The role of medical simulation curriculum in developing acute care clinical competence in undergraduate medical students in South Africa

by

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Abstract

The study aim was to explore the role, including the limits and possibilities, of medical simulation as a pedagogical method in an undergraduate acute care clinical skills curriculum within a South African tertiary education environment.

The study consisted of two phases. During phase one, I conducted a modified Delphi study to identify the acute care clinical skills competencies undergraduate medical students need to acquire to prepare them, in the role as newly qualified clinicians, for managing acute care cases within a South African in-hospital environment. Phase two explored what acute care clinical competencies would lend themselves to a medical simulation modality within a South African tertiary education environment, as well as exploring the role, the limits and possibilities of medical simulation as an educational modality in developing acute care clinical skills curriculum within a South African tertiary education environment. The data was collected through Focus Group Discussion (FGD) and semi-structured interviews with simulation experts within South Africa.

The findings of the modified Delphi study contributed to developing a comprehensive list of undergraduate acute care clinical skills competencies, previously unavailable, for SA. The value of engaging with medical practitioners at the forefront of societal engagement such as practising medical practitioners, who on a day-to-day basis are exposed to the healthcare needs of society, became evident.

Having empirically established a comprehensive set of acute care competencies for SA undergraduate medical education, phase 2 sought to identify the simulation modality/modalities that these competences would lend themselves to. Thereafter, present the SimSMART framework for curriculum developers exploring the possibility of implementing simulation as pedagogy in their context.

The findings were significant as they provided curriculum developers with contextually relevant literature to consider which competencies would best be suited to medical simulation as pedagogy, which is particularly important when considering the resource constraints within developing world contexts. The findings provided valuable insights into

complex contextual issues such as the effects of the Apartheid legacy on teaching within health sciences, communication, and social inequality.

Theoretically, the selection of social constructivism (Vygotsky) and Lave and Wenger's situated learning theories have been immensely valuable in redefining medical simulation as pedagogy as opposed to a technology.

The implications of adopting this view have the potential for an earlier introduction and smoother transition of medical students into the clinical environment, which may lead to them being better prepared for clinical practice with resultant reduced morbidity and improved patient safety.

Declaration

I, Marvin Jeffrey Jansen, hereby declare that the work on which this thesis is based is my original work (except where acknowledgements indicate otherwise) and that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree in this or any other university.

I empower the university to reproduce for the purpose of research either the whole or any portion of the contents in any manner whatsoever.

Signature:

Date: 29 November 2021

Dedication

This thesis is dedicated to all the children in Manenberg, Heideveld, Mitchells Plain, Noordgesig, Eldorado Park, Khayelitsha, and all the areas in South Africa, where children are afraid to allow themselves to dream past the gang-infested territories which hold them captive.

Dare to Dream.

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List of Appendices

List of Abbreviations / Acronyms

ACS	Acute Coronary Syndromes
ACUTE	The Acute Care Undergraduate Teaching Initiative
CBE	Competency-based Education
COP	Community of Practice
CSO	Community Service Officer
DP	Deliberate Practice
EM	Emergency Medicine
FGD	Focus Group Discussion
GMC	General Medical Council
HODs	Head of Departments
HPCSA	Health Professions Council of South Africa
HPE	Health Professions Education
HREC	Human Research Ethics Committee
IPE	Interprofessional Education
LMIC	Lower and Middle-Income Countries
LPP	Legitimate Peripheral Participation
ME	Medical Education
MKO	More Knowledgeable Other
NYC	Not Yet Competent
POC	Point of Care
RCT	Randomised Control Study
SA	South Africa
SBME	Simulation-Based Medical Education
SP's	Simulated Patients
UCT	University of Cape Town
UK	United Kingdom
ZPD	Zone of Proximal Development

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Chapter 1: Introduction

The study presented in this thesis is an exploration of the role of medical simulation in developing acute care clinical skills in undergraduate South African medical students through qualitative enquiry. In the sections below I discuss the background to the study, the problem statement, the potential impact of the study, my reflexivity, and the general organisation of this thesis.

1.1. Background to the study

In the following sections of this introductory chapter, I discuss the South African medical internship, the emergence and relevance of acute care clinical skills, and introduce the gap in the literature that this thesis seeks to address.

Health care professionals are required to perform a wide range of clinical skills and are expected to be clinically competent when managing patients. Preventable medical errors result in thousands of deaths per year within healthcare facilities across the world (Hirshon et al., 2013). The need for medical training facilities to review how they prepare students has become urgent. It is not acceptable for novice students to put their patients and themselves at risk by prematurely ‘practising’ their skills on patients within the clinical environment. Apart from the potential risk it also has ethical implications.

Within South Africa (SA), the medical programme consists of a medical internship during the final year of their undergraduate medical studies. This is followed by a two-year internship which was developed to close the gap between safely performing skills and knowledge acquired during the undergraduate years. Ultimately, this programme was designed to prepare the student for their independent practice community service officer (CSO) year (Bola et al., 2015).

The medical internship was launched in 1950 by the SA Medical and Dental Council, which governs the registration of medical practitioners. These duties have since been transferred to the Health Professions Council of South Africa (HPCSA) who in 2005 identified

shortcomings among medical practitioners (Cameron et al., 2002). In response to these deficiencies, the internship was extended to a two-year curriculum (Bola et al., 2015).
Bola et al. (2015) explored the state of medical internships in South Africa; this study raised various concerns around the supervision that medical interns received during their internship. It highlighted the importance of ensuring that medical students are competent when leaving medical school as it cannot be assumed that they will receive the necessary supervision and training during their internship. This urgency is compounded when considering acute care clinical skills due to the nature of the injuries as well as the associated time pressures.

As patient demographics change both in South Africa and globally, health care systems have had to adapt their service delivery models. With the ever-increasing growth in population and life expectancy, there has been an increased need for acute care services to respond to the needs of these populations (Hirshon et al., 2013).

Acute care has an important role to play in the prevention of death and disability as primary health care is often not ideally positioned, and is frequently unable, to respond to these needs (Hirshon et al., 2013). Acute care serves as the gateway for patients to access the health care system when requiring urgent interventions.

A practical definition of acute care should include the 'most time-sensitive, individually-oriented diagnostic and curative actions whose primary purpose is to improve health' (Hirshon et al., 2013, p. 3). As a result, Hirshon et al. (2013) propose a definition of acute care which includes the healthcare system components, or delivery platforms, used to treat urgent, often sudden, emergent injuries and illness that may lead to death or disability without urgent intervention (Hirshon et al., 2013). Acute care can include a range of clinical healthcare duties, which includes paramedic services, trauma units, emergency medicine (EM), surgery, and intensive care (Hirshon et al., 2013).

One of the educational modalities employed to address the teaching of clinical skills that includes acute care clinical skills in medical schools the world over, is simulation.

Simulation has gained popularity within healthcare education and clinical skills training is increasingly performed on patient simulators, both locally and abroad. Despite this, there currently is no consensus on which clinical competencies are required to deliver safe patient care and what the role of simulation is in developing these competencies within South Africa. Though higher education institutions are already implementing Simulation-Based Medical Education (SBME) to various degrees, the role that SBME has in developing clinical competencies in a developing world context has not been explored.
In the following sections of this introductory chapter, I describe the problem statement, the research aims and methods, researcher motivation, the potential impact of the study, locating the study within in the broader context, my reflexivity, and the organisation of this thesis.

1.2. Problem Statement

Within acute care, health care professionals often perform invasive clinical procedures, which range from wound management, to sterile procedures such as urinary catheterization and blood cultures, to surgical procedures, to name but a few. Historically, these procedures would have been perfected through repeated practice on patients within the clinical environment, with varying degrees of supervision and feedback (Kneebone, et al., 2004). However, more recently, the assumption that this approach will provide the required level of skill is being increasingly questioned, and there is increasing evidence that many of those who perform these procedures are inadequately trained to do so (Bola et al., 2015; Couper, Hugo, & Mash, 2006; Kneebone et al., 2004).

Acquiring the essential acute care skills is an integral component of being a medical practitioner, however, the traditional apprenticeship model of 'see one, do one, teach one' approach is not feasible due to ethical and practical reasons (Rodriguez-Paz et al., 2009).

Ethically, medical students who are not competent in a particular skill should not perform that skill on a patient. Practically, medical students have less access to patients due to increasing pressure placed on the health care system arising from increasing patient numbers and decreased resources. Additionally, the burden of disease in SA, namely

HIV/AIDS, tuberculous (TB) etc., means that patients present with presentations which are often beyond the scope of undergraduate medical students.

Clinical competence includes proficiency in various skills which span across domains such as, diagnostic tests, communication skills, patient management, professionalism, and system-based practise (which requires the practitioner to have a good understanding of the healthcare system).

SBME is a well-established pedagogy within health professions education and has been widely implemented as an alternative to the traditional approach to teaching healthcare professionals (McGaghie et al., 2010b). Simulation offers a learner-centred approach to skills development that is safe to both the patient and the learner. It affords medical students a 'safety net' in which learning can be contextualised and optimised. This safe environment affords students with opportunities for repeated, deliberate practice at their own pace, in a way which would not be practically and ethically possible on clinical patients within the acute care setting.

However, over-reliance on simulation can be problematic and surface-level similarities to cockpit simulation in the airline industry make it easy to uncritically accept the idea that simulation can reproduce all aspects of clinical skills. An example would be a case where a student would simply repeat a sequence of steps during a teaching session without applying themselves to the complexity and mental thought processes required to competently perform that skill.

Although SBME is gaining popularity within South Africa and Africa, there is a potential risk that within a resource-limited environment such as the South African healthcare system, the implementation of acute care skills simulation-based training into the curriculum may be seen as competing with more traditional educational modes. Additionally, when positioning a medical simulation curriculum within the context of South African healthcare system, a system that is severely under resourced and plagued with legacies of Apartheid social divisions, it becomes apparent that an exploration is crucial.

Chapter 2: Literature Review

2.1. Introduction

The purpose of this literature review is to provide the reader with a holistic view of the broader existing ‘body of knowledge’ as well as to outline more specific details which are important to the study area. As a result, it requires the researcher to critically engage with what is known about the topic being investigated. It is simply not sufficient to summarise and describe what is known about the field but the researcher needs to collate similar concepts, compare and contrast these concepts, organise ideas into common themes, and ultimately identify where gaps and inadequacies still exist (Bell, 2005).

As the phenomenon of this study was ‘Simulation’, and the context for the study of the phenomenon was South African-based, the search strategy I employed centred around the role of medical simulation within clinical skills situated in South Africa.
The diagram below provides a graphical representation of the structure of this literature review as well as the gap in the literature which this study attempts to address.

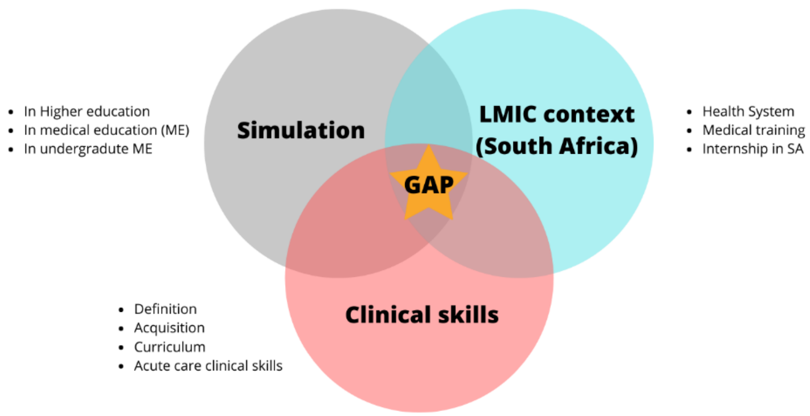


Figure 1: Diagrammatic illustration of the gap in the literature

For the purpose of this study, a narrative review was conducted. Narrative reviews have a long scholarly history within academic disciplines such as humanities, behavioural studies and health sciences education (McGaghie, 2015). Narrative reviews have been criticised within the literature for the lack of transparency in the search process and the quality assurance practises when searching (McGaghie, 2015).

Despite these flaws, narrative reviews have and continue to make significant integrative scholarly contributions in medical and health professions education (McGaghie, 2015). The narrative review compliments this study as it is aligned with the decision to adopt an interpretivist paradigm, as the researcher's influence is considered an integral part of the research process. To minimise the risk of the identified flaws of narrative reviews, I have provided a detailed and clear description of my search strategy.

When conducting narrative reviews, individual authors or scholarly teams delineate a research area based on their judgement and expert opinion and aggregate the evidence using 3 steps, namely:

1) defining the boundaries and contents of the review;
2) qualitatively assembling, analysing, interpreting, evaluating, and synthesising evidence to create plausible arguments about what the evidence means; and
3) compiling a report that integrates evidence and conveys a convincing argument to peers (Imel, 2011).

For this literature review and in a bid to be as transparent as possible, I used the following search strategy: I searched the electronic databases Academic Search Premier, Africa-Wide Information, CINAHL, MEDLINE and PsycARTICLES via EBSCOHost. PubMed, Scopus and Google Scholar were also searched.

The literature search was an iterative process using consistent search terms through the life cycle of this project. The final search being conducted in March 2021 using the following search terms:

a. Simulation training OR patient simulation OR simulation-based training OR simulation-based learning OR simulation-based education.
b. Clinical competence OR clinical competencies OR clinical skills.
c. Medical students OR medical education OR clinical education OR medical training OR clinical training OR undergraduate.
d. Emergency medicine OR acute care.

e. Curriculum OR curricula.
f. Studies limited to the last 10 years

Conducting this search produced 1019 studies. As this research project was concerned with the role of medical simulation within South Africa, the decision was made to limit this search to studies conducted within lower and middle-income countries (LMIC) environments. When this search was repeated with the filters for lower and middle-income countries (LMIC)(The World Bank, n.d.), 22 studies were produced. These results again highlight the paucity of research being done on this important topic within lower and middle-income countries. Of the 22 studies, 7 were included in this literature review based on the relevance to this topic. The table below presents the 22 studies, the study location and the reason for inclusion/exclusion from this literature review, the included studies are shaded in grey. In general, studies were excluded because they were conducted within a HIC as opposed to a LMIC .

For the purpose of this study, I have included a superscript which corresponds with the 'study no' below, when I make refence to the these studies in this chapter.

