertise and practice across the students was identified. The prior experience of students influenced perception of cues and ability to interpret significance of information which in turn affected options selected. As learners developed expertise, they moved from reliance on objective facts and rules to using concrete experiences and seeing the situation as a whole, rather than a compilation of its parts (Benner, 1984).

This research suggests that interactions with virtual patients to develop non-technical skills for first-year students are beneficial, as they align with the learning requirements of novice learners (Benner, 1984). Novice learners require continuous verbal and physical cues and benefit from small group discussions that are features of small group virtual patient activities (Konia et al., 2018). These discussions provide opportunities for novice learners to recognise important factors and cues, connect knowledge, and assess and analyse their own understandings (Konia et al., 2018). Similarly, vicarious learning is advocated to be an
important strategy for novice learners who have a deficit in prior knowledge and experience (Timbrell, 2017). Timbrell (2017) suggests vicarious learning assists novices to generate personal meanings from second-hand experiences thereby supporting learning transfer to clinical practice.

An important consideration to note when using virtual patients focused on non-technical skills is that novice learners experience frustration and confusion when confronted with ambiguous situations, unknown language or wording that veers away from objective facts. First year nursing students who have limited clinical experience were less able to detect cues and understand the salience of cues. Faculty may find more success with using straight-forward virtual patients with novice students and avoiding context-free rules (Benner, 1984). This notion of novices using context-free rules in decision-making is supported by Benner (1984).

As advanced beginners, third-year students revealed greater sophistication to learning (Benner, 1984). Using prior concrete experiences, third-year students were able to perceive the situation holistically and identify the important cues and information to progress the simulation. However, third-year students perceived that at times no suitable options were available to respond to clinical situations. Some third-year nursing students had overconfidence which biased their clinical judgments and posed a risk to safe practice. Although some third-year students were overconfident, others achieved the intended outcome of recognizing alternate solutions and problem-solving pathways.

The findings of this research emphasise that additional experience develops an awareness in students of alternate solutions and pathways. Advanced beginners appear to base their decisions on prior experiences using more intuitive decision-making (Stinson, 2017) seeking reassurance from the facilitator. Hence, it is possible that the simplistic ‘right/wrong’ decision pathway may not suit more experienced learners. To better support advanced beginners, learning scenarios need to develop in complexity by focusing on recognition of meaningful patterns and including extraneous information (Persky & Robinson, 2017). Additionally, decision options need to reflect the complexity of the scenario and be supported by explicit focus on the thought processes associated with the decision (Persky & Robinson, 2017).

### 6.7 Reflexivity

Reflexivity in this thesis was employed as a strategy to ensure quality of the research process. As previously reported, reflexivity was established and maintained by a series of online questionnaires conducted using the online survey tool Qualtrics. This enabled the student researcher to scrutinise the participants, the audience and themselves as the researcher
comprising the reflective journal. The use of the online questionnaire as the reflexive journal supported a deliberate and planned internal examination of my position relative to the research and the values that I brought to the research. It enabled me to consider how these perspectives may have shaped the data. This reflexivity allowed me to capture my self-commentary during the research and articulate how I was making sense of the data. This process also permitted me to manage subjectivity outside the research process. Data were captured from January 2017 to December 2018 during a period of intense data collection, analysis, synthesis and reporting.

Reflective journal data was downloaded from the online questionnaire, Qualtrics, in February 2019. Using the approach presented by Bradbury-Jones (2007) and Peshkin’s I’s, the aim of the analysis of the journal entries was to identify the nature of my I’s prevalent in the research. Peshkin’s I’s refers to the work undertaken by Peshkin (1988) who undertook an analysis to identify how his own subjectivity could influence his research. The outcome of that analysis was presented as a series of subjective I’s. Analysis of journal entries used interpretive and reflexive reading (Bradbury-Jones, 2007). The first step involved a “process of reading the data for meaning and representation” (Bradbury-Jones, 2007, p. 2486). This was followed by an inductive process, where I recognised themes that represented the different kinds of ‘I’s’ prevalent in the research (Bradbury-Jones, 2007). Below, I present a discussion of the nature of the I’s identified in my analysis, supported by excerpts from my journal, to demonstrate the how the self-commentary and internal examination developed and influenced the research.

**Champion I**

The champion I states upfront my belief of the fundamental value and role of non-technical skills in clinical practice and that introducing these concepts, knowledge and skills early into undergraduate education creates more opportunities for students to strive towards competence. I felt it was important to recognise the value I placed on these skills as well as to articulate my anticipation that the VSPR could achieve similar outcomes when compared to face-to-face learning. This enabled me to declare my position relative to non-technical skills and to be aware of this position as I progressed with the research. For example:

Journal entry 11/1/2017: “I believe that NTS are important and should be developed early on in undergraduate education. This enables students to be aware of these skills in practice and gives them opportunities to critique practice, reflect on skills demonstrated and integrate and develop their own skills, as a result. I believe that virtual learning offers an alternative to face to face and can be as effective in most areas. I have a small area of doubt if this is true for NTS as there are emotions and feelings also involved with these which can be hard to replicate in online learning. I
believe that VSPR is an innovative resource to develop student awareness of practice and what to expect. It presents practice as not perfect and real.”

Having declared this position upfront enabled me to pause and check that what I was hearing from the participants was what the data were really saying and not what I wanted to hear. This declaration prompted me to always ensure the findings were congruent with, and grounded in, the data and to be mindful of the potential implications from my stance towards the data.

Journal entry 9/6/2017: “Insight by some participants is fantastic. However, is that because I am hearing what I want to hear? Need to be careful here of subjectivity. Always ensure the data is front and centre.”

Journal entry 10/7/2017: “I know that some of it will change when I discuss but feeling confident that the overarching themes are congruent and make sense of what the data indicates.”

Structured I

I value and appreciate structure and clarity. The questionnaire entries document the real struggle experienced during the research to think deeply about the data and what it means. Whilst I value abstract thought and a desire to be creative, thoughtful and delve into the art of qualitative research, at times the ability to enter into this in-depth thinking seemed beyond me.

Journal entry 20/2/2017: “Limited progress this week - thinking interrupted and no depth to activities completed.”

Journal entry 22/6/2017: “Hmm - perplexed with thought in trying to decipher the themes in the data.”

Often when faced with situations requiring complex and deep thought, the structured I would prevail, and I would return to the pragmatic aspects and focus pragmatic aspects of planning research, even developing the questionnaire question for my reflexive journal.

Journal entry 24/2/2017: “Whilst waiting for inspiration I have planned all the focus groups for the students.”

Whilst deep thought is still a place where I am not comfortable, my progress through the research does identify where time and space was quarantined to ensure I could engage and wrestle with deep thinking.

Journal entry 22/2/2107: “Hmm perplexed with thought in trying to decipher the themes in the data. Loving the challenge.”
Journal entry 5/11/2017: “Ok taking its time as this part requires real thinking, rereading and more thinking.”

Impatient I

The impatient I represents the internal need to progress and get the job done. The impatient I supports moving quickly from one part of the research to the next and clinging to the findings emerging as absolute. Rather than reflecting on and considering all alternatives and permitting more thoughtful and innovative insights, the impatient I wanted to kick goals. Whilst the impatient I and the structured I were complementary, they were at risk of deep thinking and had the potential to influence the credibility of the findings. Consideration was needed to take my time and remember this is an iterative process.

Journal entry 19/5/2017: “I am trying to work hard to progress the outputs. Feeling really pleased.”

Journal entry 14/2/2018: “Need to kick some goals today for the how paper and get a draft happening.”