Study no:	Study Title	First Author	Study Location	Participants Demographics	Included in Literature review	Reason for exclusion
1	Student and educator experiences of maternal-child simulation-based learning: a systematic review of qualitative evidence protocol	MacKinnon K,	Canada	Medical students and educators	No	Study Location
2	A Novel Simulation to Assess Residents' Utilization of a Medical Interpreter	Zdradzinski MJ	USA	Residents	No	Study location
3	Developing and implementing a global emergency medicine course: Lessons learned from Rwanda	Yi S, Umuhire OF	Rwanda	Medical doctors	Yes	N/A
4	Simulation-enhanced nurse mentoring to improve preeclampsia and eclampsia care: an education intervention study in Bihar, India	Raney JH	India	Nurses	Yes	N/A
5	Promoting anaesthetisia providers' non-technical skills through the Vital Anaesthesia Simulation Training (VAST) course in a low-resource setting	Mossenson AI	Rwanda	Anaesthetists	Yes	N/A
6	The development and implementation of a 12-month simulation-based learning curriculum for pediatric emergency medicine fellows	Jeffers JM	USA	EM Fellows	No	Study location/ Participants not at undergraduate level

	utilizing debriefing with good judgment and rapid cycle deliberate practice					
7	Clinical performance and patient outcome after simulation-based training in prevention and management of postpartum haemorrhage: an educational intervention study in a low-resource setting	Nelissen E	Tanzania	Healthcare workers	Yes	N/A
8	Measuring movement towards improved emergency obstetric care in rural Kenya with implementation of the PRONTO simulation and team training program	Dettinger JC	Kenya		Yes	N/A
9	Unexpected medical undergraduate simulation training (UMUST): can unexpected medical simulation scenarios help prepare medical students for the transition to foundation year doctor?	Watmough S	UK	Medical students	No	Study location
10	Simulation in medical education	So HY	Hong Kong		No	Study location
11	Development and assessment of a pediatric emergency medicine simulation and skills rotation: meeting the demands of a large pediatric clerkship	Fielder EK	USA	Medical students	No	Study location
12	A multidisciplinary international collaborative implementing low cost, high fidelity 3D printed airway models to enhance Ethiopian anesthesia resident emergency cricothyroidotomy skills	Gauger VT	Ethiopia	Registrars	Yes	N/A
13	A short trauma course for physicians in a resource-limited setting: Is low-cost simulation effective?	Pringle K	Nicaragua	Registrars	Yes	N/A
14	Educational Perspectives: Toward More Effective Neonatal Resuscitation: Assessing and Improving Clinical Skills	O'Currain E	Ireland		No	Study Location
15	A Simple Low-Cost Method to Integrate Telehealth Interprofessional Team Members During In Situ Simulation	Bond WF	USA	Medical specialist	No	Study Location
16	Development of a neonatal curriculum for medical students in Zimbabwe - a cross sectional survey	Chimhuya S	Zimbabwe	Medical doctors	Yes	N/A
17	Effectiveness of high fidelity simulation versus low fidelity simulation on practical/clinical skill development in pre-	Roberts F	Scotland	Physiotherapy students	No	Study Location

	registration physiotherapy students: a systematic review					
18	Primary care emergency team training in situ means learning in real context	Helen Brandstorp	Norway	Healthcare workers	No	N/A
19	A Mastery Learning Module on Sterile Technique to Prepare Graduating Medical Students for Internship	Allison Blumenfeld	Norway	Medical Students	No	Study Location
20	Rapid Cycle Deliberate Practice Simulation Curriculum Improves Pediatric Trauma Performance: A Prospective Cohort Study	Diana Hou Yan	Norway	Medical specialist	No	N/A
21	Start-up of a simulation center in an acute care hospital	Beth Quaas	N/A	N/A	No	Study Location
22	NightShift simulation to train newly qualified doctors in non-technical skills: a feasibility study	Michael Brown	UK	Medical doctors	No	N/A

As highlighted in the search above, literature within LMIC are limited, therefore in a bid to strengthen this search, additional search strategies were implemented to improve the veracity of this literature review, these included 'Snowballing' (Greenhalgh & Peacock, 2005), which involves scanning the reference lists of all full-text papers and using judgments to decide whether to pursue these further. The 'Snowballing' approach was particularly beneficial to the study as it unearthed many of the seminal authors within the field. Referrals of relevant journal articles from various stakeholders such as the thesis supervisors, colleagues and other scholars in the field were also explored. Seminal studies and studies which were of particular relevance to this study, which fell outside of the search criteria listed above, were included in the literature review to strengthen the search. These seminal studies relate to the medical simulation field as a whole.
All the literature is briefly referenced in-text, and comprehensive information is provided in the reference list.

2.2. Simulation

2.2.1. Simulation in higher education

Industries such as the travel, aviation and the military have all utilised simulation, and over time simulation has filtered into health professions education (Anderson & Morrison, 1993; Chung, 2000; De Witt et al., 2010; Kizakevich et al., 2003). The modalities most often utilised within education include desktop computer-based simulation, part-task trainers, and full-body immersive simulators (Kahn, et al., 2011).

The application of simulation has increased in higher education institutions over the last decade, particularly within the traditional fields such as engineering, technology, engineering, mathematics education as well as in teaching education and management studies. Simulation is often used to facilitate a deeper understanding of concepts and relationships between them, advance inquiry, problem-solving, and decision making (Chernikova et al., 2020; Rosen, 2008).

Simulation allows learners to practise authentic real-world problems related to their professional fields, as the opportunity to engage with these problems in the workplace is often sporadic or not feasible during their training. Additionally, practice in the workplace without adequate systematic guidance can be overtaxing for students and come with risks and potential ethical concerns (Binstadt et al., 2007; Chernikova et al., 2020). This problem can be compounded by time constraints, as real-life situations often fail to provide sufficient practice opportunities as "critical situations appear less frequently or require a lot of time before decisions lead to observable consequences" (Chernikova et al., 2020, p 500).

These challenges all contribute to making practice within the workplace inaccessible and often suboptimal for learning, particularly within the novice learner cohort.

Simulation, which seeks to replicate aspects of the workplace, recreates an approximation of practice, in which complexity can be reduced or increased as required. This ability to modify complexity allows a skilled facilitator the opportunity to design simulations that challenge learners within the students' Zone of Proximal Development (ZPD) – see Theoretical framework chapter. These approximations can help engage learners in specific aspects of professional practice by reducing confusion and can contribute to efficiently using resources for learning (Chernikova et al., 2020; Cook, 2014; Grossman et al., 2009).

2.2.2. Healthcare Simulation

One of the earliest documented applications of simulators was in the 1700s when Angelique Marguerite Le Boursier (1715-1794) used birthing simulators to reduce infant and maternal mortality in France (Moran, 2010). More recently, there was the development of computer-controlled simulation mannikins such as the 'Harvey' cardiac mannikin in the 1960s for the training of cardiology procedural skills (Cooper & Taqueti, 2008; Massoth et al., 2019). SBME has spread to diverse medical disciplines and continues to expand rapidly (Bradley, 2006;

McGaghie, Issenberg, Petrusa, & Scalese, 2010a; Perkins, 2007; World Health Organization, 2013).

There are many advantages which healthcare simulation affords healthcare training institutions, including decreased risk to patients and learners, customizable clinical scenarios not dependant on patient availability but student need, near-immediate feedback, repeatable reproducible opportunities to practice, practical hands-on experience for invasive procedures, the ability to allow errors to continue to their natural conclusion (good or bad), safe exposure to authentic medical equipment and, undesirable interference is reduced (Issenberg, et al., 2005). Despite the growing popularity across the world, the implementation of SBME within the South African healthcare education environment has been slow (Labuschagne, et al., 2014), with much of the simulation based training being limited to isolated part task training (Matlala, 2021). This being said, certain disciplines such as emergency medicine and anaesthesiology have an established presence of implementing simulation both locally and abroad. A survey which reviewed the state of medical simulation amongst the South African Society of Anaesthesiologists (SASA) members found that the majority of its members used simulation in their teaching utilising various technologies (Swart, Duys, & Hauser, 2019).

As a starting point, it is important to define healthcare simulation; while many definitions have been presented over the years, the one that resonates with me is one presented by Gilles Chiniara et al. "Healthcare simulation is an instructional medium used for education, assessment, and research, which includes several modalities that have in common the reproduction of certain characteristics of clinical reality" (Chiniara et al., 2013. p 1381). This definition attempts to adequately depict the scope of healthcare simulation and the fact that it is not a monolithic concept. The degrees to which characteristics are reproduced may vary from situation to situation, however, one of the fundamental precepts is that participants are allowed to influence the trajectory of the educational experience through verbal or physical interaction with the simulator (Chiniara, Cole, Brisbin, Huffman, Cragg, Chiniara, et al., 2013).

One of the important distinctions to be familiar with when engaging with healthcare simulation is to clearly differentiate the tools used for learning from the actual educational modalities, and importantly, a third dimension, namely simulation as pedagogy.

In simulation training and education, more than any other field in the general healthcare education environment, this has been a continued problem (Chiniara, Cole, Brisbin, Huffman, Cragg, Chiniara, et al., 2013). The simulator is often considered an educational method, even though that same simulator can be used to facilitate a range of very different educational encounters (Chiniara, Cole, Brisbin, Huffman, Cragg, Chiniara, et al., 2013). This is of particular importance for this study as one of the key findings of this study was the reconceptualization of simulation as pedagogy as opposed to simply a technology within the South African environment.

As mentioned earlier, there are many different modalities within simulation such as computer-based virtual reality, simulation computer-enhanced manikins, part-task trainers, simulated patients and procedural skills simulation (Kahn et al., 2011). Broadly, these modalities can be divided into four subgroups namely, computer-based simulation, simulated patients, simulated clinical immersion, and procedural simulation, with hybrid or blended simulation arguably forming a fifth subgroup (Chiniara, Cole, Brisbin, Huffman, Cragg, Chiniara, et al., 2013).

i. A computer-based simulation which in essence is a modality that affords the student to interact with the simulated experience using a computer screen.
ii. Simulated Patients (SPs) is another simulation modality that attempts to replicate clinical encounters with real patients. SPs has been utilised within medical education for decades (Barrows, 1993). SPs is often used to replicate encounters such as history taking, physical examination, and clinical reasoning, and can involve either real patients or a trained actor playing the role of an actual patient. However, as opposed to simulated clinical immersion (described below), the environment largely does not affect the way the educational experience unfolds or the occurrence of specific events. SPs can also be utilised in nonclinical settings such as classrooms (Chiniara et al., 2013).
iii. In simulated clinical immersion, students are exposed to an environment that attempts to reproduce (to varying degrees) the clinical environment. Simulated clinical immersion is similar to SPs in many regards however the attempts to recreate the environment is greater than in SPs. The environment can be real (using the actual clinical setting) or simulated

(Chiniara, Cole, Brisbin, Huffman, Cragg, Chiniara, et al., 2013). It is important to know that the concept of environment is diverse as it includes not only the physical setting but also the equipment, team members, and non-tangible aspects such as culture (Dieckmann et al., 2009).

iv. Procedural simulation focuses on acquiring and improving procedures and technical skills. It allows the learner to replicate specific behaviours and movements inherent in the real-life counterpart. It also allows the learner to train in the specific sequence of actions (procedures), that are required to appropriately perform a specific technical skill (Chiniara, Cole, Brisbin, Huffman, Cragg, Chiniara, et al., 2013).

v. Hybrid simulation is an experience that combines two or more simulation modalities.

More recently another subgroup has emerged within the literature, namely simulation-based clinical systems testing (SbCST); here the purpose of the simulator is used to assess and adapt the clinical environment to deliver safer care (Colman et al., 2019). This form of simulation allows healthcare leaders the ability to evaluate and design for the complex interactions between people and the built environment, as literature suggests that the built environment impacts patient safety (Colman et al., 2019). The built environment can consist of elements such as the indoor atmosphere, interior design, and the overall layout of the space. Failure to adequately consider these design decisions can inadvertently introduce latent safety threats and system inefficiencies (Colman et al., 2019).
Furthermore, Victoria Brazil (Brazil, 2017), proposes using the function of simulation as its descriptor as opposed to the traditional descriptors such as procedural simulation, high fidelity manikin etc. She goes on to propose the term translational simulation as an appropriate term for describing the subset of simulation activities that are directly focused on improving healthcare processes and outcomes.

2.2.3. High Fidelity vs Low Fidelity

Technologies within medical simulations have continuously improved since the humble beginnings of 'ResusciAnne'(Hunt, Shilkofski, Stavroudis, & Nelson, 2007; Perkins, 2007). As a result of this continuous development of hardware and software, current simulators can provide a realistic experience and contain features such as feedback mechanisms, communication mechanisms, automated physiological responses, and the ability to interact with the manikin. In high fidelity simulations, students are presented with complex immersive environments which require two-way interaction between the student and the manikin. Alternatively, part-task trainers, which is considered low fidelity provide limited functionality that meet only selected requirements for practising procedural skills (Massoth et al., 2019). The term 'fidelity' is generally used to refer to the degree of realism of a simulation.

Naturally, one would expect that this increase in technology and 'realism' would have a positive effect on learning outcomes. However, there is currently no evidence in the literature that high fidelity is more advantageous than low fidelity simulation concerning knowledge or skills acquisition (Cheng et al., 2015; Finan et al., 2012). More concerning is that one study found that the use of high-fidelity simulation 'led to equal or even worse performance and growth in knowledge as compared to low-fidelity simulation, while also inducing undesirable effects such as overconfidence' (Massoth et al., 2019, p. 1).

Interestingly, there has been some discussion around fidelity or realism in medical simulation, and more importantly, the different aspects that afford realism. Traditionally, fidelity in simulation would refer to technological advances and physical resemblance of the simulation as opposed to principles of educational effectiveness (Hamstra, et al., 2014). However, studies of simulator fidelity emerging from the aviation industry and military have highlighted that fidelity is multifactorial (Allen, et al., 1991) and that fidelity requirements vary according to the learning context (Hamstra et al., 2014).
From the onset, the term fidelity is problematic as there is little to no consensus on what the term means. There has been some confusion surrounding the classification of manikins as different authors have classified the same manikin as low or high fidelity (Hamstra et al., 2014). Allen et al. (1991) attempt to provide some clarity around the ambiguity of fidelity by concluding that two major dimensions underpin the definition and constructs of fidelity namely, the structural fidelity (how the simulator looks) and functional fidelity (what the simulator does). However, even this distinction is problematic as it fails to take into consideration the unique complexities of the educational environment.

Apart from the definition, there have been many studies that have shown that an increase in structural fidelity does not automatically translate into increases in educational effectiveness (Allen et al., 1991; Finan et al., 2012; Hamstra et al., 2014; Massoth et al., 2019). Concerning competencies such as teamwork and communication, the interaction between the learners is crucially important, this appears to suggest that the simulation environment is more important than the structural fidelity of the simulator (Hamstra et al., 2014; Sharma, et al., 2011). This being said, certain skills, such as surgical procedures, require a higher degree of structural fidelity when dealing with the psychomotor skills aspect of the procedure but other aspects such as clinical decision making may not be adequately addressed by the structural fidelity of the manikin only.

Considering the evidence surrounding fidelity; it may be more beneficial to consider the required fidelity of a simulation event relative to the demands and nature of the clinical skill (functional fidelity), as opposed to the physical resemblance to a human patient only (structural fidelity) (Hamstra et al., 2014). By considering the functional fidelity, and through the effective orientation of the learner to the context and structural fidelity, the educator and learner can transfer fidelity into the simulation scenario. Theoretically, this could be explained when one considers that in a constructivist paradigm of education and knowledge acquisition, the learner actively attempts to make the learning context relevant to their learning objectives (Hamstra et al., 2014); therefore, the relevance of low structural fidelity depends on the goals of the learner. Examples where low fidelity simulations have been used successfully include a study by Matsumoto et al. (2002) who used a coffee cup and drinking straws to successfully train ureteroscopy skills. The effectiveness of this model could be attributed to functional task alignment as opposed to only what the simulator looks like as there is a risk that a fixation on fidelity without due consideration for the educational design, could in fact lead to decreased functional fidelity, whilst maintaining structural fidelity. Rousin et al. (2017) discuss the various challenges faced by simulation centres to deepening learning experiences within the simulation centres, I elaborate on this later in this chapter.

Furthermore, a multi-disciplinary study[12], including Anaesthesiology departments, Otolaryngology departments, and Learning Health Sciences collaborated to develop a low-cost, high-fidelity simulator in Ethiopia. This study found improvements in the knowledge, skills, and confidence of the registrars using a 3D printed laryngotracheal model. Additionally, this study highlighted the benefits of academic partnerships within LMIC environments (Gauger et al., 2018). These findings are particularly important in developing world contexts where resources are in scarce supply.

2.2.4. Cost

Inevitably as structural fidelity and technological complexity increases, the associated costs also increase, and an overreliance on the level of structural fidelity, as opposed to functional fidelity, could negatively affect the educational effectiveness. Some authors have expressed concern that despite the fact that Simulation-Based Medical Education (SBME) has been shown to be effective at reducing the risk to patients, it does come at a significant cost; this cost has been identified as a major criticism of SBME (Zendejas et al., 2011). The ideology that investment within the health sector could be beneficial to the greater society through improving healthcare delivery does exist, however as technology expenditure continues to increase; there is an ethical imperative to evaluate the outcomes of SBME against the resources invested within this sector (Zendejas et al., 2011). This viewpoint is peculiar as the patient safety risk and subsequent potential litigation would surely outweigh the cost associated with implementing healthcare simulation as a patient safety training initiative.

A systematic review conducted on SBME research found that cost reporting is infrequent and often incomplete (Zendejas et al., 2011). A comparative review study which looked at the effectiveness of traditional clinical teaching methods, in this case, the Halstedian 'see one, do one, teach one', and SBME with deliberate practise (DP) was conducted. The findings concluded that SBME with DP was superior to traditional clinical teaching methods in accomplishing specific clinical skill acquisition outcomes across a diverse range of skills and specialities (McGaghie et al., 2014; McGaghie et al., 2011). However, this review is not without critique as the purpose of the review was to perform a head-to-head comparison of the two educational methods (Halstedian 'see one, do one, teach one', and SBME with DP) towards the goal of clinical skill acquisition only. It did not address other aspects of clinical skills such as judgment under pressure, medical decision making, situation awareness, teamwork, or professional behaviour. Also, the studies were relatively small, with the

participant number ranging from 13- 108, and finally, of the 14 studies reviewed, the majority (10 out of 14) were conducted in a postgraduate medical education setting.
Despite these challenges, a study[5] in Rwanda, found an improvement in skills retention and self-reported learning in the workplace after completing a 3-day simulation course, named 'Vital Anaesthesia Simulation Training (VAST)'; this course is designed to teach core clinical challenges and non-technical skills and highlighted the importance of the simulation environment by using low-cost simulators in low resource environments (Mossenson et al., 2020). A study[13] by Pringle et al. (2015), showed that a simulation-based trauma course using low-cost simulators for physicians, resulted in a significant increase in knowledge and skills.
It must be noted that these studies were not conducted within an undergraduate context, which is significant as postgraduate participants generally have more clinical experience and as a result have more experience to draw from when learning competencies.

To this end, there is literature (albeit limited) emerging that demonstrates the successful implementation of SBME within existing education interventions to achieve learning outcomes (McGaghie et al., 2014). The caveat being that SBME is not conducted in isolation from the clinical environment in order to simplify the learning process, as oversimplification can potentially hamper the evolution or development of deep understanding (Kneebone et al., 2004; McGaghie et al., 2014). A prospective educational intervention study[7] in Tanzania observed a 38% reduction in the incidence of postpartum haemorrhage following the introduction of a half-day simulation-based obstetric training activity in a rural referral hospital (Nelissen et al., 2017).
Also, a mixed-method study[4] conducted in Bihar, India explored changes over time in nurses use of evidence-based practices during simulated births at primary health clinics. The interventions improved the usage in the evidenced-based management of preeclampsia and eclampsia cases (Raney et al., 2019).
These studies demonstrate the potential healthcare benefits of successfully integrating simulation into existing healthcare systems, even in environments where resources are constrained such as LMICs.

A systematic review and meta-analysis on “The effectiveness of medical simulation in teaching medical students critical care medicine” (Beal et al., 2017) found 17 studies comparing simulation to other teaching modalities, in terms of knowledge and skills acquisition after a simulated training activity. The study found that when compared to other teaching modalities, simulation was significantly more effective, with an effect size of 0.84 (95% CI = 0.43 to 1.24; $P \leq 0.001$; $Z = 4.02$; $I2 = 89\%$). The size of the effect is large (0.84) according to Cohen (1988) which categorizes effects of less than 0.2 as small, 0.2 to 0.8 as moderate, and greater than 0.8 as large. When interpreting these results one needs to be mindful that the efficacy of implementing simulation as pedagogy is determined by multiple confounding variables or factors other than just the simulators as is highlighted by the criteria for deliberate practise (DP). I provide greater discussion on DP and integration below.

Also, it must be noted that an overwhelming majority (20 out of a total of 22) of the studies included in this study (Beal et al., 2017) were from Europe and North America, again highlighting the scarcity of research in this field within a developing world context. Although this type of research has a place, in recent years experts within healthcare simulation and HPE have advocated for a paradigm shift away from ‘description’ and ‘justification’ studies, towards to more structured programmes of research that seek to explore the when, for whom, how, and why our interventions do or do not work (Cook, 2014; McGaghie et al., 2011). These descriptions and/or justification type study designs often fail to clarify whether effects are attributable to the simulation modality under investigation, its instructional design, or both and therefore do little to advance the science of simulation (Cook, 2014; Issenberg et al., 2011).

Medical simulation is complex and therefore requires in-depth exploration to understand the various factors at play (Dieckmann et al., 2012; McGaghie et al., 2010b). Eva (2010) concerning the advancement of knowledge in the field, states that there is a need for movement “away from research that is intended to prove the effectiveness of our educational endeavours and towards research that aims to understand the complexity inherent in those activities” (p. 708). Within simulation, this implies that there is a need for research that attempts to provide a ‘deeper understanding about the active ingredients in simulation-based learning and research environments that bring about desired learning effects’ (Dieckmann et al., 2012, p. 4).

Despite a growing body of literature supporting the use of simulation-based medical education (SBME) in the acquisition and mastery of clinical skills, there have been no studies that seek to explore the role of an undergraduate medical simulation acute care clinical skills curriculum in developing clinical competence within a resource-constrained environment. From the literature, it becomes evident that there is a need for research which attempts to explore the role of simulation in complex encounters; these encounters can take various forms and within education can occur at an individual, team, or systems level. Also, within LMIC environments, there is a need to critically explore the role of simulation within a LMIC environment, as it evident that many of the current studies were conducted within HIC environments. It is important to note that any reference to LMIC extends beyond simply resource constraints. I discuss LMIC conceptually during the latter parts of this chapter.

2.2.5. Deliberate Practice and Integration

Concerning DP, the criteria for DP (see below) are crucial, and often extremely difficult to satisfy (McGaghie, 2009);

- clearly outlined learning objectives,
- motivated learners,
- appropriate difficulty levels,
- constructive feedback,
- rigorous, reliable measurement,
- consistent monitoring and error correction,
- evaluation and performance that can reach a level of mastery standard (Wayne et al., 2006), and
- ability to progress to the next level.

Literature suggests that to optimise learning, integration of SBME activities with DP into the existing curriculum needs to occur. This implies that a medical simulation curriculum has to be a well-thought-out process as opposed to a haphazard add-on to the existing curriculum devoid of planning and scheduling (Davids, 2012; McGaghie et al., 2014).

As the volume, scope and complexity of simulation programmes have dramatically increased over the years, the need for programmatic integration has increased. Simulation programmes face many challenges including, "balancing the in situ, node-based, and center-based simulation delivery" (Rousin et al. 2017). Herein lies the challenge as integrating simulation activities into a complex system such as healthcare presents many challenges, such as curriculum time shortages, limited resources, and resistance from faculty to new technologies such as simulation.

2.2.5 Simulation in LMIC contexts

Lower and middle-income countries (LMICs) are defined as countries with a (Gross National Income) GNI per capita between $1,036 and $4,045 (The World Bank, n.d.). However, the implications for healthcare and healthcare education in LMICs extend past simply monetary constraints (Puri et al., 2017).

Patients accessing healthcare facilities in LMICs experienced 50% more adverse events compared to high-income countries (HICs) (Jha et al., 2013). This figure is believed to be much higher as there are severe underreporting of adverse events in LMICs (Puri et al., 2017).

Medical simulation has established itself as a validated education modality to improve patient safety within health professions education in HICs (Cook, Hatala, & Brydges, 2011). However, while simulation has been increasingly used to improve the quality of patient care and safety within HICs (Cook et al., 2011), the uptake of simulation within LMICs has been slow (Frehywot et al., 2013). This slow uptake has been attributed to various factors such as cost (Al-Hlq, 2010; E. R. Cohen et al., 2010; Dirzu, 2017; Zendejas et al., 2011), lack of specialised skills needed to effectively utilise simulation as a modality (Chimhuya, Mbuwayesango, Aagaard, & Nathoo, 2018), lack of protected teaching time for educators and learners, and lack of equipment (Swart et al., 2019). However, it must be noted that there is a severe lack of simulation studies within LMICs and as a result, more studies are needed to critically explore the true cost in relation to the potential healthcare benefits of simulation within an LMIC environment.

Despite this slow uptake, there have been examples of successful simulation initiatives within an LMIC context such as the 'Helping Babies Breathe' programme in Tanzania. This

programme sought to improve neonatal resuscitation using low fidelity manikin and showed a statically significant neonatal mortality reduction (Mduma et al., 2015).
The 'Helping Babies Breath' (HBB) project was a simulation-based programme conducted in Tanzania, Pakistan and Kenya. In the Tanzania study, staff were provided with one-day HBB training, in two scenarios, 'routine care' and neonatal resuscitation'. During the study period, no additional HBB training was conducted. The study found that the proportion of staff who were found competent using OSCE examinations increased from 41% to 71% for routine care, and 18% to 74% for neonatal resuscitation several months after initial one day HBB training (Ersdal et al., 2013). However, this improvement did not transfer to clinical care, and more concerning were worse in some cases. These results are an example of an improvement in T1 science, with no improvement in T2 and T3 science. McGaghie et al.(2012) define T1 science as evidence limited to controlled laboratory settings; T2 science as evidence which have transferred from the controlled laboratory settings to clinical practice; and T3 science as evidence of patient and public health improvement as a result of an educational intervention. This study showed that while the HBB training improved long term performance in a simulated environment (T1), it failed to translate those results into clinical practise and public health improvement (T2 and T3). The authors of this study suggested factors such as resource limitations and high staff turnover in LMIC contexts as contributors to the failure of these results to translate to clinical practise. This study highlights the need for a multi-faceted approach for effecting behavioural change within medical education, of which simulation is a component of. A systematic review of behaviour change interventions and policies influencing primary healthcare professionals' practice found that 'interactive and multifaceted continuous medical education, training with audit and feedback, enablement through advanced information technology-based systems, and collaborative team-based interventions can effectively modify healthcare professionals' practice and patient outcomes' (Chauhan et al., 2017).
The above illustration of the complexity entailed in skill acquisition and transfer between a simulated and authentic setting' supports the ideas expressed by Chiniara et al.(2013). Arlington et al's study (2017) of 3 staffs' experiences of the HBB programme in Tanzania supports the value of a multifaceted approach. They found that when the frequency of training and local mentoring was increased, a decrease in mortality was observed. The staff

participating in this study considered 'the supportive supervision visits and the follow-up visits critical for skill retention' (Arlington et al., 2017, p6).

The studies, based in Tanzania, support the case for continuous professional development in the form of mentoring to strengthen the transfer of knowledge and skill from simulation to practice.

The Simnovate Global Health Domain Group (Puri et al., 2017) was a project which sought to evaluate the use of simulation in LMICs and provide a framework to improve simulation use in LMICs. This project conducted a scoping review on the use of simulation in LMICs and found that the usage of simulation in LMICs was limited and sporadic. An overwhelming majority of the studies conducted in LMICs evaluated baseline adherence to guidelines rather than focusing on improving medical knowledge through educational intervention (Puri et al., 2017). Interestingly, 80% of the studies included in the review were from middle-income countries, as a result, lower-income countries are severely underrepresented in this study.

While this literature has illuminated the strides made within the medical simulation field, it also highlights the challenges faced, particularly within LMIC contexts, for example, staff shortages, high staff turnover, resource constraints, lack of specialised skills and strategies for promoting transfer of knowledge and skills from simulation to clinical practice contexts. These challenges underscore the necessity of exploring the various modalities of simulation and time allocated for those modalities that may be feasible, as well as effective, given the variety of constraints that may operate in various settings. An implication is that context is likely to be a key variable in influencing what is feasible and effective.