Journal entry 3/5/2017: “Remember to take my time and that it will be an iterative process.”

Insightful I

Whilst I appreciate structure and tend toward impatience, the journal entries identify the development of insight into the data as well as my skills and self-confidence. The entries suggest the importance of being able to analyse one’s performance and identify areas for improvement to ensure deep and detailed data is obtained that focuses on answering the research questions. The series of excerpts below identifies progression and development through the research, from identifying concerns with the data, to when I gained insight into and an understanding of the research.

Journal entry 20/2/2017: “Perplexing that I did not do a good job moderating the focus group. Data is limited in its depth. The questions in the interview guide will need to be reviewed as it appears to investigate more along the lines of what is the impact rather than how student learn. Research data could be deeper if moderation techniques developed.”

Journal entry 3/5/2017: “The data analysis process is now clear to me and that the framework analysis approach will be used as part of the case study to see how the VSPR scenarios address prior theory established from the literature.”
Journal entry 9/6/2017: “Understanding what I am doing and why. Have some clarity to the research process.”

A significant moment in my research was the identification and realisation of the applicability and fit of what I was doing with case study research. This was a “light bulb” moment for me. The development of my understanding of the case study methodology and methods enabled drawing together the separate components of the research into one unified case study. This afforded me the opportunity to see my thesis as a holistic piece of work and enabled me to focus on the data to answer the research questions.

Journal entry 6/3/2017: “The use of the case study approach really resonates and makes sense. It ties in the rest of my research and will hopefully present my findings and the thesis as a holistic piece of work.”

Journal entry 6/3/2017: “I think that the approach of case study with VSPR as the case really fits with the thesis. The data will enable thick and rich description of the learning involved with VSPR and present it so that themes from the review can be utilised across the research. The data sources should help provide triangulation as required in case study research.”

Other journal entries suggest development of my self-confidence, self-awareness, enabling me to maintain a position of strength in challenging situations. These entries demonstrate the development of insight into myself and the research as being capable and a feeling of pride in being true to the data.

Journal entry 6/3/2017: “This component is really taking shape and actually feel a little proud I could pull it together.”

Journal entry 19/5/2017: “I am more confident in what I am doing and the rationales for why. Have been able to hold my own over the last few weeks and feeling like I am finally coming to grips with this research thingy.”

I think an interesting entry in the journal indicates the development of an awareness of the impact of my research. I became proud of my work and its synthesised findings when I took a step back and viewed my research from a different perspective.

Journal entry 7/3/2018: “It has been highlighted that the outcomes of the research may not change the world but they will change my world.”

Changeable I
The changeable I represents the variability in the emotions experienced in the research that were at times turbulent, unsettling, productive and uncomfortable. During the times when emotions represented a positive frame of mind such as confidence, empowerment and invigoration, thoughts regarding the data were clear but questioning. When emotions changed to a more negative stance, including feeling overwhelmed, confused and doubting, thoughts regarding the data were unsure and limited.

Journal entry 20/2/2017: “Starting to feel invigorated about potential insights into the learning experience of student and VSPR.”

Journal entry 29/5/2017: “Really enjoying this component of my PhD research. It feels more like real research than the other two stages I have completed.”

Journal entry 9/6/2017: “Feeling empowered and on track.”

It was interesting to note the impact of feedback on the progress and development in the research. Positive feedback supported progress and reinforced confidence and development. Constructive criticism engendered feelings of doubt and a lack of clarity in a way forward.

Journal entry 3/5/2017: “Feeling a little perplexed since meeting yesterday. Thought I was on top of everything and then again derailed by a very confusing meeting.”

Journal entry 6/7/2017: “Have felt some real support recently with really helpful feedback and suggestions on how to manage and reduce the data to make it more meaningful. Have actually learnt a lot.”

Challenged I

Engaging in and making sense of the data from the research presented a challenge and a level of complexity that I had not previously encountered. However, excerpts from the journal indicate a tendency to rise to the challenge of understanding the data and how my emotions evolved from discomfort to having fun.

Journal entry 6/7/2017: “I love the data. The complexity that it has revealed regarding the VSPR interactions is exciting and I am really looking forward to delving into the ‘how’ data.”

Journal entry 1/8/2017: “The data is rich and interesting. Love working with it and trying to understand what it is telling me.”

Journal entry 22/8/2019: “Love the qualitative data. It is rich and descriptive and the wrestle with the themes etc. is fun!”
6.8 The quest

Indeed this PhD quest was messy, difficult and uncomfortable with no clearly defined path from point A to point B (McCulloch, 2013). This PhD was a long and arduous search for ‘something precious,’ however the search and the ‘something precious’ lacked clarity and substance. At times, there was no discernible path to follow, resulting in frustration, feeling lost and like there was no solution to the problem at hand. At other times, the path chosen was a dead-end culminating in feeling out of control and a sense of hopelessness with what I was trying to achieve.

As with any quest, there were times of great triumph, achievement and progress and times when doubt, uncertainty and negativity pervaded all thought to the point where giving up was an attractive option. At these times, the value and worth of peers and collegial support cannot be underestimated. The impact of small successes and being able to rise to the demands of being accountable for my research was momentous.

In my quest, I employed the notion of apprenticeship to learn the knowledge, art and skills of research from experts. I used self-commentary and internal examination to support insight, self-discovery and clarity of thought. I utilised passion, resilience, grit and determination to solve overwhelming problems and maintain focus on the task. I used collegial discussion to deepen understanding and promote retention and extension of concepts. I developed and applied skills of self-discipline. I gained self-confidence in seeing myself as capable, respected and being able to defend my research. When I empowered the use of supervisors, I found success in the research and scholarly thinking. I developed a sense of self and an awareness of my personal strengths and areas for improvement that I bring to the research.

6.9 Strengths and limitations of the research

The strengths of this research lie in the suitability, application and adherence to case study methods. Case study methods are valuable to gain new insights into phenomena and are particularly useful in exploring educational intervention (Atchan, Davis, & Foureur, 2016) in this research. A conceptual framework using Flin et al, (2008) categories and elements of non-technical skills along with themes identified in Peddle et al (2016) was used to guide the research. The framework was current and informed by the literature, and I was immersed and well-versed in the existing and emerging information surrounding non-technical skills.

The qualitative data were strengthened through data collection using a purposive sample of diverse nursing students and faculty from two schools enabling data triangulation. The ability
to focus on the case, the virtual patient interaction, using focus groups and individual interviews facilitated a detailed, in-depth understanding of the student experience and faculty perspectives. The interview schedules were piloted with feedback on the interview style and questions enabling revision to questions and techniques. One interviewer completed all the interviews. However, caution must be exercised as research participants may not be representative of the wider population, and there is risk that data arises from dominant participants.

Theoretical suppositions that are accepted in clinical practice were used to guide data analysis. Coding in the comparative analysis was challenging because there was no common taxonomy and shared language. However, rigour of the analytic process across all stages of the research was established by the coding of a random selection statements by all authors. All authors jointly constructed categories and sub-categories and themes and sub-themes. Data were examined for coherency, consistency and fit, with conflicts resolved through discussion which resulted in revisions to categories and themes made by consensus. The naturalistic setting of the study supports transferring findings to other student cohorts.

This study did not collect data on the significance of particular non-technical skills in various professions or strive to identify new categories and elements of non-technical skills. Caution must also be exercised when reviewing the compared statements and the proportionality of statements as the competency standards documents address a wide arc of care and the statements may have been drawn from different levels within the documents. Other limitations of the research are the inability to replicate the case study due to specificity of the participants. This also limits the ability to generalise findings to the wider population. Whilst data collection yielded substantial amounts of data, audit trails and databases enabled data management and representation of findings. Additionally, exploring the similarities and differences between and within the units of analysis from the two sites was beyond the scope of this study.