2.3. Faculty Development

Medical education has undergone various pedological adaptations over the decades, and naturally, educators need to acquire new knowledge, skills, and abilities in response to these demands (Chimhuya et al., 2018; Leslie, Baker, Egan-Lee, Esdaile, & Reeves, 2013; Roussin & Weinstock, 2017).

Faculty development has been identified as a crucial component of any system to assist faculty members in preparing for the challenges and everchanging responsibilities (Cheng, Grant, et al., 2015). From the literature, faculty development can be defined as a 'range of activities that institutions use to renew or assist faculty in their roles and can include workshops, seminar series, courses, fellowships, and individualized feedback' (Cheng, Grant, et al., 2015; Leslie et al., 2013, p.7).

Faculty development programs have been found to improve the practice of education, enhance individual competencies, and positively influence cultural change within organizations (Cheng, Grant, et al., 2015; Irby, O'Sullivan, & Steinert, 2015). This is important as one of the seminal papers by Issenberg (2006), identified three components for the effective use of simulation, namely: training resources, trained educators, and curricular institutionalization.

An effective faculty development programme empowers faculty members with the necessary skills to perform their roles effectively (Monekosso, 2014). Within medical education, one of the challenges faced by medical schools is that many of the faculty members despite having a healthcare qualification have limited professional educational training (Matsika et al., 2018). This challenge is exacerbated by the rapid evolution in educational methodologies which requires faculty members to continually upskill themselves to remain current.

Within an LMIC environment, 'emigration of faculty, infrequent curriculum review, inadequate training in medical education, poor investments in infrastructure and lack of faculty development programs' have been identified as major challenges (Matsika et al., 2018, p183).

Within simulation, the impact of faculty development is even more pronounced as it requires the faculty member to have an understanding of simulation technologies, educational theory and simulation pedagogy. This presents various challenges as many of the faculty members may not have been exposed to simulation during their undergraduate training. Quality faculty development has been identified as key for the sustainability of simulation worldwide (Irby et al., 2015; Peterson, Watts, Epps, & White, 2017).

Various professional boards and licensing bodies have identified the need for faculty development to maintain the quality and consistency of simulation activities (Decker et al., 2015; Peterson et al., 2017). A study by the National Council of State Boards of Nursing strongly supports the use of a structured framework for developing simulation faculty and notes the importance of consistency across programs that use simulation as a teaching tool

(Jeffries, Dreifuerst, Kardong-Edgren, & Hayden, 2015). The Society for Simulation in Healthcare accreditation standards for teaching and education also include criteria related to ongoing faculty development and evaluation (Peterson et al., 2017).

This literature illustrates the importance and complexity of faculty development, and the effect it has on the successful implementation of educational programmes, including simulation programmes. Also, these complexities are amplified in LMIC environments given the challenges and threats discussed above.

2.4. Clinical Skills

Within medical education, clinical skills occupy a relatively large proportion within health professions curricula (Michels et al., 2016). While much has been written in the form of textbooks and journal articles concerning clinical skills, there remains some uncertainty around the definition of clinical skills, namely to what is, and what is not a clinical skill.
A clinical skill can be composed of one or several different domains such as examination skills, practical procedural skills, communication skills, and patient and system management skills. The acquisition of clinical skills entails three components:

1) the acquisition of the physical psychomotor component i.e. the act of doing certain movements (procedural knowledge),

2) an understanding of why a skill should be performed (underlying basic science knowledge), and

3) the interpretation of findings (clinical reasoning) (Michels et al., 2016).

2.5. Clinical Skills Acquisition

One of the prominent models for skill acquisition was developed by Dreyfus and Dreyfus (2004). The model presents individual skill progression across 5 stages, namely: novice, advanced beginner, competent, proficient, and expert. According to this model, the novice learner follows a set of stringent rules which are not contextually grounded and they have limited responsibility for anything other than applying these stringent rules.
As the novice learner gains experience and an understanding of the context, they progress to the second stage, namely, advanced beginner. Competence develops after having extensive contextual experience. Proficiency develops in individuals who use intuition in

decision making and develop and apply their own rules to formulate plans. Finally, an expert is characterised by displaying a fluid performance that occurs unconsciously, automatically, and does not depend on explicit knowledge (Benner, 2004; Dreyfus, 2004; Peña, 2010).

This model depicts the progression through the various stages as a gradual transition from a position of adhering to stringent rules to a more intuitive position that relies more on implicit knowledge. However, even at this level, the expert recognises analytical approaches when intuition fails (Dreyfus, 2004).

This model is not without its critics, as Peña (2010) concluded that it is debatable whether the Dreyfus model can fully explain the acquisition of clinical skills as clinical skills is a complex interplay between implicit and explicit knowledge that cannot simply be attributed to expert intuition.

2.6. Medical Internship in South Africa

The South African (SA) medical internship is designed to close the gap between the knowledge and skills acquired during their undergraduate studies and the clinical skills required to safely perform as an independent practice medical practitioner (Bola et al., 2015).

The internship was introduced in 1950 by the SA Medical and Dental Council, which was tasked with overseeing the registration and governance of medical practitioners. Subsequently, these duties were assumed by the Health Professions Council of South Africa (HPCSA). The 1-year internship was extended to 2 years after a deficiency in the competence among medical practitioners was identified (Bola et al., 2015; Cameron et al., 2002).

A study by Bola et al. (2015) explored the condition of medical internships within South Africa. This study raised various concerns around the supervision that medical interns received during their internship; 33.0% of the medical interns who performed an interventional procedure for the first time did so without any supervision and 25.6% experienced an adverse event where senior help was not available. More than 50% of the interns completed an entire shift supervised by an inexperienced medical officer with less than 3 years' clinical training in that specialty. This could have serious safety implications for both the patient and doctor (Bola et al., 2015). This study highlights the importance of ensuring that medical students are competent when leaving medical school as it cannot be assumed that they will receive the necessary supervision and training during their internship. This urgency is compounded when considering acute care clinical skills due to the nature of the injuries as well as the associated time pressures.

2.7. Acute Care

Globally populations continue to increase, this has led to an increased demand for acute care services (Hirshon et al., 2013; Yi, Umuhire, Uwamahoro, Guptill, & Cattermole, 2017). This has resulted in the need for integration between emergency services and primary care and public health measures to adequately respond. Acute care plays a crucial role in the prevention of death and disability, as primary care is often not ideally positioned, or frankly often unable, to assume this role (Hirshon et al., 2013). Additionally, acute care serves as a gateway to health care services for individuals with require urgent interventions.

Historically, standard medical definitions for acuity have emphasised time pressure as the only consideration (Hirshon et al., 2013). However, this definition is somewhat flawed as acute services are more complex and includes all promotive, preventive, curative, rehabilitative or palliative actions, at an individuals or/and populations level. The goal of these interventions is to improve health and the efficiency of these interventions rely heavily on time, frequency, and rapid interventions (Hirshon et al., 2013).

Considering this, an operational definition of acute care should include the most time-sensitive, individually-oriented diagnostic and curative actions whose primary purpose is to improve health. Hirshon et al. (2013, P. 4) propose a definition of 'acute care that includes the health system components, or care delivery platforms, used to treat sudden, often unexpected, urgent or emergent episodes of injury and illness that can lead to death or disability without rapid intervention'.

Acute care as a sub-specialty includes a range of clinical functions including EM, acute care surgery, intensive care, pre-hospital care and inpatient stabilization and responds to life-threatening medical emergencies irrespective of the cause (Hirshon et al., 2013).

Acute care seeks to complete a health system paradigm through the integration with preventative and primary care.

While acute care as a sub-speciality has been increasing globally, it is important to acknowledge the importance and significance of context and culture within medicine. A study done in Rwanda sought to develop and implement a global emergency medicine course and concluded that ‘clinical and cultural insights...can only be shared through global EM experiences that are properly contextualized and facilitated by local EM practitioners’ (Yi et al., 2017, pg. 208)

Cultural and contextual appropriateness is universally important, and within an LMIC this importance is heightened as the tolerances for resource wastage are extremely unforgiving. During the following paragraphs, I discuss curriculum as a concept and how it is applied to this research.

2.8. Curriculum

Defining curriculum is a challenging exercise; primarily because in its most holistic form ‘curriculum is the most holistic, inclusive and comprehensive entity and notion in education’ (Sockett, 1976, p. 6) and can be described as ‘everything that is happening in the classroom, department, Faculty or School, or the University as a whole’ (Genn, 2001, p.2).

Marsh (2009) suggests that an appropriate point of departure is by considering that curriculum exist at 3 levels; namely;

- the planned curriculum,
- the enacted curriculum, and
- the experienced curriculum.

The planned curriculum is primarily concerned with establishing the important goals and objectives within the curriculum. The enacted relates to the actual interactions between the educators and the learners and the experienced curriculum which refers to what happens in the learning spaces (Marsh, 2009). I use the word learning spaces as opposed to classroom or lecture hall as curriculum experiences extend beyond the classroom (Marsh, 2009), which is particularly relevant to this study, as the clinical skills environment is integrally linked with the healthcare system and as a result, learning often occurs beyond the traditional teaching spaces. It is important to be cognisant of these distinctions as the educator needs to be mindful of addressing all 3 levels when developing a curriculum.

The curriculum has an important role in developing learning competencies, as well as social attitudes and skills (Goldie, 2006). Also, the curriculum provides a critical contribution to reasoning skills and the acquisition of contextual knowledge (UNESCO, n.d.).

Description of a curriculum usually defines the learning that is expected to take place during a course or programme of study in terms of knowledge, skills and attitudes. It is the conceptual organisation of the teaching, learning and assessment methods that provides an indication of the learning resources required to support the effective delivery of the course, as well as the evaluation of the design and implementation at course and programme levels. This underpins the motivation for the methodology of this study; during the various data collection phases, we seek to systematically gather valuable insights from experts regarding, appropriateness of medical simulation as a pedagogy.

As outlined above, curriculum is more than a syllabus, as a syllabus describes the content of a programme and can be seen as one part of a curriculum; and most curricula operate within organisational and societal constraints (McKimm, 2007).

As the concept of curriculum needs to take account of organisational and societal constraints in which it is immersed, it is important to consider the South African context. South Africa as a country has a long history of colonialism dating back to the 1600s by the Dutch, and more recently by the British in 1795 and 1815 (Ahmed, 2019). In 1948 the Apartheid regime came into power, and these factors have resulted in high levels of poverty and inequality in SA for particular social groups who were systematically discriminated against by their exclusion from quality schooling; and very limited access to most higher education institutions (Amosun, Hartman, Van Rensburg, Duncan, & Badenhorst, 2012; Khine & Hartman, 2021). It is important to provide this context as it gives insights into the reality of a large proportion of the student body.

The impetus to decolonialise medical and other health professional curriculum programmes by focussing on contextually relevant knowledge and skills, as well as widening access to historically excluded social groups, gained momentum after the 1994 national democratic elections. Contextual relevance and inclusive student recruitment were characteristic of most faculties of health sciences endeavours as they embarked on curriculum change or transformation (Hartman et al., 2012).

Despite these changes, faculties were challenged to intensify and expand their transformation in relation to student participation in curricular transformation and governance following the 2015 -2016 #RhodesMustFall and #FeesMustFall student protests. These were nation-wide student protests for affordable higher education and curricular that embodied socio-culturally relevant questions and topics. The implications of what a socio-culturally relevant curriculum would entail for Acute Care Simulation-based clinical training at undergraduate level was therefore a key reason for having diverse health professional participation in a modified Delphi, which was further explored in Focus Group Discussion (FGD) and semi-structured interviews.

This inclusive definition for the curriculum was chosen because it complements the definition of healthcare simulation that has been implemented for this project, which is everything that seeks to 'replicate the clinical environment' (Cheng, Hunt, et al., 2015). Implicit in this definition is the fact that learning can occur anywhere, both inside the classroom and outside as healthcare simulation as a methodology requires the educator to be mindful of more than just the content of the programme. Decisions around the equipment, the environment, the group dynamics, when the content is being introduced, the structure of the debrief, whether further practice opportunities are required and how these impact curricular design, as well as monitoring transfer into clinical practice, to name but a few, need to be addressed. Consequently, the educator needs to be mindful of the knowledge, skills and attitudes that are required to adequately prepare the students to manage the varied and complex situations they could encounter. At a curriculum level, there is limited research available on developing an undergraduate curriculum within an LMIC context. The search strategy outlined earlier in this chapter uncovered a study[16] conducted in Zimbabwe by Chimhuya et al. (2018) who found a significant gap between their existing curriculum and the ideal as envisioned by various stakeholders.

2.9. Competency-based education

Competency-based education has gained traction over the last decade within health professions education. Records show that CBE can track its roots to the Morrill Land-Acts of 1862. The Morrill Land-Acts provided education specifically aimed at the needs of farm and townspeople who could not attend prestigious universities in the United States (Gervais, 2016).

In terms of theoretical foundations, CBE adopts ideas from several modern learning theories such as Tyler, who popularised linking measurable learning objectives to assessment practices; John Carroll who explored how students learn and acquire knowledge; Benjamin Bloom who popularised the 'mastery of learning' concept; and others (Gervais, 2016). From the literature there is a consensus that a CBE model includes the following components:

- 'An emphasis on outcomes, a strong pedagogy, the use of interdisciplinary resources, and assessment of a student attainment of competencies across the curriculum'(Gervais, 2016, p.8), and
- A student only graduates when they can demonstrate the prerequisite knowledge, skills, attitudes, values, and behaviour gained through attainment of the identified competencies (Gervais, 2016).

While many institutions have adopted CBE, some debate around defining CBE still exists (Frank, Snell, et al., 2010). A systematic review conducted by Frank, Mungroo et al. (2010) reviewed the CBE-related literature to identify key terms and constructs to inform the development of a useful working definition of CBE for medical education. They identified four major themes (organising framework, rationale, contrast with time, and implementing CBE) and six sub-themes (outcomes defined, the curriculum of competencies, demonstrable abilities, assessment of competencies, learner-centred and societal needs). Ultimately, they proposed the following definition:

> *Competency-based education (CBE) is an approach to preparing physicians for practice that is fundamentally oriented to graduate outcome abilities and organized around competencies derived from an analysis of societal and patient needs. It de-emphasizes time-based training and promises greater accountability, flexibility, and learner-centeredness (Frank, Snell, et al., 2010, p4).*

While there has been much development regarding the definition and the components of a CBE philosophy; exactly how to go about developing a CBE curriculum can be challenging. There are many ways to navigate the curriculum development process, however, the method proposed by Kern et al. (2009) best resonates with me. The six-step process they propose draws from numerous curriculum development approaches such as Tyler (1949), Taba (1962), Yura and Torres (1986)as well as work from McGaghie (2009), who suggested that curricula should be linked to the health needs of society. This relates to my motivation for conducting this research as it relates to the social relevance and urgency of exploring the role of medical simulation in developing acute care clinical competencies in a developing world context such as South Africa.

Kern et al.'s (2009) steps consist of problem identification and general needs assessment; target needs assessment; goals and objectives; educational strategies; implementation; and evaluation and feedback. During steps, one and two, the health care needs, or other problems are identified and critically analysed. This problem may relate to a specific health problem or a group of problems; these problems could also relate to particular qualities required by healthcare workers or may relate to the healthcare needs of a society in general. A complete problem identification would entail analysing the current approach of patients, practitioners, the medical education system and society, to address the problem and would be followed by identifying an ideal approach of how the relevant stakeholders should be approaching the problem or need. The difference between the ideal approach and the current approach is what constitutes a general needs assessment.

CBE was valuable in the conception of the methodology of this study as it provided a framework in which to collect data as well as which stakeholders to consult. As a result, various stakeholders were consulted when trying to establish the needs and one of the ways Kern et al. (2009) suggest for conducting the needs assessment is by using group judgement methods such as a Delphi study. As there is currently no consensus on what undergraduate acute care clinical competencies are required to deliver safe patient care in the acutely ill patient in South Africa, I deemed it important to identify what these competencies are, and what the role of SBME is in facilitating the acquisition of these competencies. For this study, the experts comprised a diverse spread; during round one of the Delphi study, the experts were comprised of emergency medicine registrars from four medical training institutions that offer emergency medicine as a specialist programme. These expert inputs are strengthened by FGD with curriculum experts that have more than five years' experience in curriculum design and experience with clinical skills within a South African tertiary education environment. The motivation for selecting these experts are outlined in Chapter 4 - Research Methodology. While I acknowledge that the stakeholder engagement could have been more diverse, the omissions such as patients and undergraduate students were primarily due to time and resource constraints; the inclusion of the voice of these important stakeholders is critical in future research.

In conclusion, the literature review sought to provide the reader with a holistic view of the broader existing 'body of knowledge' concerning healthcare simulation, faculty development, and acute care clinical skills, and curriculum within a South African context. In addressing these objectives, simulation has been successfully utilised in various industries, and as a result, has been adopted within many healthcare and healthcare education systems. Simulation allows learners to practise authentic real-world problems related to their professional fields, as the opportunity to engage with these problems in the workplace is often sporadic or not feasible during their training. The South African (SA) medical internship is designed to close the gap between the knowledge and skills acquired during their undergraduate studies and the clinical skills required to safely perform as an independent practice medical practitioner. Despite these intentions, literature has shown that the SA internship is not without its faults, with many interns performing invasive procedures without the necessary supervision (Bola et al., 2015). At a patient level, patients accessing healthcare facilities in LMICs, such as South Africa experienced 50% more adverse events compared to high-income countries (HICs).

As acute care services are often positioned at the entry for patients accessing healthcare systems, and due to the urgency and often invasive nature of acute care skills, simulation is ideally positioned to contribute to acquiring these much-needed competencies by medical students in SA. These competencies can be composed of one or several different domains such as examination skills, practical procedural skills, communication skills, and patient and system management skills.

Simulation, which seeks to replicate aspects of the workplace, recreates an approximation of practice, in which complexity can be reduced or increased on demand as required. This ability to modify complexity allows a skilled facilitator the opportunity to design simulations that challenge learners within the students' Zone of Proximal Development (ZPD). However, while simulation has been increasingly used to improve the quality of patient care and safety within HICs (Cook et al., 2011), the uptake of simulation within LMICs has been slow.

This slow uptake has been attributed to various factors such as cost (Al-Hlq, 2010; E. R. Cohen et al., 2010; Dirzu, 2017; Zendejas et al., 2011), lack of specialised skills needed to effectively utilise simulation as a modality (Chimhuya et al., 2018), lack of protected teaching time for educators and learners, and lack of equipment (Swart et al., 2019). Despite this slow uptake, there have been examples of successful simulation initiatives within an LMIC context.

Though technologies within medical simulations have continuously improved, there is currently no evidence in the literature that high fidelity is more advantageous than low fidelity simulation concerning knowledge or skills acquisition. As technology has continued to increase, so associated costs have increased, even though the true cost is often unreported or incomplete in simulation research.

For simulation to continually grow and become a contextually relevant pedagogy with LMIC, faculty development will need to be prioritised. Faculty development has been identified as a crucial component of any system to assist faculty members in preparing for the challenges and ever-changing responsibilities. Faculty development programs have been found to improve the practice of education, enhance individual competencies, and positively influence cultural change within organizations. Within an LMIC environment, 'emigration of faculty, infrequent curriculum review, inadequate training in medical education, poor investments in infrastructure and lack of faculty development programs' as well as insufficient training resources and a lack of commitment for curricular institutionalisation of simulation pedagogy into the existing curriculum have been identified as major challenges (Matsika et al., 2018, p183).

It is clear that the challenges within the LMIC environment are complex and multi-factorial, this within the context of severely stretched resources makes it imperative to efficiently use these resources. Implementing simulation, whilst proven in various contexts, could place additional pressure on the resources within these contexts, therefore it becomes crucial to explore the role of simulation within LMIC context such as SA. As addressing this monumental task would be beyond the scope of a PhD project, this thesis sought to address a subset of this problem, namely the role of undergraduate medical simulation curriculum in developing acute care clinical skills competencies.

In the following chapter, namely ‘Chapter 3 – Theoretical Framework’, I discuss the theoretical grounding of the study and explore the conceptual links between the various theories that have formed my thought processes around the role of medical simulation in developing acute care clinical competencies.

Chapter 3: Theoretical Framework

3.1. Introduction

In this chapter, I discuss the theoretical grounding of the study and explore the conceptual links between the various theories that have formed my thought processes around the role of medical simulation in developing acute care clinical competencies. At a macro level, the study is epistemologically positioned within constructivism, with aspects of social constructivism being discussed within the context of simulation. Within the social constructivism cluster, I go on to discuss the socio-cultural learning theories of Vygotsky and the theory of situated learning as presented by Lave and Wenger (1978). Medical education as a field is influenced by various theoretical ideologies and disciplines with social psychology, anthropology, economics, cognitive psychology, general education and social sciences being particularly prominent in the field (Kaufman, 2018).
Also, as Jean Piaget was the prominent theorist in the science of cognitive development throughout much of the 20th century (Carey, Zaitchik, & Bascandziev, 2015), I discuss aspects of cognitive development throughout this chapter.

At a micro level, the theories of situated learning including a community of practice (COP) and legitimate peripheral participation (LPP) provide valuable insights for positioning medical simulation as pedagogy as opposed to a technology, and the role it plays in developing competencies within LMIC environments, such as South Africa.

A theoretical framework provides a critical lens through which researchers view their work. Maxwell (2005) states that a theoretical framework ultimately serves two purposes; 1) it provides the reader with an indication of what is already known in the research area (the relationship between existing theories and research topic), and 2) It provides the reader with an indication as to how the research topic contributes to the existing body of knowledge. Additionally, a theoretical framework informs the research questions and methodology, as well as motivate the significance of the research (Maxwell, 2005).

Within the field of Health Professions Education (HPE), theories are often applied from other fields; this borrowing affords researchers the ability to utilise these theories to a problem within a health education context. While this borrowing may provide new insights, and/or expand the original theory, there is a risk of misappropriating the theory if researchers fail to understand the scope, purpose, limitations and paradigmatic stance of the theory (Teunissen, 2010; Vapio, Farnan, & Park, 2017).

Throughout this chapter, I also discuss Piaget's cognitive constructivism and contrast many of its theoretical underpinnings against those of Vygotsky. This was important as cognitive constructivism has been widely applied within the field of medical education and it is important to make explicit the motivation for excluding it from this thesis.

This study aimed to explore the role of an undergraduate acute care clinical skills medical simulation curriculum within South Africa, with particular emphasis placed on the pedagogy of 'medical simulation'.

The diagram below (Figure 2) provides a graphical representation of my theoretical framework and how it informs the way that I view this research topic.

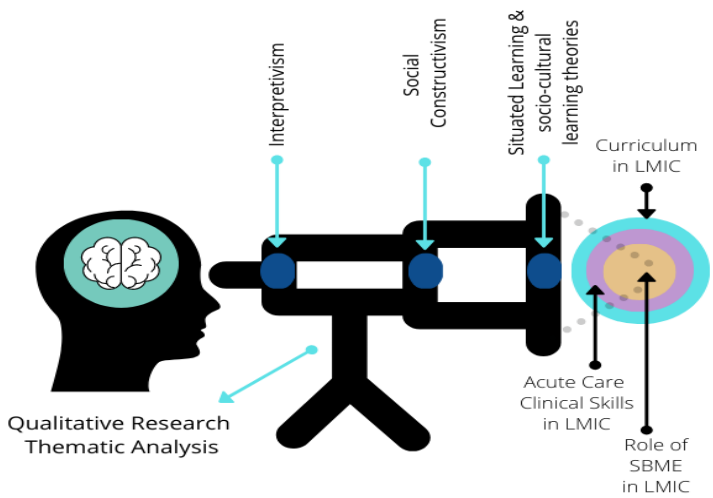


Figure 2: Diagrammatic representation of theory lenses

The diagram uses the image of a viewer and a telescope to illustrate how the various theories influenced the study area. In this diagram, the viewer views the study subject through a series of lenses; these lenses affect how the subject is viewed. Additionally, the position, and orientation of the lenses all affect how the study area is viewed. Finally, the lenses are held in place by the telescope's frame, which in this illustration is the qualitative research paradigm. During the course of this chapter, I provide greater clarity on the specifics of how these theories were utilised in this study.

Ultimately, whatever is viewed through the telescope is observed and interpreted by the viewer. This illustration recognises and demonstrates the importance of the researcher when conducting qualitative research as he or she is an integral part of the research process (Maxwell, 2005a; Miles & Huberman, 1994; Rabiee, 2004; Tavakol & Sandars, 2014a).

In the same way, theories within education seek to provide greater insights into learning, as opposed to truth statements about human behaviour. These theories seek to provide a framework to explain why and how we learn.

The diagram also delineates the boundaries of the study by locating it within Health Sciences Education, exploring the role of SBME within an acute care clinical skills curriculum within LMICs such as South Africa.

Higher education institutions have adopted SBME to various degrees, however, the role that SBME has in developing clinical competencies in a developing world context has not been explored within LMICs such as South Africa. Therefore, this study was conceptualised through interrogating the various ways in which these theories relate to the role of an acute care clinical skills medical simulation curriculum.

Ultimately, the purpose of this chapter is to explore the conceptual linkages between the theories I have selected, to explain the rationale for the research methodology and interpret the findings related to the study aim, namely, the role of medical simulation in developing acute care clinical competence in undergraduate medical students in South Africa.

3.2 Paradigm

A paradigm is a way in which the world is viewed and is influenced by the philosophical assumptions about the nature of social reality, the ways of knowing, and ethics and value systems (Patton, 2002).

This study adopts an interpretivist paradigm; interpretivism seeks to integrate human interest into a study. Greater clarity on the motivation and appropriateness of adopting this paradigm is discussed under the heading: 'Paradigmatic Considerations' in Methodology - Chapter 4.

3.3 Ontology

The ontology (philosophical assumptions about the nature of social reality) of the study is subjectivism. Subjectivism provides the researcher with a means to conceptualise subjectivity (Ratner, 2012). Subjectivism in qualitative research interprets the interactions between the researcher and research participants. This is often done employing interviews. This approach allows the participants freedom to express their ideas, and affords the researcher the freedom to interpret those ideas; this process is guided by the research aim and questions, the literature, and the theoretical framework (Ratner, 2012). Subjectivism was important for the methodological design of this study, as I the researcher was an integral part of the conception, evaluation, and formation (write-up) of this study (see Reflexivity)

The epistemology chosen for this study is social constructivism; below I explore social constructivism in greater detail and describe how it relates, influences and bolsters the understanding of this research topic.

3.3.1. Constructivism

Within the constructivism literature, constructivism is referred to as the 'how' of learning and thinking. It provides a framework to conceptualise how learners make sense of learning materials (Amineh & Hanieh, 2015). From the literature, there are 2 major strands within the constructivist perspective, (i) cognitive constructivist perspective and (ii) social-cultural perspective (socio-constructivist perspective) (Amineh & Hanieh, 2015).

Before I explore these perspectives, it is important to understand the concepts of cognitive development and learning. Cognitive development is 'the construction of thought processes, including remembering, problem-solving, and decision-making' (Karpov & Haywood, 1998, pg. 28), whereas learning refers to the change in an individual's behaviour or behaviour potential (or capability) as a result of experience or practice (Amineh & Hanieh, 2015). This distinction is important to understand, as it is fundamental to understanding the similarities and differences between social and cognitive constructivism.

3.3.2 Social Constructivism

Lev Vygotsky's main contribution to constructivism emerged from his theories concerning language and thought, and their mediation by society. Vygotsky proposes that the process of knowing is influenced and mediated by people, culture and community (Amineh & Hanieh, 2015). These mediators "can include people, adults and children, with various degrees of expertise, but can also include artefacts such as books, videos, wall displays, scientific equipment, and a computer environment intended to support intentional learning" (Brown at al., 1993, p. 191). This is pivotal in the theoretical conception of this study as I argue that medical simulation as pedagogy is a powerful mediator in the development of undergraduate acute care clinical skills competencies. Simulation draws upon the idea of 'learning by doing', a foundational concept which is central to social constructivism and situated learning theory, which I discuss later in this chapter.

It is important to note that Vygotsky died at a relatively young age (age 38) and as a result, some of his theories are incomplete and still in the process of being translated from Russian (McLeod, 2018). Despite this, numerous commentaries seek to make meaning of Vygotsky's theories.