Finally, case studies are influenced by the sensitivity and integrity of the researcher. It is important to note that the student researcher led the design, development and authorship of the VSPR, had a prior professional relationship with some of the participants and knew intimately the context of the scenarios which may have impacted the data obtained. However, the student researcher was on research leave during data collection and had no formal relationship with the students or faculty who participated in the research. Additionally, the student researcher worked closely with supervisors to ensure rigour in the research, transparency in analysis and trustworthiness of findings. Importantly, a reflexive journal enhanced research quality by identifying values, beliefs and thought processes and helping me manage my own influence on the data.
6.10 Recommendations

To progress a more deliberate approach and systematic use of non-technical skills in Australian competency standards documents, each profession should develop clear, unambiguous statements inclusive of the categories and elements of non-technical skills. Collaboration across the regulatory boards in Australia to review and clarify the standards documents to achieve a common taxonomy, with shared statements and a greater commonality of fundamental skills, would support collaborative interprofessional practice. Additionally, to reflect contemporary practice and meet current consumer and health service needs, it is important that all health professional regulatory boards, in Australia and internationally, review standards documents for each profession.

In undergraduate nursing programs including international programs with large student cohorts, virtual patients can be utilised as effective, engaging, flexible, consistent and repeatable simulations that develop communication, situation awareness, teamwork, leadership, decision-making and professional skills such as duty of care, empathy and advocacy. However, to maximise learning non-technical skills through virtual patients and subsequent application in practice, there are a number of recommendations originating from this research.

Firstly, the virtual patient needs to use instructional video storytelling approaches to present an interactive and immersive opportunity for students to feel present in the care interaction so they can learn from another’s firsthand experience. Second, virtual patients aiming to develop non-technical skills must present authentic, realistic situations with imperfect practice and demonstrate adverse patient outcomes that engage learners and enable them to feel accountable and experience the consequences of their decisions. Adverse patient outcomes prepare students for the rigours of real practice and arm them with the means to challenge, and question poor practice in the clinical setting. Third, the ability of the virtual patient to highlight the importance of the patient as a member of the team will mobilise students to ensure patients are actively involved in their care. Finally, the ability to learn via error supports learning transfer to the practice setting.

The complexity of learning in the virtual patient scenario and options presented need to be tailored to meet the learning needs and experience of the students. Novice learners need scenarios that are simplistic by focusing on non-technical skills with obvious cues and limited distractors, whereas third-year students require greater complexity in the scenario and more nuanced cues and information with more creative options to progress the simulation.
We recommend that faulty sequence virtual patient interactions prior to clinical placement learning opportunities and after long breaks. Virtual patients prepare students for the reality of practice through socialisation to role and practice repertoire development that builds non-technical skills and heightens student situation awareness and ability to implement non-technical skills in practice. Virtual patients also ensure refreshers and remediation of non-technical skills following breaks in practice. Finally, proximity of the interaction to clinical practice would maximise the ability of the student to solidify resultant practice change and learning transfer to the clinical practice setting.

To maximise learning through virtual patient interaction, it is recommended that facilitation of learning occurs in small groups supported by facilitator-guided group discussion. Whilst self-directed learning was thought to be valuable, the ability of the group discussion to support novice learners enable practice regarding non-technical skills and dissection of errors in practice was deemed more beneficial for student learning.

To facilitate learning non-technical skills though virtual patient interaction for undergraduate nursing students, faculty need to: use non-technical skills in education practice to maximise learning; provide opportunities for reflection, supported by constructive feedback, and guided interaction to enable learners to reconceptualise negative experiences and feelings into learning; be conscious of the potential for groupthink; have the ability to maintain awareness in the classroom, whilst enabling a supportive and secure learning environment: and finally, ensure that the level of complexity of the learning in the virtual patient interaction fits with the level of the learner.

6.11 Future research

These findings present significant opportunities for nursing education as virtual patient approaches can be distributed across large, diverse student populations. They are more flexible, consistent and can be repeated at times convenient to the learner.

However, this research has also identified further areas for investigation to explore application of virtual patient interactions across the learning continuum in postgraduate and continuing professional development. Extension of the research is also required to investigate the perceptions and experiences of students from other professions following interactions with virtual patients. Additionally, the relationship between clinical experience and decision-making process warrants investigation to enable insight into the decision-making nuances of more experienced students, to ensure learning resources offer suitable complexity to optimise learning. The ability of virtual patients to be an effective resource for privileging and maintaining
focus on effective communication skills across the learning continuum to support patient safety requires further study.

The application of non-technical skills by faculty to maximise learning poses new concepts in educational practice that warrants further investigation. The role of faculty in debriefing to reconceptualise learning from negative patient outcomes, and use specific facilitation strategies to prevent groupthink, and support reflection and provide constructive feedback about risks of overconfidence warrants further investigation.

Whilst application of virtual patients may reduce costs and enable engagement of larger student cohorts than traditional simulation approaches, further research would clarify the ability of the student to transfer changes in practice and the influence of experiencing error and adverse patient outcomes on the learning transfer. Finally, to confirm that suggested benefits in teaching and learning afforded by interactions with virtual patients to develop non-technical skills knowledge, skills and practice are likely, a comparison between outcomes of face-to-face simulation experiences and virtual patients may be warranted.

6.12 Summary

The learning experience associated with ‘getting it right’ supported by constructive and non-judgemental interaction, discussion and feedback, can promote development of a practice repertoire for undergraduate nursing students related to non-technical skills. Importantly, this practice repertoire needs to include development of language, to enable students to socialise to the profession of nursing and understand what it means to be a member of that group (Jacobs, 2017). This repertoire, combined with the heightened awareness of students, enables learning to be integrated into the practice of students and implemented in the clinical setting to promote patient safety practices. Findings suggest that learning by mistakes is a significant element in promoting learning transfer to clinical practice. Alignment of these findings with previous literature suggests that there is some relationship between making mistakes, learning and transfer of practice (Gardner et al., 2015; Reime et al., 2016). Further research would be required to substantiate this premise. Overall, this study contributes important new understandings of the use of virtual patients in nursing education locally and internationally.
Chapter 7  Conclusion

This chapter summarises findings from this study and highlights the difference that these findings make for future practice to develop non-technical skills in undergraduate nursing students to and promote safe clinical practice. Interactions with virtual patients are associated with improved learning outcomes related to non-technical skills in particular, communication, teamwork and decision-making with some reports that virtual patients are also useful in developing leadership skills and situation awareness. The findings suggested that authentic and realistic virtual patients are a suitable resource for integration into undergraduate nursing education and virtual patients may play a significant role in preparing students for practice. Further virtual patients develop cognitive schema which supports learning transfer of non-technical skills to new clinical situations.

Whilst non-technical skills are essential in the provision of safe and competent patient care, a gap was identified in in undergraduate nursing education.. This study has explored if and how non-technical skills are developed in nursing students using virtual patients. The study provided enhanced understandings of the factors that promote learning non-technical skills via virtual patients and how that learning translates to effective practice in the clinical setting. Additionally, the research identified important factors that need consideration by faculty when integrating and facilitating learning non-technical skills using virtual patients in undergraduate health professional curricula.

The student researcher was committed to the thorough study of a practical real-world problems and considered providing practical and useful solutions to concrete problems, along with valued outcomes and recommendations for action, the focal point of the research. By using naturalistic environments, a focus was maintained on the virtual patients. The student researcher maintained the perspective that understanding is influenced and co-created by more than one person.