Vygotsky was critical of Piaget's contribution to constructivism in that Piaget held the position that development is preceded by learning, while Vygotsky held the opposite position i.e. learning precedes development.

Piaget believed that while knowledge is actively constructed by the student, it is dependent on the existing cognitive structures; this implies that learning is relative to the stage of the student's cognitive development. He believed that children were born with a primitive mental structure upon which all other knowledge is based. He referred to these cognitive models as schemas. Piaget conceptualised intellectual growth as a process of adaptation; this adaptation is achieved through assimilation, accommodation, and equilibration. Assimilation is the process of fitting new knowledge onto existing schemas. During assimilation, when you are faced with new information, you process this information by referring to existing information you already have and try to fit the new information into the existing information you already have.

Accommodation is the cognitive process of revising existing cognitive schemas, perceptions, and understanding so that new information can be incorporated. This happens when the existing schema (knowledge) does not work, and needs to be changed to deal with a new object or situation.

Finally, Piaget believed that all human thought seeks order and is uncomfortable with contradictions and inconsistencies in knowledge structures; that is 'equilibrium' in our cognitive structures. Equilibrium occurs when a child's schemas can deal with most new information through assimilation. However, an unpleasant state of disequilibrium occurs when new information cannot be fitted into existing schemas (assimilation).

So, Piaget proposed that learning does not occur passively, but occurs through a process of active construction of meaning. Piaget explains that when an encounter challenges a learner, they are placed in a position of disequilibrium. The learner is then required to change their thought process to return to a state of equilibrium. This implies that learners make meaning of new information through a process of association with the knowledge that they already possess. If the learner can do this, the student will use a process of accommodation to restructure their existing knowledge to higher-level thinking.

Social constructivism learning is a collaborative process, and knowledge develops from the students' engagements with their society and culture. Also, unlike Piaget, Vygotsky believed that cognitive development varies across cultures, as opposed to being universal across cultures (Vygotsky, 1978). This ideology resonates with me as this project sought to explore the role of medical simulation in an LMIC environment, and while similar research has been conducted, they were conducted predominantly in HIC environments. Vygotsky highlighted the importance of different cultures and societies and the influence they have on cognitive development.

Vygotsky believed that this process is too complex to be broken down into predictable standard steps (such as assimilation, accommodation and equilibration) and believed that the child's mind (which is an interplay between the brain, cognition, social interaction, and speech) is fundamentally social and as a result, speech moves from a position of communicative social to inner egocentric. Vygotsky (1978) states: "Every function in the child's cognitive development appears twice: first, on the social level, and later, on the individual level; first, between people (inter-psychological) and then inside the child (intra-psychological). This applies equally to voluntary attention, to logical memory, and to the formation of concepts. All the higher functions originate as actual relationships between individuals." (p. 57)." This explains why children from different cultures could have different cognitive structures, as the social structures within which they developed could be different. As a result, cognitive development is multifactorial and complex, and I struggle to see how this development can be universal and not dependant on culture as is proposed by Piaget. Vygotsky's theories emphasize the following:

> (1) an underlying assumption that people rationalise their experience by conceptualising a model of the world and the way that it functions and,
> (2) the belief that language is the most essential system by which people construct reality (Flick, Von Kardorff, & Steinke, 2004).

These assumptions raise some important questions around the development of simulation curriculum within LMICs such as South Africa. One of which is:
To what degree the students' experiences (which to a large degree occur outside of the classroom and traditional clinical skills centre) influence how they rationalise their educational experiences?
And, what are the educational implications, if any, for a medical simulation curriculum, which is positioned in the context of a multi-lingual and multi-cultural society such as SA?

South Africa (SA), is a diverse, multi-lingual, and multi-cultural society, and the medical students are representative of this society (Matthews & Van Wyk, 2018). SA has 11 official languages and a diverse range of religions, cultures, and beliefs systems; and as presented by Vygotsky both culture and language are crucial to learning. Therefore, exploring the role of medical simulation within SA is crucially important, as environments differ culturally from location to location and this has the potential to influence how students interact with the curriculum. Literature by McNamee et al. (2019, p.158) found that 'medical interns in South Africa are often confronted with contextual challenges that are unrelated to their medical knowledge, including multilingual environments.' These contextual challenges are compounded by South Africa's racially divided past. The legacy of Apartheid has placed strain on the relationships between medical students and their clinical facilitators on the

clinical platform, particularly when the parties come from different racial and/or socio economic backgrounds (Khine & Hartman, 2021).
Also, within the literature, an overwhelming majority of the simulation literature has been conducted within HIC environments, which potentially has influenced the medical simulation sub-culture. As a result, there lies a risk that this literature does not necessarily represent the situation in SA.

Social constructivism resonates with me as simulation seeks, to varying degrees, to replicate aspects of the clinical environment; a clinical environment that is situated within a social setting. This replication extends past simply the knowledge and skills, but encompasses the cultural, religious, linguistic and belief systems of the student participants and ultimately patient management. The skilled simulation educator should be cognisant of this and develop scenarios that recognise that higher-order functions are as a result of firstly inter-psychological and then intra-psychological development.
Also, the interaction between the learner and facilitator or the learner and more 'knowledgeable' peer resembles Vygotsky's 'Zone of Proximal Development' (see below).
So, considering the assumptions of social constructivism regarding knowledge, reality, and learning, medical simulation is aligned to social constructivism in the following ways:
As knowledge (according to social constructivism) is a human product and is socially and culturally constructed, so medical simulation as pedagogy relies on the interactions between team members or between the learner and facilitator to construct knowledge. For example, a team of undergraduate medical students are presented with a patient presenting with anaphylaxis in the simulation centre, using a full-body high fidelity mannikin. During the management of this simulated patient, the students are interacting with each other, and with the facilitator, and reflecting on their own. The interactions during this encounter are mediated by simulation and rely on speech between the group members, which Vygotsky refers to as communicative social speech to inner speech (where the student internalises the knowledge, and either dismisses it or accepts it as new knowledge. Furthermore, the facilitator in this example acts as Vygotsky's 'knowledgeable other' in that they 'guide' the students through this complex situation. The instructor in this example is tasked with designing a simulation scenario (see scaffolding below) which is positioned at the edge of the students learning curve, this implies that the student can

engage with the activity but requires assistance from an MKO to move towards a higher cognitive level. Furthermore, simulation within the context of a diverse society, such as SA, affords the instructor the opportunity to construct a simulation that allows the learners to interact with each other, challenging cultural, religious, linguistic and belief systems, within a safe environment (limits any harm to patients), while being realistic (replicating aspects of the clinical environment) and addressing the medical learning outcomes.

For example, at a fully body immersive simulation level, when teaching the management of a polytrauma patient, a skilfully developed scenario could challenge cultural belief system on leadership, as the age of the leader is often considered important, and team members might struggle to take instruction from younger team members. At a part task trainer level using the same example as above, the student could be challenged with the scenario of delivering a blood transfusion in a patient that refuses blood transfusion due to religious belief systems.

These are typical examples, which many students may encounter, however these examples may play out very different depending on the cultural, religious, linguistic and belief systems in which they are performed.

Additionally, simulation affords simulation educators an opportunity to design, implement, and debrief clinical interaction between students and healthcare providers which can initiate discussion around sensitive but crucially important topics such as race and equality on the clinical platform. These are issues which are not unique to South Africa, and countries all over the world are currently grappling with complex racial and equality tensions.

3.3.2.1 Zone of Proximal Development

Vygotsky (1978) describes the concept of the Zone of Proximal Development (ZPD) as "the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem-solving under adult guidance or in collaboration with more capable peers" (p. 86). In its simplest form, this zone can be interpreted as the ‘distance’ between what a student can do without assistance from a facilitator and what they can do with the support of a knowledgeable facilitator (McLeod, 2018).

Critical to this learning process is the presence of a more knowledgeable individual, often a parent, a facilitator or often in the case of medical education, often a healthcare professional; however, as has been suggested by many commentaries on Vygotsky's ZPD, in certain instances this 'knowledgeable other' can also be a peer (Glassman, 2001; McLeod, 2018)

The ZPD is illustrated in the diagram (Figure 3) below:

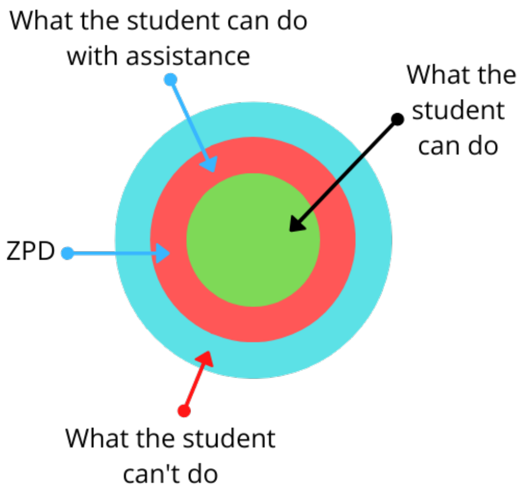


Figure 3. Graphical representation of Vygotsky's ZPD

Whilst Vygotsky and Piaget both recognised that certain problems fall outside the learner's range of understanding; Vygotsky believed that with adequate guidance that learner would be able to accomplish that task whereas Piaget believed that certain problems were simply out of reach due to the learner's mental capabilities at that particular stage (Woolfolk, 2004).

An important concept which emerged from Vygotsky's ZPD is that of 'scaffolding'. While Vygotsky did not specifically refer to scaffolding, this concept was introduced by Wood, Bruner and Ross (1976). They define scaffolding as a process "that enables a child or novice to solve a task or achieve a goal that would be beyond his unassisted efforts" (Wood et al., 1976, p 90). Scaffolding is crucial to the development of a comprehensive simulation curriculum as simulation has many modalities within it and the optimising the sequence of introduction the different modalities supports the learner in building on previous experiences. As a result, the educator can utilise these modalities as required; for example: In learning fluid administration in the anaphylactic patient, the educator might start with a part-task trainer that seeks to teach the practical skill of IV cannulation. Thereafter, the student might progress to a full-body immersive simulation of an anaphylactic patient that requires the student to draw from their knowledge on the part-task trainer but also requires a more comprehensive understanding of not only the relevant pathophysiology but also cognisant of the team dynamics and how they affect patient management.

As mentioned earlier, the ZPD has implications for medical simulation, which seeks to replicate the clinical environment to various degrees. The clinical environment is inherently reliant on social interactions, and during a medical simulation teaching activity, there are interactions between the learner and the ‘knowledgeable other’ often represented by the facilitator but can take the form of another student. These interactions seek to bring the student from a position where they have pre-existing knowledge to a position of acquiring new knowledge through assistance from a ‘More Knowledgeable other’ (MKO). The MKO is primarily concerned with the role of ascertaining the level at which a student can operate independently and then guide the student to complete the task which was outside of their reach without their guidance.

In the ZPD, the student can be facilitated through this zone by using medical simulation as a pedagogy; by using a well-constructed medical simulation, the student will be able to identify the gaps in their knowledge, and be able to see a physical representation of their actions (correct or incorrect); this provides the student with an anchor on which to base abstract concepts such as drug interactions, team dynamics and leadership skills, and clinical decision making, again allowing the facilitator to scaffold within the ZPD. The student is then able to internalise and process what is happening through the simulation and make sense of what has happened during the debriefing of the simulation. The movement from inter-psychological to intra-psychological and internalisation is enabled when the facilitator understands what is required for learning to occur (Fanning & Gaba, 2007); that, in turn, implies knowledge of educational theory, and the ability to apply this when conducting debriefing.

Vygotsky’s conception of the intra-psychological processes is that socio-cultural influences are at play, even when the MKO is absent. The cognitive activities are affected by value and beliefs systems, and tools of intellectual adaptation (McLeod, 2018; Valsiner & van der Veer, n.d.).

In a series of experiments on children that studied how they explore 'tool and symbol in child development', Vygotsky and Luria concluded that a complex combination of symbolic and practical activity is crucial to what they term higher psychological functions (Valsiner & van der Veer, n.d.). I argue that the development of clinical skills can be considered a higher psychological function due to the complex nature of clinical skills.

Clinical skills are complex, as it involves knowledge, skills and attitudes, which inherently relies on the interplay between cultural norms and values. As an example, making eye contact is an important component of establishing rapport during clinical skills within many western societies, however within many African cultures, making direct eye contact could be seen as disrespectful, particularly when interacting with an older individual (Ntuli, 2012). Additionally, Vygotsky refers to high psychological functions as cognitive processes which expand beyond the fundamental functions such as self-control. This positions medical simulation as a pedagogy to act as a mediator to facilitate the development of acute care clinical skills competencies.

As alluded to earlier in this chapter, Vygotsky's intra-psychological phase and instructional tool of scaffolding within the ZPD is concerned with fostering an environment where students can identify their gaps in learning, and the facilitator deliberately scaffolds to close those gaps.

As a practical example, during a simulated activity with a 3rd-year medical student, it would be unlikely for that student to be able to manage a life-threatening severe asthma patient at that stage of their undergraduate education. However the student might be able to provide oxygenation and nebulization to such a patient, the MKO can through scaffolding and mediation facilitate the student by, breaking the complex management into manageable tasks appropriate to the level of the student. By doing this, the student can identify gaps within their knowledge, apply the abstract complex concepts practically, and with the help of their peers and/or facilitate address those gaps.

This being said, some counter-arguments against using social constructivism as a theoretical underpinning for research about medical simulation is that it can never fully replicate the clinical environment completely and that it removes much of the social-cultural complexity inherent to the clinical environment. Though I acknowledge this view, I would argue that

this removal of some of the social-cultural complexity inherent to the clinical environment by simulations should not be viewed as a negative, but rather a positive attribute of the modality that can be used to optimise students' learning. Using the example of the 3rd year medical student again, an example of removing the socio-cultural complexity could take the form of simply providing the scenario without a complex medical history with comorbidities. While this may remove some realism of the scenario, this is done intentionally by the educator in a bid to prevent the students from becoming cognitively overloaded. The educator is then able to re-introduce this complexity as the learner progresses.
Another example using this scenario could be to remove interactions with allied health professionals during the initial training sessions, then as the learner comes to grip with their professional role, complexity is systematically introduced in the form of interprofessional interactions which are inherent to the clinical environment.
Medical simulation when utilised appropriately, allows the facilitator to intentionally remove some of the complexity inherent to the clinical environment to minimise the risk of cognitive overload through scaffolding and simplify the competencies within the simulated environment. As the student masters the skill in the simulated environment, complexity can be reintroduced in a controlled manner (through scaffolding) until a prescribed level of competence is attained. In addition to optimising students' learning experiences, this process also minimises any undue risk to patients by removing the early part of the learning curve from the patient. The student is then able to build on this level of competence and master those competencies within the clinical environment, where complexity is at its highest.
Medical simulation should not be considered as a technology, but rather a pedagogy; And within that methodology, there are various modalities to employ based on the requirements such as part-task trainers, scenario-based training, simulated patients (SPs), etc. Each of these modalities introduces various degrees of socio-cultural learning and introduce varying degrees of complexity inherent to the clinical environment in a safe space that is conducive to learning. So, the key lies in utilising the appropriate mode based on the needs of the students. For example, during the initial exposure to intravenous cannulation, it might be more appropriate to employ a task trainer to teach the general psychomotor skills associated with that skill, but as students become more proficient at the skill, one can introduce more complexity by increasing the fidelity. By using this approach, complexity can

be introduced in a more controlled and repeatable manner; both of these (controlled, and repeatable) are difficult if not impossible to control in the clinical environment when managing critically ill patients.

Vygotsky's theory was relevant to this study as it provided a theoretical grounding for viewing medical simulation as pedagogy as opposed to technology, as medical simulation can reify the often abstract concepts within acute care clinical skills by providing a physical representation with which the student can interact within a safe environment. It also provided a conceptual framework for how medical simulation educators need to be developed if they are to employ medical simulation as a pedagogy rather than a technology. More importantly, Vygotsky's theory was crucial to recognising the importance of culture, language and belief systems when developing simulation curriculum, and as a result the importance of conducting contextually relevant research.

Vygotsky's sociocultural theory was complemented by Lave and Wenger's situated learning theory as it provided greater insight into the significance of situating the learning in an authentic environment. The paragraphs below clarify these conceptual links and how they relate to this research.

3.3.3. Situated learning

Lave and Wenger (Lave & Wenger, 1991) in the 1990s proposed a process that occurred through Legitimate Peripheral Participation (LPP) in Communities of Practice (CoP), which they referred to as Situated Learning theory (O'Brien & Battista, 2020). This theory was in contrast to the individualistic, cognitive and behaviourist views dominating education during that time. In the words of Jean Lave *"The ideas worked out in Situated Learning were intended as both a critique of conventional theories of learning, doing, and social change and as a means of analysing situations of all kinds in which learning was of interest to researchers... It was specifically not intended as a normative or prescriptive model for what to do differently or how to create better classrooms or businesses*" (Lave, 2008, p56).

Lave and Wenger proposed that learning has the following characteristics (Lave, 1991; O'Brien & Battista, 2020):

1) Learning is a social process,

2) Learning is embedded in everyday activities, context, and culture;

3) Learning is often unintentional and,

4) Learning is progressive in terms of the learners' participation.

Ultimately, the fundamentals of situated learning are the concept that learning takes place in the same contextual environment in which it is to be applied. Lave and Wenger (1991) propose that learning should not be conceptualised as the simple transmission of abstract and decontextualized knowledge from one person to another, but rather as a social process in which knowledge is co-constructed. This positioned Situated learning theory as a theory that offered alternative ways to conceptualise learning in settings outside of the traditional classroom setting.

Lave and Wenger place particular emphasis on learning within a social setting, they do this by highlighting relationships and engagements between newcomers and old-timers. This is done to reconceptualise practice and learning as a process of support and co-construction (Lave and Wenger 1991).

As the theory progressed, Wenger introduced the concept of identity, stating that identity includes more than the simple acquisition of skills and/or knowledge; but rather identity formation is centred around knowing how individuals know what they know as well as how individuals know who they are (Wenger 1998).

Over the last 30 years, Situated Learning theory has been used across various domains within health professions education. These domains range across professions such as medicine, nursing, pharmacy, social work, occupational therapy, dental and many other health professions (O'Brien & Battista, 2020).

Situated learning is a model of how individuals acquire professional skills and Lave and Wenger (1991) propose that learners acquire knowledge better when actively participating in the learning experience. In contrast to traditional learning activities, which generally occur in abstract, out of context experiences, situated learning proposes that learning takes place through the relationships amongst students and links prior learning with informal, and often unintended contextual learning.

Situated learning is defined as a process that occurs through Legitimate Peripheral Participation (LPP) in Communities of Practice (CoP) (O'Brien & Battista, 2020).In the following paragraphs, I discuss CoP and LPP and conclude this chapter with a discussion on how these theories influenced this study.

3.3.3.1 Communities of Practice (CoP)

The term 'Community of Practice' was first proposed by Lave and Wenger, who sought to understand how novice people acquired knowledge in established communities of experts (Lave & Wenger, 1991). The theory was developed through observing various apprenticeships including meat cutters, recovering alcoholics, midwives, naval quartermasters, and tailors (Lave & Wenger, 1991).

Although the term Communities of Practice was coined relatively recently, the concept has been around for as long as humans have engaged in a process of collective learning within a common domain (Wenger, 1998).

Etienne Wenger (Lave, 1991) summarises Communities of Practice (CoP) as "groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly" (p. 64). CoP's are ubiquitous and everyone belongs to multiple CoP's simultaneously (Lave, 1991).

Within CoP's, through a process of 'participation and reification', meaning is negotiated (Wenger, 1998, p. 58); Reification being defined as a process of giving form to experience by producing objects. 'Any community of practice produces abstractions, tools, symbols, stories, terms, and concepts that reify something of that practice in a congealed form' (Wenger, 1998, p. 59).

A CoP can develop naturally as a result of the participant's common interest in a field, or it can be intentionally constructed to acquire specific knowledge. Through the process of sharing information and experiences within the group, members learn from each other and have an opportunity to develop (O'Brien & Battista, 2020; Wenger, 1998).

It is important to note that not every community is a CoP; Wenger provides 3 characteristics of a CoP, namely: the Domain, the Community, and the Practice.

> Domain: Simply being part of a community does not necessarily mean that you are part of a CoP. According to Wenger, there needs to be a shared domain, as members

within a CoP have a commitment towards this domain. This domain is valued and members learn from each other.

Community: Through mutual engagement within the shared domain, members engage in discussions, share information, and learn from each other. By simply having the same title, does not automatically create a CoP, as members need to interact and learn from each other, even if these interactions aren't daily.

Practice: A CoP is more than simply a group of individuals with a common interest, as members of Cops develop a shared repertoire of resources (experiences, tools, solutions) in a shared practice. This does require a degree of time and sustained interaction.

When these three elements are present and cultivated, a CoP is present. The process through which a newcomer gains access to this CoP is LPP.

I argue that medical simulation can facilitate learning within a CoP, as medical simulation creates an environment that satisfies the characteristics of a CoP.

While I acknowledge that the original study participants were not students, through critical engagement with the characteristics (outlined above) for a CoP, students engaging with medical simulation fit the criteria for a CoP, namely, they have a defined domain, within a community, in a shared practice.

In terms of domain, as CoP can develop naturally or be intentionally constructed to acquire specific knowledge, students participating in a simulated activity as part of a curriculum, share a defined domain. This domain is specific enough to focus engagement around a particular topic such as acute care, and the students commit to the domain, as they desire to acquire these competencies. Also, the design of a well-developed medical simulated activity facilitates learning amongst the members of the CoP.

In terms of community, while I acknowledge that simply being a medical student does not automatically make you part of a community. Medical simulation affords the educator the ability to develop a scenario that encourages members to interact with and learn from each other. This positions the skilled educator in an ideal position to purposefully create an environment in which critical engagement can thrive, as it cannot be assumed that this community as a component of a CoP will emerge passively or automatically.

Finally, in terms of practice, medical students participating in a simulated activity have to draw from experiences, be it from the clinical environment or elsewhere, and share solutions and tools. Furthermore, the concept of curriculum as inclusive of all learning opportunities, as outlined in the previous chapter, entails that students can learn not only during the simulation and debrief, but also on the clinical platform.

Considering all of this, I argue that medical student participating in a medical simulation developing acute care competencies are in fact a CoP.

While the students might be part of a CoP, it is important to recognise that the CoP is ultimately a group of diverse individuals, and these individuals bring along with them their culture, religion, and belief systems. Recognising this is crucially important, as it cannot be assumed that members of a CoP will simply suspend their culture, religion, and belief systems and adopt the those of the CoP. Furthermore, the facilitators and other clinical staff that the students interact with on the clinical platform also form part of this CoP. The importance of these interactions within the apprenticeship model are crucially important, particular within a previously, and largely still divided social society such as South Africa (Khine & Hartman, 2021).

3.3.3.2 Legitimate Peripheral Participation (LPP)

The model of Legitimate Peripheral Participation proposes a reconceptualization of the recognition afforded to learning and training which occurs in what are termed 'communities of practice' (Lave, 1991).

The newcomer's participation at first is legitimately peripheral, but over time participation becomes more complex and engaged as the newcomer progresses towards the centre (Floding & Swier, 2011).

As a reminder, it is important to note that at the time of proposing this theory, Lave and Wenger were challenging educational assumptions, many of which are still present today. These include the ideas that learning is an individual process and that it has a beginning and an end. Also, learning is best separated from other activities, and that it is the result of teaching.

Wenger illustrates the LPP process using case studies, one of which is depicted in the Yucatec Mayan culture. Through describing the process of becoming a midwife, Wenger using the example of a young girl growing up in a home where her grandmother is a midwife. The young girl is exposed to this life through dinner table stories and through seeing her grandmother attend to mothers at all hours of the morning. As time progresses, the young girl is requested to conduct treatment-related errands and accompany her grandmother to deliveries. Her involvement continues to increase until she bears her child, and delivers the placenta (a culturally significant moment). Through this process, the young girl's participation was initially towards the periphery, limited to less important tasks, and as she gained trust the importance of the tasks increased until she is recognised by the community of practice as a full participant.

Medical simulation affords the educator the ability to intentionally design learning experiences that facilitate the process of LPP, to gain access to the CoP. A medical simulation activity can be designed to engage different roles across a spectrum of responsibilities. For instance, a scenario where students are initially required to perform a peripheral task, these can include preparing an IV line, taking a blood pressure etc. As the student progresses, the significance and complexity of the tasks allocated to them increase, for example, placing the IV line, intubating the patient etc. This example illustrates how medical simulation can facilitate entering into a CoP through LPP.

As simulation has become an integral part of medical education within many tertiary institutions including South Africa, it becomes crucially important to critically explore the role, if any, that medical simulation has in developing competencies as the resources, monetary and others, are in short supply and need to be optimised.
The implications for conceptualising medical simulation pedagogy as a mediator to facilitate students in the ZPD, for entry into a CoP through LPP are important. These implications strengthen the ideas that medical simulation is more than a technology, and can facilitate learning by harnessing its inherent strengths. Strengths that are entrenched in theories of social constructivism and situated learning theory.

Chapter 4: Methodology

4.1. Introduction

The purpose of this chapter is to discuss the methodological considerations of this study. The term methodology, as applied to educational research, is an interrelated construct that includes the researcher's underlying beliefs about reality, existence or being (ontology), the nature of knowledge (epistemology) and values (axiology) (Lakshini, 2015; Patton, 2002). These constructs influenced a set of assumptions I had, which contributed to the overall research design and analysis of this study. Research in medical education seeks to increase the knowledge and the level of understanding of the learning and education process by conducting investigations (Ringsted et al., 2011).

In this chapter, I start by discussing the paradigmatic considerations and research paradigm of this study. Thereafter I discuss (Part A) the description and justification of the various methods used during this study.
The second part (Part B) of this chapter addresses how I conducted the study, under the headings: research and study design; enrolment and recruitment, data collection, and data saturation.
Finally, I discuss the methodological limitations and ethical considerations and of the study.

4.2. Paradigmatic Considerations

A paradigm is a way in which the world is viewed and is informed by philosophical assumptions about the nature of social reality (known as ontology), ways of knowing (known as epistemology) and ethics and value systems (known as axiology) (Patton, 2002).

The term paradigm originated from the Greek word 'paradeigma' which means pattern, was first used by Thomas Kuhn (1962) to explain a conceptual framework shared by a community which afforded him with a model for examining problems and finding solutions. Kuhn (1962) defines a paradigm as: "an integrated cluster of substantive concepts, variables and problems attached with corresponding methodological approaches and tools…"(p 69). He states that the term paradigm refers to a research culture with a set of beliefs, values, and assumptions that a community of researchers has in common regarding the nature and conduct of research (Kuhn, 1962). A paradigm hence implies a pattern, structure and framework or system of scientific and academic ideas, values and assumptions (Olsen et al., 1992).

This study adopts an interpretivist paradigm; interpretivism seeks to integrate human interest into a study. Interpretive researchers assume that access to reality is constructed as a result of social interactions through mechanisms such as language, instruments, shared meanings, and consciousness (Meyers, 2008). The motivation for adopting this approach was multifaceted: from a research design perspective, since health science education as well as the clinical environment involves social interactions amongst individuals, it lends itself to an interpretivist paradigm which takes the position that reality is subjective and co-constructed by individuals (Samuel, 2019). The subjectivity of this paradigm was particularly valuable as I was interested in exploring the role of medical simulation amongst various stakeholders, within a particular context (that being SA). In terms of methodology, the interpretivist paradigm was deemed appropriate as it assumes that there are many possible interpretations of the same data, all of which are potentially meaningful. Broadly speaking, interpretive research is any type of research where the findings are not derived from the statistical analysis of quantitative data (Strauss & Corbin, 1990).

4.2.1. Paradigmatic choice

The interpretivist paradigm adopted in this study is contrary to the majority of research within medicine that tends to assume a positivist approach. A positivist paradigm in research has a view of reality that one truth exists and that can be explained by the direct cause-effect relationship. The epistemological assumptions in this paradigm are that reality can be objectively observed and is independent of the knower or observer. The positivist methodology has been used in verifying hypotheses, testing probabilities to arrive at associations or a direct cause and effect. Measurement, prediction and generalisability are core methodological aims, hence quantitative methods of data collection tend to be the dominant methods of data collection in this paradigm (Tavakol & Sandars, 2014b).

The positivist paradigm was critiqued especially in the fields of Humanities and Social Studies for its notion of a single truth and that reality exists independently of the human mind. This led to the recognition of multiple views of reality held by different people. More attention to the social, emotional and conceptual aspects of truth was given to participants in the dialogue of the research. This addresses the dehumanising aspect of positivism that fails to elucidate the human feelings and conditions that prevail (Cohen et al., 2011).