Case study methodology was used in all stages of the research. The first phase of the case study used document analysis to establish the need for education related to non-technical skills in undergraduate health professional curriculum and to provide critical information to develop the conceptual framework to guide the case study. Phase two of the case study focused on investigation of integrating virtual patients to develop non-technical skills in undergraduate nursing education. A purposive convenience sample was used with data obtained via interview and focus groups. Units of analysis were first- and third-year nursing students and faculty involved in facilitating learning across two education facilities in Victoria leading to registration as registered nurses. The researcher used framework analysis and constructs from clinical
practice for data analysis. Several elements supported rigour and trustworthiness in the research (e.g. case study methods, naturalistic environments, a well-informed and current conceptual framework, triangulation, pilot interviews, and multisite data collection).

Non-technical skills are addressed in competency standards documents for professions that practise in secondary and tertiary acute care settings in Australia. Therefore, these skills are a necessary component of undergraduate health professional education. However, there are some shortcomings in the standards documents to be considered by the regulation bodies to support interprofessional collaborative practice. Areas of significant concern for the well being of practising health professions, such as dealing with stress and managing fatigue, are absent from the standards documents. While many statements supporting interprofessional collaboration and patient safety are present in the standards documents, the lack of continuity of elements of non-technical skills across the professions suggest that inconsistencies may be present in practice. Based on research findings, we suggest professional organizations adopt a more unified and collaborative approach to standards across professions.

Integrating interactions with virtual patients across an undergraduate curriculum assisted nursing students and faculty to develop knowledge, skill, attitudes and practice of non-technical skill categories including communication, situation awareness, teamwork, decision-making skills and humanistic attributes of duty, advocacy and empathy. Students perceived that leadership skills were developed to a lesser extent, with minimal learning related to managing stress and coping with fatigue.

Interactions with virtual patients influence knowledge, attitudes and practice of non-technical skills in undergraduate nursing students via authenticity in the virtual patient interaction, socialisation to the professional role, vicarious learning and learning by making mistakes. This research highlights the importance of connection of the virtual patient interaction to the learning surrounding the activity to maximise student learning outcomes. Additionally, learning non-technical skills from interactions with virtual patients requires consideration of the educational design of the simulation experience, the sequencing of learning activities surrounding the virtual patient, and the challenges faced in representing the unstructured, unpredictable nature of the clinical environment in a simulation setting.

Virtual patients privilege non-technical skills in curricula for students and faculty. The depiction of the imperfect reality of clinical practice better prepares students for the rigours of clinical practice and promotes development of a practice repertoire enabling students to recognise and respond to poor practice in the clinical environment. Importantly, this research highlights the significance of “getting it wrong to get it right” in education and the subsequent change in student practice, that is transferrable to different contexts, to support patient safety.
The learning experience associated with ‘getting it right’ supported by constructive and non-judgemental interaction, discussion and feedback, can promote development of a practice repertoire for undergraduate nursing students related to non-technical skills. Importantly, this practice repertoire needs to include development of language to enable students to socialise to the profession of nursing and understand what it means to be a member of that group (Jacobs, 2017). This repertoire, combined with the heightened awareness of students, enables learning developed via interactions with virtual patients to be integrated into the practice of students and implemented in the clinical setting to promote patient safety practices. To manage potential limitations to learning from virtual patient interactions including fear, overconfidence, groupthink and confusion, facilitation approaches, opportunities for reflection, constructive feedback and debriefing may be key. The embodiment of non-technical skills in practice by faculty in the learning experience promotes learning non-technical skills for both students and faculty.

There are a number of new findings in this research regarding virtual patient interaction aiming to develop non-technical skills in undergraduate nursing students. Firstly, this research has established the ability of virtual patients to develop specific categories of non-technical skills in undergraduate nursing students that are required in accordance with competency standards documents. However, we identified that the year level of the student affected learning and practice development of non-technical skills. Other new findings included the ability of the virtual patient to privilege non-technical skills in the curriculum and the importance of depicting the imperfect reality of practice to afford opportunities to learn through mistakes. This research also identified potential risks for learning by mistakes that have not previously appeared in associated literature such as fear, groupthink and overconfidence. Others new findings include the importance of faculty embodying non-technical skills in educational practice to support the development of a practice repertoire that supports learning transfer to different practice contexts. Finally, this study demonstrated that learning non-technical skills via interactions with virtual patients can change how students perceive practice and help students transfer their learning to the clinical setting to support safe and competent patient care. This change in practice suggests that learning from virtual patient interactions is transferrable from one context to another. However, findings suggest that learning by mistakes is a significant element in promoting learning transfer to clinical practice. Alignment of these findings with previous literature suggests that there is some relationship between making mistakes, learning and transfer of practice (Gardner et al., 2015; Reime et al., 2016). Further research would be required to substantiate this premise. Nonetheless, these findings point to the value of virtual patients in developing safe and competent practice and ultimately, enhancing patient safety.
Chapter 8  Appendices
Appendix 1. Ethics approval Monash University

Monash University Human Research Ethics Committee (MUHREC)

Research Office

Human Ethics Certificate of Approval

Date: 20 December 2012

Project Number: CF12/3958 – 2012001891

Project Title: Virtual Simulated Patients, Non-Technical Skills and undergraduate health professionals

Chief Investigator: Prof Debra Nestel

Approved: From: 20 December 2012 To: 20 December 2017

Terms of approval

1. The Chief investigator is responsible for ensuring that permission letters are obtained, if relevant, and a copy forwarded to MUHREC before any data collection can occur at the specified organisation. **Failure to provide permission letters to MUHREC before data collection commences is in breach of the National Statement on Ethical Conduct in Human Research and the Australian Code for the Responsible Conduct of Research.**

2. Approval is only valid whilst you hold a position at Monash University.

3. It is the responsibility of the Chief Investigator to ensure that all investigators are aware of the terms of approval and to ensure the project is conducted as approved by MUHREC.

4. You should notify MUHREC immediately of any serious or unexpected adverse effects on participants or unforeseen events affecting the ethical acceptability of the project.

5. The Explanatory Statement must be on Monash University letterhead and the Monash University complaints clause must contain your project number.

6. **Amendments to the approved project (including changes in personnel):** Requires the submission of a Request for Amendment form to MUHREC and must not begin without written approval from MUHREC. Substantial variations may require a new application.

7. **Future correspondence:** Please quote the project number and project title above in any further correspondence.

8. **Annual reports:** Continued approval of this project is dependent on the submission of an Annual Report. This is determined by the date of your letter of approval.

9. **Final report:** A Final Report should be provided at the conclusion of the project. MUHREC should be notified if the project is discontinued before the expected date of completion.

10. **Monitoring:** Projects may be subject to an audit or any other form of monitoring by MUHREC at any time.

11. **Retention and storage of data:** The Chief Investigator is responsible for the storage and retention of original data pertaining to a project for a minimum period of five years.
MEMORANDUM

To: Ms Monica Peddle, School of Nursing and Midwifery, FHS
From: Secretary, La Trobe University Human Ethics Committee

Subject: UHEC acceptance of Monash University Human Research Ethics Committee (MUHREC) CF12/3958 – 2012001891

Title: Virtual Simulated Patients, Non-Technical Skills and undergraduate health Professionals

Date: 08 March 2013

Thank you for submitting the above protocol to the University Human Ethics Committee (UHEC). Your material was forwarded to the UHEC Chair for consideration. Following evidence of a full review and subsequent final approval by the MUHREC, the UHEC Chair agrees that the protocol complies with the National Health and Medical Research Council’s National Statement on Ethical Conduct in Human Research and is in accordance with La Trobe University’s Human Research Ethics Guidelines.

Endorsement is given for you to take part in this study in line with the conditions of final approval outlined by the MUHREC.

Limit of Approval. La Trobe UHEC endorsement is limited strictly to the research protocol as approved by the MUHREC.

Variation to Project. As a consequence of the previous condition, any subsequent modifications approved by the MUHREC for the project should be notified formally to the UHEC.

Annual Progress Reports. Copies of all progress reports submitted to the MUHREC are to be forwarded to the UHEC. Failure to submit a progress report will mean that endorsement for your involvement this project will be rescinded. An audit related of your involvement in the study may be conducted by the UHEC at any time.

Final Report. A copy of the final report is to be forwarded to the UHEC within one month of it being submitted by the MUHREC.

If you have any queries related to the information above or require further clarifications, please contact me through Research Services on telephone (03) 9479-1443, or by e-mail at: humanethics@latrobe.edu.au.

On behalf of the La Trobe University Human Ethics Committee, best wishes with your research!

Ms Barbara Doherty
Appendix 3. Ethics approval Victoria University

MEMO

TO       Monica Pendle
         Lecturer
         La Trobe University

FROM   Associate Professor Deborah Zion
        Chair
        Victoria University Human Research Ethics Committee

DATE    03/04/2017

SUBJECT Ethics Application – HREC Approved Application External to Victoria University

Dear Ms Pendle

Thank you for submitting this request for ethical approval of the project entitled:

**Monash University** “Virtual Simulated Patients, Non-Technical Skills and undergraduate health professionals”

*(Project approved by Monash University)*

The proposed research project has been accepted and deemed to meet the requirements of the National Health and Medical Research Council (NHMRC)’s National Statement on Ethical Conduct in Human Research (2007) by the Chair of the Victoria University Human Research Ethics Committee. Approval has been granted from 3 April 2017 to 3 April 2019. Any variations to the protocol must be approved through the original approving HREC and notified to VUHREC.

Please note that the Human Research Ethics Committee must be informed of the following: any changes to the approved research protocol, project timelines, any serious events or adverse and/or unforeseen events that may affect continued ethical acceptability of the project. In these unlikely events, researchers must immediately cease all data collection until the Committee has approved the changes. Researchers are also reminded of the need to notify the approving HREC of changes to personnel in research projects via a request for a minor amendment. It should also be noted that it is the Chief Investigators’ responsibility to ensure the research project is conducted in line with the recommendations outlined in the National Health and Medical Research Council (NHMRC)’s National Statement on Ethical Conduct in Human Research (2007).

On behalf of the Committee, I wish you all the best for the conduct of the project. Kind regards,

**Associate Professor Deborah Zion**

Chair
Victoria University Human Research Ethics Committee
Appendix 4. Participant information statement

Explanatory statement for virtual simulated patient research participants

Title: Virtual simulated patients, non-technical skills and undergraduate health professionals

Research team: Ms Monica Peddle (Student), Prof Debra Nestel (Supervisor) & Assoc Prof Margaret Bearman (Supervisor)

My name is Monica Peddle and I am a student completing my Doctor of Philosophy at Monash University. My supervisor is Professor Debra Nestel, Professor of Medical Education at the Gippsland Medical School, Monash University and Associate Professor Margaret Bearman, HealthPEER, Monash University Clayton.

I am conducting a research project investigating the impact of an online education resource called, Virtual Simulated Patient Resource (VSPR) on the development of non-technical skills in undergraduate health professional students and the subsequent impact this may have on patient care.

There are a number of aims of this research. For stage one the aim is to determine the current utilisation of virtual simulation to develop non-technical skills in undergraduate health professional through an integrative literature review. Stage two involves the investigating the implementation of education related to non-technical skills into undergraduate health professional programs through a cross sectional survey of health professional educators in Australia and New Zealand. In the third stage the aim is to investigate the impact of the utilisation of the VSPR on the development of non-technical skills in undergraduate health professional and the subsequent impact on clinical practice. The fourth and last stage is to investigate nontechnical skills from a lay perspective including the perception of realism portrayed in the VSPR and the role of non-technical skills.

We will be inviting all selected participants to participate in the research. We will ask you to complete the activities as listed below for each stage of the research.

Stage Three
The third stage invites participants who are undergraduates enrolled in health science bachelor programs who have engaged with the scenarios to attend a focus group to explore the concept of non-technical skills in undergraduate education and clinical
practice. The focus group will run for one hour and will be conducted at a mutually convenient location. Participants of the focus group will receive a movie ticket for participating in the focus groups. This stage will also invite undergraduate nursing class facilitators to participate in individual interviews. Interviews will be of 30-60 minutes duration. Interviews will be conducted at a time and place that is convenient to the facilitator.

I do not envisage you will experience discomfort as a result of participating in any of the activities associated with the research. However, counselling services are available if you become distressed at any time during your participation in this project.

Being in this study is voluntary and you are under no obligation to participate. You may withdraw from your online and interview involvement at any stage. Due to the anonymous nature of the online questionnaire data the information retrieved will not be able to be excluded from the research. If you decide to withdraw from the interviews and focus groups please contact the project manager to ensure that your information is removed from the research database.

Storage of the data collected will adhere to the University regulations and kept on University premises in a locked cupboard/filing cabinet for five years.

A report of the study will be submitted for publication. Individual participants will not be identifiable in this report or any other materials emanating from this project. If you would like to be informed of the aggregate research findings, please contact Monica Peddle on 9479 5903 or m.peddle@latrobe.edu.au. The findings are accessible for five years.

<table>
<thead>
<tr>
<th>If you would like to contact the researchers about any aspect of this study, please contact the Chief Investigator:</th>
<th>If you have a complaint concerning the manner in which this research &lt;insert your project number here&gt; is being conducted, please contact:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Debra Nestel</strong>&lt;br&gt;Professor of Simulation Education in Healthcare&lt;br&gt;School of Rural Health&lt;br&gt;Faculty of Medicine, Nursing and Health Sciences&lt;br&gt;Monash University, Victoria, Australia&lt;br&gt;Phone: +61 3 9902 6201&lt;br&gt;Mobile: +61 (0) 404 465 959&lt;br&gt;Email: <a href="mailto:debra.nestel@monash.edu">debra.nestel@monash.edu</a></td>
<td><strong>Executive Officer</strong>&lt;br&gt;Monash University Human Research Ethics Committee (MUHREC)&lt;br&gt;Building 3e Room 111&lt;br&gt;Research Office&lt;br&gt;Monash University VIC 3800&lt;br&gt;Tel: +61 3 9905 2052 Fax: +61 3 9905 3831 Email: <a href="mailto:muhrec@monash.edu">muhrec@monash.edu</a></td>
</tr>
</tbody>
</table>
Appendix 5. Consent form focus groups

Title: Virtual Simulated Patients, Non-technical skills and undergraduate health professionals

Participant Group 5: All health professional undergraduates enrolled in Bachelor Programs.

NOTE: This consent form will remain with the Monash University researcher for their records

I agree to be invited to participate in a focus group on my experiences with non-technical skills during my undergraduate education  
☐ Yes  ☐ No

I agree to allow the focus group to be audio-taped  
☐ Yes  ☐ No

I understand that my participation is voluntary.

I understand that any data that the researcher extracts from the interviews is for use in reports or published findings and will not, under any circumstances, contain names or identifying characteristics.

I understand that data from the interview transcripts and audiotapes will be kept in a secure storage and accessible to the research team. I also understand that the identifiable data will be destroyed after a five-year period unless I consent to it being used in future research.

<table>
<thead>
<tr>
<th>Participant’s name</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Signature</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 6. Consent form individual interviews

Consent form for individual interview

Title: Virtual simulated patients, non-technical skills and undergraduate health professionals

Participant Group 5: Academic facilitators of undergraduate classes using VSPR

NOTE: This consent form will remain with the Monash University researcher for their records

I agree to take part in the research project specified above. I have had the project explained to me, and I have read the explanatory statement, which I will keep for my records.

I agree to participate in an individual interview  □ Yes  □ No
I agree to allow the interview to be audio recorded  □ Yes  □ No

I understand that my participation is voluntary.

I understand that any data that the researcher extracts from the interviews is for use in reports or published findings and will not, under any circumstances, contain names or identifying characteristics.

I understand that data from the interview transcripts and audiotapes will be kept in a secure storage and accessible to the research team. I also understand that the identifiable data will be destroyed after a five-year period unless I consent to it being used in future research.

Participant’s name

Signature

Date
Appendix 7.  Focus group question guide 2014

Focus Group Questions.

Now that you have undertaken the VSPR program, I'd like to ask you some questions. In a focus group, we are not seeking consensus but would like you to share your opinions with each other about the resources. Please be honest in your responses. I welcome positive and negative comments equally.

VSPR is a web based resource that consists of six modules and five play your own adventure game type simulation scenarios. This resource explores that application of NTS including, teamwork, communication, leadership, situation awareness and decision-making in health professional practice.

1. Firstly, who has used the resource?
2. How much of the resource have you completed?
3. What were your reactions to VSPR?
   a. The content?
   b. The process?

I’d like to focus on the content first and then we will discuss the process.

CONTENT QUESTIONS
4. If I talk about NTS, what does that mean to you? Discuss NTS with each other.
5. What is your understanding of the role of non-technical skills in patient care?
6. Did any component of VSPR contribute to this understanding? If so, which scenario/s and how? If not, can you state why?
7. Thinking about your clinical placement, can you give an example of when you observed effective NTS at work?
8. Having viewed the virtual patient, was there a relation to the clinical setting? (Depending on time)
9. What was helpful about the VSPR content? Why?
10. What was unhelpful? Why?
11. What has been most helpful for your clinical placements?
12. Has anything been unhelpful for your clinical placements?
13. Did anything surprise you about the content of the VSPR?
14. Is there anything else that we should have included?
15. Did you face challenges with using NTS in your clinical placements? If so, which ones? Why? If not, why?

PROCESS QUESTIONS: USING THE VSPR
16. How did you find using the VSPR program/modules? Easy? Hard?
17. How could it be improved?
18. Have you used anything like this previously? If so, what?
19. Do you want more of this? Less? Different focus?
20. Would you recommend it to your peers? If not, why?

Focus Group Questions.

Now that you have undertaken the VSPR program, I’d like to ask you some questions. I encourage you to discuss with each other and share your experiences with the group. In a focus group, we are not seeking consensus but would like you to share your opinions with each other about the resources. Please be honest in your responses. I welcome positive and negative comments equally.

Ground Rules - only one person speaking at a time, no side conversations among neighbours, everyone participating with no one dominating, and so on.

VSPR is a web based resource that consists of six modules and five play your own adventure game type simulation scenarios. This resource explores that application of NTS including, teamwork, communication, leadership, situation awareness and decision-making in health professional practice. The resource contains modules and scenarios. We will be exploring the scenarios today. (VISUALS)

ICEBREAKER – Introduce each other around the table.

DISCUSSION STARTER QUESTION (Inverted Funnel) – Let’s start by having you write as long a list as you can of everything that is involved, one way or another, with non-technical skills in healthcare/VSPR scenarios. Share your thoughts with each other.

What is your understanding of the role of non-technical skills in patient care? Share your thoughts with the group.

QUESTIONS

1. What were your thoughts, feelings and perceptions at the time when working through the VSPR scenario?
2. How did VSPR scenarios contribute to your understanding, thinking or practice of NTS? Which component or scenario/s and how? If not, can you state why?
3. What was helpful about the VSPR scenario? Why? What was unhelpful? Why?
4. Thinking about your clinical placement, can you give an example of when you observed effective NTS at work? How did VSPR scenario learning affect this?
5. Did you face challenges with using NTS in your clinical placements? If so, which ones? Why? If not, why?
6. Having viewed the virtual simulated patient scenarios, was there a relation to the clinical setting?
7. What was most helpful for your clinical placements from VSPR scenario? Has anything been unhelpful for your clinical placements?
8. Did anything surprise you about the content of the VSPR?
9. Is there anything else that we should have included?
PROCESS QUESTIONS: USING THE VSPR

10. How did you find using the VSPR program/modules? Easy? Hard?
11. How could it be improved?
12. Have you used anything like this previously? If so, what?
13. Do you want more of this? Less? Different focus?
14. Would you recommend it to your peers? If not, why?
15. How long did you spend on it? When? Where?

FINAL QUESTION
Ask each participant to give a final summary statement
Appendix 9. Individual interview question guide

Individual Interview Questions.

Now that you have utilised the VSPR program, I’d like to ask you some questions. Please be honest in your responses. I welcome positive and negative comments equally.

VSPR is a web based resource that consists of six modules and five play your own adventure game type simulation scenarios. This resource explores that application of NTS including, teamwork, communication, leadership, situation awareness and decision-making in health professional practice. The resource contains modules and scenarios. We will be exploring the scenarios today. (VISUALS)

STARTER QUESTIONS
Can you provide some background to your role and experiences?
I would like to start by getting you to describe your understanding of NTS?
Can you describe the role of NTS in patient care?
What is your perception of student understanding of these?

QUESTIONS

1. What were your thoughts, feelings and observations at the time when working through the VSPR scenario to integrate it in your subject?
2. Can you describe you observations of the students as the videos were playing?
3. Do you think the VSPR scenarios contributed to your understanding of NTS and their role in patient care?
4. How would they develop understanding of NTS of the students?
5. Having viewed the virtual simulated patient scenarios, did they feel real and authentic?
6. Is there a relation to the clinical setting?
7. How do you think the student perceive the VSPR scenarios?
8. Thinking about student’s clinical placements, would the VSPR scenarios play a role in student preparation?
9. What would be most helpful for student’s clinical placements from VSPR scenario? Would anything be unhelpful for their clinical placements?
10. Do you think students are able to transfer learning to the clinical setting?
11. Do they experience challenges with transferring NTS in their clinical placements? If so, which ones?
12. Do the scenarios help in socialising students to their professional roles?
13. What is helpful about the VSPR scenarios that you think promotes learning? Why?
14. What do you think the two options that appear on the screen after the videos prompt in the students?
15. Do the negative outcomes of VSPR promote or hinder learning?
16. What is the role of debriefing in the VSPR learning?
17. Did anything surprise you about VSPR?
18. Is there anything else that we should have included?
FINAL QUESTION

Ask each participant to give a final summary statement – What is the role of VSPR scenarios in student learning regarding NTS.
## Appendix 10. Analytical codebook student focus groups

<table>
<thead>
<tr>
<th>Category</th>
<th>Code</th>
<th>Definition</th>
<th>Description/example</th>
<th>Illustrative quote</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(Theory driven)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| **Topics**          | Communication | Communication is the exchange of information, feedback or response, ideas and feelings. (Crichton, 2013)(p.69) | *Send information clearly and concisely*  
*Include context and intent during information exchange,*  
*Receive information especially by listening*  
*Identify and address barriers to communication* (Crichton, 2013) |                   |
|                     | Teamwork      | A distinguishable set of two or more people who interact, dynamically, interdependently, and adaptively toward a common and valued goal/objective/mission, who have each been assigned specific roles or functions to perform, and who have a limited life-span of membership (Crichton, 2013, p.94). | *Support others*  
*Solve conflicts*  
*Exchange information*  
*Coordinate activities*  
TEAMWORK BEHAVIOURS:  
*Performance monitoring,*  
*Feedback*  
*Closed loop communication*  
*Backing up behaviours.*  
TEAM PERFORMANCE NORMS:  
*Team self-awareness*  
*Fostering team interdependence.* (Crichton, 2013) |                   |
<table>
<thead>
<tr>
<th>Category</th>
<th>Code</th>
<th>Definition</th>
<th>Description/example</th>
<th>Illustrative quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decision-making</td>
<td>D</td>
<td>Decision-making can be defined as the process of reaching a judgement or</td>
<td>*Situation assessment/Defining problem</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>choosing an option, sometimes called a course of action, to meet the needs</td>
<td>*Generating and considering one or more response options</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>of a given situation (Crichton, 2013, p.41)</td>
<td>*Selecting and implementing an option</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*Outcome review (Crichton, 2013, p.41)</td>
<td></td>
</tr>
<tr>
<td>Leadership</td>
<td>L</td>
<td>Team leadership is about directing and co-ordinating the activities of</td>
<td>*Use authority</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>team members; encouraging them to work together; assessing performance;</td>
<td>*Maintain standards</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>assigning tasks; developing team knowledge, skills and abilities;</td>
<td>*Plan and prioritise</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>motivating; planning and organising; and establishing a positive team</td>
<td>*Manage workload and resources (Crichton, 2013) (p.130)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>atmosphere (Crichton, 2013)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Situation</td>
<td>S</td>
<td>The perception of the elements in the environment within a volume of time</td>
<td>*Gathering information,</td>
<td></td>
</tr>
<tr>
<td>awareness</td>
<td></td>
<td>and space, the comprehension of their meaning and the projection of their</td>
<td>*Interpreting information,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>status in the near future (Crichton, 2013, p.18)</td>
<td>*Anticipating future states. (Crichton, 2013, p.18)</td>
<td></td>
</tr>
<tr>
<td>Stress</td>
<td>T</td>
<td>A particular relationship between the person and the environment that is</td>
<td>*Identify causes</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>appraised by the person as taxing or exceeding his or her resources and</td>
<td>*Recognise symptoms and effects</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>endangering his or her</td>
<td>*Implement coping strategies (Crichton, 2013, p.158)</td>
<td></td>
</tr>
<tr>
<td>Category</td>
<td>Code</td>
<td>Definition</td>
<td>Description/example</td>
<td>Illustrative quote</td>
</tr>
<tr>
<td>-----------------------</td>
<td>----------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>wellbeing.</td>
<td></td>
<td>(Crichton, 2013, p.157)</td>
<td>-------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Fatigue</td>
<td></td>
<td>The state of tiredness which is associated with long hours of work, prolonged periods without sleep, requirements to work at times which are 'out of sync' with the body's biological or Circadian rhythms.' (Crichton, 2013, p.191)</td>
<td>*Identify causes of fatigue</td>
<td>*(Crichton, 2013, p.191)</td>
</tr>
<tr>
<td>Other topic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relationship to clinical role</td>
<td></td>
<td>Socialisation into professional role</td>
<td>The process during which individuals learn new roles, values, behaviours, and knowledge pertinent to a new social group or profession. (Dinmohammadi, Peyrovi, &amp; Mehrdad, 2013) (p.26) Formal and informal rules</td>
<td>Explicit and implicit (Dinmohammadi et al., 2013)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The initiation of students into the personal and professional complexities of real clinical practice (Peddle et al., 2016, p. 406)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transfer of learning to the clinical setting</td>
<td></td>
<td>The degree to which students apply to their jobs the knowledge, skills, behaviours and attitudes they have gained in training. (Botma, Van Rensburg, Coetzee, &amp; Heyns, 2015, p. 499)</td>
<td>concepts, knowledge, information, procedures, and methods. (Botma et al., 2015, p.499) develop transferable skills (Peddle et al., 2016)</td>
<td></td>
</tr>
<tr>
<td>Other relation to clinical role</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VP Representations</td>
<td>Realism</td>
<td>The degree to which the experience feels, sounds and appears like the real thing (Paige &amp; Morin, 2013)</td>
<td>Physical factors</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Psychological factors</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Social factors (Paige &amp; Morin, 2013)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Category</td>
<td>Code</td>
<td>Definition</td>
<td>Description/example</td>
<td>Illustrative quote</td>
</tr>
<tr>
<td>-------------------</td>
<td>------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Student reactions</td>
<td></td>
<td>Ability of the virtual patient to produce a response in the student (Peddle et al., 2016) to an action, situation or event</td>
<td>Genuine reactions (Peddle et al., 2016)</td>
<td></td>
</tr>
<tr>
<td>Emotion</td>
<td></td>
<td>A strong personal feeling resulting from interaction with other human beings, event or situation accompanied by physiological and behavioural changes (Merriam-Webster Dictionary, 2017)</td>
<td>Positive and negative</td>
<td>Linked to the complexity and presence of the virtual patient (Peddle et al., 2016)</td>
</tr>
<tr>
<td>Empathy</td>
<td></td>
<td>To understand and another person feelings, thoughts and situation from their point of view (Jeong, 2015)</td>
<td>Include statements, head nodding and eye contact and body lean (Peddle et al., 2016)</td>
<td></td>
</tr>
<tr>
<td>Variability</td>
<td></td>
<td>Depicts the unstructured and unpredictable nature of the rapidly changing clinical environment (Peddle et al., 2016)</td>
<td>Interactivity (Peddle et al., 2016)</td>
<td></td>
</tr>
<tr>
<td>Other virtual patient representation</td>
<td></td>
<td>(Data driven)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Appendix 11. Analytical codebook facilitators.

<table>
<thead>
<tr>
<th>Category</th>
<th>Code</th>
<th>Definition</th>
<th>Description/example</th>
<th>Illustrative quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Theory driven)</td>
<td>Topics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication</td>
<td></td>
<td>Communication is the exchange of information, feedback or response, ideas</td>
<td>*Send information clearly and concisely</td>
<td>(Crichton, 2013, p.69)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and feelings. (Crichton, 2013, p.69)</td>
<td>*Include context and intent during information exchange</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*Receive information especially by listening</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*Identify and address barriers to communication (Crichton, 2013)</td>
<td></td>
</tr>
<tr>
<td>Teamwork</td>
<td></td>
<td>A distinguishable set of two or more people who interact, dynamically,</td>
<td>*Support others</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>interdependently, and adaptively toward a common and valued goal/objective/mission, who have each been assigned specific roles or functions to perform, and who have a limited life-span of membership. (Crichton, 2013, p.94)</td>
<td>*Solve conflicts</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*Exchange information</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*Coordinate activities</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TEAMWORK BEHAVIOURS:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*Performance monitoring</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*Feedback</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*Closed loop communication</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*Backing up behaviours.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TEAM PERFORMANCE NORMS:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*Team self-awareness</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*Fostering team interdependence.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Crichton, 2013)</td>
<td></td>
</tr>
<tr>
<td>Decision-making</td>
<td></td>
<td>Decision-making can be defined as the process of reaching a judgement or</td>
<td>*Situation assessment/ Defining problem</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>choosing an option, sometimes called a course of action, to meet the needs of a</td>
<td>*Generating and considering one or more response options</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*Selecting and implementing an option</td>
<td></td>
</tr>
<tr>
<td>Category</td>
<td>Code</td>
<td>Definition</td>
<td>Description/example</td>
<td>Illustrative quote</td>
</tr>
<tr>
<td>-------------------</td>
<td>------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>Leadership</td>
<td></td>
<td>Team leadership is about directing and co-ordinating the activities of team members; encouraging them to work together; assessing performance; assigning tasks; developing team knowledge, skills and abilities; motivating; planning and organising; and establishing a positive team atmosphere (Crichton, 2013, p.129)</td>
<td>*Use authority&lt;br&gt;*Maintain standards&lt;br&gt;*Plan and prioritise&lt;br&gt;*Manage workload and resources (Crichton, 2013, p.130)</td>
<td></td>
</tr>
<tr>
<td>Situation awareness</td>
<td></td>
<td>The perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future (Crichton, 2013, p.18)</td>
<td>*Gathering information,&lt;br&gt;*Interpreting information&lt;br&gt;*Anticipating future states. (Crichton, 2013, p.18)</td>
<td></td>
</tr>
<tr>
<td>Stress</td>
<td></td>
<td>A particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her wellbeing. (Crichton, 2013, p.157)</td>
<td>*Identify causes&lt;br&gt;*Recognise symptoms and effects&lt;br&gt;*Implement coping strategies (Crichton, 2013) (p.158)</td>
<td></td>
</tr>
<tr>
<td>Fatigue</td>
<td></td>
<td>The state of tiredness which is associated with long hours of work, prolonged periods without sleep, requirements to work at times which are ‘out of sync’ with the body’s biological or</td>
<td>*Identify causes of fatigue&lt;br&gt;*Recognise effects of fatigue&lt;br&gt;*Implement coping strategies (Crichton, 2013, p.191)</td>
<td></td>
</tr>
<tr>
<td>Category</td>
<td>Code</td>
<td>Definition</td>
<td>Description/example</td>
<td>Illustrative quote</td>
</tr>
<tr>
<td>--------------------------</td>
<td>------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Other topic</td>
<td></td>
<td>Relationship with technical skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relationship to clinical role</td>
<td></td>
<td>Socialisation into professional role</td>
<td>The initiation of students into the personal and professional complexities of real clinical practice (Peddle et al., 2016, p. 406)</td>
<td>The process during which individuals learn new roles, values, behaviours, and knowledge pertinent to a new social group or profession. (Dinmohammadi et al., 2013) (p.26) - Formal and informal rules - Explicit and implicit (Dinmohammadi et al., 2013)</td>
</tr>
<tr>
<td>Transfer of learning to the clinical setting</td>
<td></td>
<td>The degree to which students apply to their jobs the knowledge, skills, behaviours and attitudes they have gained in training. (Botma et al., 2015, p. 499)</td>
<td>Concepts, knowledge, information, procedures, and methods. (Botma et al., 2015, p.499) - Develop transferable skills (Peddle et al., 2016)</td>
<td></td>
</tr>
<tr>
<td>Other relation to clinical role</td>
<td></td>
<td>Preparation for practice</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Provides foundation for further development</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Student understanding of NTS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VP Representations</td>
<td></td>
<td>Realism</td>
<td>The degree to which the experience feels, sounds and appears like the real thing (Paige &amp; Morin, 2013)</td>
<td>Physical factors - Psychological factors - Social factors (Paige &amp; Morin, 2013)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Student reactions</td>
<td>Ability of the virtual patient to produce a response in the student (Peddle et al., 2016)</td>
<td>Genuine reactions (Peddle et al., 2016)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Circadian rhythms.'</td>
<td>(Crichton, 2013,p.191)</td>
<td></td>
</tr>
<tr>
<td>Category</td>
<td>Code</td>
<td>Definition</td>
<td>Description/example</td>
<td>Illustrative quote</td>
</tr>
<tr>
<td>----------</td>
<td>------</td>
<td>------------</td>
<td>----------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Emotion</td>
<td></td>
<td>A strong personal feeling resulting from interaction with other human beings, event or situation accompanied by physiological and behavioural changes ((\text{Merriam-Webster Dictionary, 2017}))</td>
<td>Positive and negative linked to the complexity and presence of the virtual patient (Peddle et al., 2016)</td>
<td></td>
</tr>
<tr>
<td>Empathy</td>
<td></td>
<td>To understand and another person feelings, thoughts and situation from their point of view (Jeong, 2015)</td>
<td>Include statements, head nodding and eye contact and body lean (Peddle et al., 2016)</td>
<td></td>
</tr>
<tr>
<td>Variability</td>
<td></td>
<td>Depicts the unstructured and unpredictable nature of the rapidly changing clinical environment (Peddle et al., 2016)</td>
<td>Interactivity (Peddle et al., 2016)</td>
<td></td>
</tr>
</tbody>
</table>

**Other virtual patient representation**

| Instructional design | The design of systems, computer programs, etc. to help people learn more effectively (Cambridge University Press) |

**Learning through decisions**

**Visual learning**

**Faculty**

<p>| Application of learning | The act of helping other people to deal with a process or reach an agreement or solution without getting directly involved in the process, discussion, etc. yourself (Cambridge University Press) |</p>
<table>
<thead>
<tr>
<th>Category</th>
<th>Code</th>
<th>Definition</th>
<th>Description/example</th>
<th>Illustrative quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior clinical experience of the facilitator</td>
<td></td>
<td>Knowledge or skill from doing, seeing, or feeling things (Cambridge University Press)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facilitator reactions</td>
<td></td>
<td>Behaviour, a feeling or an action that is a direct result of something else (Cambridge University Press)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facilitator understanding of NTS</td>
<td></td>
<td>Knowledge about a subject, situation, etc. or about how something works (Cambridge University Press)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning beyond the VP</td>
<td>Learner prior experiences</td>
<td>Knowledge or skill from doing, seeing, or feeling things</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reflection on practice</td>
<td></td>
<td>Active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and further conclusions to which it leads … it includes a conscious and voluntary effort to establish belief upon a firm basis of evidence and rationality. (Lotter &amp; Miller, 2017)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relationship to other learning</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>Contradictory learning and practice environments</td>
<td>Gap between what is taught in the classroom and what the student nurses experience in the clinical area (Saifan, AbuRuz, &amp; Masa'deh, 2015)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Chapter 9 References


Berger, R. (2015). Now I see it, now I don’t: Researcher’s position and reflexivity in qualitative research. *Qualitative Research, 15*(2), 219-234.


Clarke, M. L. (2016). *Peer tutoring of junior nursing students: Student experiences and perceptions of self-efficacy and benefit*. Liberty University. Doctoral Dissertations and


Frosch, D. L. (2015). The patient is the most important member of the team. *BMJ, 350*, g7767.


performances in assessing and managing clinical deterioration: Randomized controlled trial. *Journal of Medical Internet Research, 16*(9). e214


Patient Safety and Quality Care Group of European Commission. (2014.). *Report into the Key Findings and Recommendations on Patient Safety Education and Training*.


Schopper, H., Rosenbaum, M., & Axelsson, R. (2016). 'I wish someone watched me interview:' Medical student insight into observation and feedback as a method for teaching communication skills during the clinical years. BMC Medical Education, 16(1), 286.