Following the post-positivist paradigm, there are various approaches to acquiring meaning and knowledge, for example, the interpretivist, constructivist and social constructionist approaches. The commonality in these approaches is that the researcher tries to understand the world that has been lived and experienced by the participants through their representations. In the interpretivists' view, there are natural and social realities, and the researcher logically or rationally figures out what the meaning and realities are that emerges from the data. In the constructivists' view, reality is relative and is based on the multiple views of people. Knowledge is created by the construction of ideas in the individual's mind drawing upon previous experiences. In the social constructionist approach, reality is negotiated through multiple lenses and knowledge can be variable as a result of co-constructions amongst the participants and with the researcher through social interactions (Flick et al., 2004).

The table below by Pizam and Mansfield (2009) illustrates some of the major differences between interpretivism and positivism.

Table 1: Comparison between positivism and interpretivism (Pizam & Mansfield, 2009)

Assumptions	Positivism	Interpretivism
Nature of reality	Objective, tangible, single	Socially constructed, multiple
Goal of research	Explanation, strong prediction	Understanding, weak prediction
Focus of interest	What is general, average and representative	What is specific, unique, and deviant
Knowledge generated	Laws Absolute (time, context, and value-free)	Meanings Relative (time, context, culture, value bound)
Subject/Researcher relationship	Rigid separation	Interactive, cooperative, participative

With reference to the table above, it must be noted that it appears that the table itself was developed within a positivist paradigm, as depicted by the way in which some of the assumptions are characterised. For example, under the heading 'Goal of research', the authors refer to ‘strong prediction’ and ‘weak prediction’; where it would be more appropriate to indicate an ‘absence of prediction’ under Interpretivism, as Interpretivism is generally not concerned with predictive goals.

As is the case with any paradigm, interpretivism is not without its critiques, below I discuss some of the advantages and disadvantages of interpretivism as a paradigm, as well as how I mitigated the disadvantages.

4.2.2. Advantages and Disadvantages of Interpretivism

Potential disadvantages (as viewed from a positivist paradigm) of interpretivism as a paradigm is related to the subjective nature of this approach, this could be attributed to the researcher's involvement in the various aspects of the project. For this reason, primary data generated in interpretivist studies cannot be generalized since data is heavily impacted by personal viewpoints and values. In the case of this research, this ‘disadvantage’ can be seen as a potential positive as I was able to draw from my experience and knowledge of the research topic, i.e. medical simulation in the undergraduate curriculum, to uncover the important complex contextually relevant research question as opposed to superficial matters. However, in a bid to minimise undue influence by the researcher, an interview guide was used during all of the interviews. The interview guide provides pre-determined boundaries within which to frame questions and limits the potential to stray too far from the study objectives; and finally, a broad range of subject experts was enrolled for this research.

As an advantage, interpretivism allows researchers the ability to explore aspects such as cross-cultural differences (Meyers, 2008). Aspects such as ethics, leadership and analysis of factors impacting leadership can be explored in great depth. Data generated through studies within an interpretive paradigm can be associated with a high level of validity because data in such studies tend to be trustworthy and honest (Meyers, 2008). These criteria for strengthening rigour are elaborated later in the chapter. Multi-culturalism and identity formation in medical education has received growing attention globally, with literature suggesting that identity formation is complex and multifactorial (Goldie, 2012; Lakshini, 2015; Maitra, Lin, Rydel, & Schillinger, 2021). Within an LMIC context , the interpretivism paradigm was important , as a central component of this research was the exploration of the cross-cultural contextual differences in implementing a simulation curriculum in a developing world context.

Part A: Description and justification

4.3.Delphi study

The Delphi method is a combination of qualitative and quantitative processes that draws mainly upon the opinions of identified experts to develop theories and projections for the future (Brady, 2015). The goal of this method is to reach a consensus among a group of anonymised experts though iterative rounds of inputs (Green, 2014). Delphi studies have been used in curriculum development, to collate competencies in different fields such as nursing, physiotherapy, anaesthesia, and psychiatry.

The Delphi technique provides consensus among a panel of experts so that the opinions of the panel on the relative importance of specific issues are progressively refined by reviewing colleagues' input. Key features are anonymity of the panel members, iteration with controlled feedback from a series of questionnaires, quantitative analysis of the group response and the use of explicitly defined expert opinion (Couper et al., 2006). It is based on the premise that collective intelligence enhances individual judgement and captures the collective opinion of experts (Green, 2014).

The Delphi technique is effective for achieving the following objectives: (Hsu & Ohio, 2007)

1. To determine or develop a range of possible programme alternatives;
2. To explore or expose underlying assumptions or information leading to different judgments;
3. To seek out information that may generate a consensus on the part of the respondent group;
4. To correlate informed judgments on a topic spanning a wide range of disciplines, and;
5. To educate the respondent group as to the diverse and interrelated aspects of the topic

Regarding Delphi participant selection, choosing the appropriate participants is the most important step in the entire process as it directly relates to the quality of the results generated. (Hsu & Ohio, 2007). Recruitment and enrolment are discussed later in this chapter.

The Delphi method was deemed appropriate for the following reasons: (1) participants in this study were spread out across multiple locations, making in-person interviews impractical and not cost-effective; (2) the participants involved in the study were busy professionals who required flexibility for participation, for which this modified Delphi study allowed; (3) all participants were experienced experts in their respected fields; (4) and finally, the Delphi method provided a viable tool for learning as much as possible from highly experienced organizing practitioners in the least amount of time (Brady, 2015). Despite variations in qualitative Delphi studies (Brady, 2015; Creswell, 2003), certain consistent criteria apply to all qualitative Delphi studies including purposive sampling, emergent design, anonymous and structured communication between participants, and thematic analysis (Brady, 2015).

4.3.1. Delphi study modification

This study implemented a modified version of the traditional Delphi technique. The modification was not novel, and was used in 'The Acute Care Undergraduate Teaching (ACUTE) Initiative' (Perkins et al., 2005). A modified version of the Delphi studies has been used in a variety of studies (Couper et al., 2006; Michels et al., 2016; Woodcock, Adeleke, Goeschel, Pronovost, & Dixon-Woods, 2020). In addition, some studies have demonstrated that the modified Delphi method can be superior to the original Delphi method and perceived as highly cooperative and effective (Eubank et al., 2016). The primary benefits of modifying the traditional Delphi method is related to improved response rate, and the ability to build upon previous work within the field (Custer, Scarcella, & Stewart, 1999). This was particularly useful in this study as it used pre-determined headings and sub-headings which were developed by engaging with previous studies conducted on this topic (See - Data Collection section below).

The modification utilised different stakeholders during round 1 and round 2 of the study, as opposed to a single cohort of stakeholder across the various rounds. This was done in keeping with the underlying philosophy that curriculum development is multifaceted and is influenced by various stakeholders. Therefore during round 1 of the Delphi study, EM registrars were identified as the most appropriate stakeholder for this round (see below), and during round 2 healthcare providers with more than 5 years' experience in undergraduate curriculum development and teaching in acute care clinical skills were identified as the most appropriate stakeholder to address the research objective. Using this modification allowed me to draw from the various strengths of the stakeholders while harnessing the strengths of the Delphi technique. Round one explored potential competencies that could be included in an undergraduate curriculum from emergency medicine registrars through relevant professional organisations (College of Emergency Medicine of South Africa) and head of departments (HOD) at the four institutions. Respondents were invited to contribute suggestions via email (relating to knowledge, skills or attitudes) relevant to the safe care of the acutely ill, that they consider important for medical undergraduates to possess at the point of graduation. These responses were then be compiled into general categories (airway, breathing, circulation etcetera).

4.3.1.1 Delphi Study Logistics and Limitations

The logistics around conducting a Delphi study that included participants across the various institutions in SA was challenging. An important limitation of the study was the selection of the round one contributors' to the study, namely, the EM registrars. It could be argued that enlisting registrars to provide undergraduate competencies could be problematic; however, the decision to include EM registrars was both intentional and necessary.

EM registrars were ideally positioned to contribute to this study as the study was looking at the clinical skills competencies for the acutely ill patient particularly, which is an area of interest for EM registrars. Secondly, as it is mandatory to complete internship and community service in South Africa before registering as a medical practitioner, all the EM registrars have a lived experience as to the undergraduate clinical competencies required to safely manage an acutely ill patient within the South African health system.

Despite this, I mitigated the risks of the EM registrars providing clinical skills competencies that are inappropriate for the undifferentiated medical practitioners in the following ways:

Firstly, during the recruitment process, the researcher emphasized that the competencies contributions provided are intended for an undergraduate clinical skills curriculum, this was also physically communicated in the information sheet (see annexure 1).

Secondly, the researcher enlisted a multi-professional team of undergraduate curriculum experts during round two of the Delphi study.

Finally, from a regulatory body standpoint, the Health Professions Council of South Africa (HPCSA) is particularly restrictive in sharing information on its members, which makes accessing any information to recruit participants extremely challenging and unlikely. Considering all these factors, the researcher believed that the EM registrars presented the most appropriate subset of participants under the circumstances.

Considering the strengths and limitations of the traditional Delphi method as well as the underlying theoretical underpinning of this study, the modified Delphi method was considered the most appropriate method to use for this study.

4.4. Phase 2:

4.4.1.Focus group discussions

The focus group discussion (FGD) is an established data collection method in qualitative research (Stalmeijer et al., 2014). FGD was first described Paul Lazarsfeld and later refined by Mertel and Kendall in (1946) and Stalmeijer et al., (2014), and can be described as: "… group discussions organized to explore a specific set of issues ... The group is focused in the sense that it involves some kind of collective activity ...crucially, focus groups are distinguished from the broader category of group interview by the explicit use of the group interaction as research data" (Kitzinger, 1994, p. 103).

The use of focus group interviews within medical education has rapidly increased within the 21st century (Stalmeijer et al., 2014). This popularity of focus group interviews in medical education can be partially attributed to the fact that medical education as a field of inquiry seeks to pursue "scientific, social, and cultural questions related to medical training and practice as well as issues relevant to health professions more broadly" (Stalmeijer et al., 2014, p 924). The premise of FGD is to explore how individuals make meaning of their experiences in their world (Stalmeijer et al., 2014). FGD attempt to facilitate a broad understanding of phenomena as opposed to simply a quantitative representation. Within an FGD, the researcher attempts to gain a greater understanding of the individual and/or group insights, attitudes, and/or opinions concerning phenomena. The interaction between the FGD participants will influence the research data, therefore the FGD participants need to be comfortable and non-threatened with each other (Rabiee, 2004).

FGD can be particularly beneficial when researching poorly understood research topics (Kitzinger, 1995) and can be used prior, during, or after other research activities (Stalmeijer et al., 2014). FGD by design is an appropriate method for exploratory research (Stalmeijer et al., 2014) and therefore was particularly valuable for this project as a data collection tool as I sought to explore the role of medical simulation in developing undergraduate acute care clinical skills competencies in SA.

Despite the versatility of FGD, there are situations where FGD are inappropriate; for example, topics of a particularly sensitive nature, or situations where large power differentials exist between the FGD participants can be problematic (Barbour, 2005).

For this study, I deemed it appropriate to facilitate the FGD as there were no known hierarchical relationships between me and the FGD participants. As the medical simulation community in SA is relatively small, we had interacted on a professional level on various occasions, however, there were no formal hierarchical relationships. Because I had interacted with the participants professionally on previous occasions, it made it easier to build rapport with the participants, they opened up and were able to discuss freely during the FGD; this made the data that much more rich.

Currently, it is agreed that there is no definitive number of FGD that need to be conducted, but rather that the number be informed by the number of FGDs it takes to reach saturation (Stalmeijer et al., 2014). However, Crabtree and Miller (1999) recommend at least four to five focus groups if focus group interviews are the only data collection method.

Additionally, the number of FGD participants is dependent on various factors such as the research context and study aim (Stalmeijer et al., 2014). FGD should have sufficient participants to allow for diverse opinions and attitudes but also, be small enough to allow each participant to be heard (Stalmeijer et al., 2014). Generally, researchers agree that this number is somewhere between six and ten participants per FGD (Barbour, 2005; Crabtree & Miller, 1999; Stalmeijer et al., 2014).

4.4.1.1 Focus Group Moderation

The purpose of an FGD is to facilitate discussion between the research participants and generate rich data relevant to the topic. The role of an FGD facilitator in a focus group interview is a challenging one and the moderator needs to display good interpersonal skills, be adaptable and be non-judgemental (Stalmeijer et al., 2014). These attributes contribute to creating an environment where participants interact with open and honest dialogue (Stalmeijer et al., 2014). The degree of active participation in terms of control and direction provided by the moderator depends on the research outcomes and moderator style.
A moderator should have sufficient background knowledge on the topic of discussion to place comments in perspective and probe areas of concern (Stalmeijer et al., 2014).

There have been some questions around researchers assuming the role of moderator because of the potential for the researcher's assumptions and bias to influence the process (Stalmeijer et al., 2014). However, by adopting an interpretivist paradigm it is acknowledged that the researched reality is co-constructed between the participants and the researcher and as a result, the researcher is part of the process. It is important that the researcher's subjectivity, though embedded in the research process, is managed and reported; it is for this reason that I included a section on reflexivity in the conclusion chapter.

Additionally, I deemed it necessary and appropriate to moderate the FGD as I had previous experience in facilitating FGDs within the health science education field and more importantly in medical simulation, which is relatively new within the South African context. This equipped me with the skills required to be attuned to the medical simulation landscape as well as the SA health education terrain and probe with challenging questions that would provide the richest data for addressing the research objectives and aims.

4.4.1.2 FGD logistics and limitations

The logistics around FGD can be challenging as it requires multiple individuals to be available at the same time, which is particularly demanding when dealing with healthcare educators who often fulfil clinical duties as well as teaching responsibilities.
It was especially taxing in this study, as I had to cancel and reschedule the FGD on multiple occasions to accommodate the participants.

I acknowledge that the number of participants who participated in the FGD was limited despite an exhaustive recruitment process. Hence the decision to incorporate the FGD into phase 2 (semi-structured interviews) of this study. It was originally envisioned that the FGD be an additional standalone phase.

As mentioned earlier in this chapter, there is no definitive literature on the optimal number of participants in a FGD, however, I intended to recruit more participants. The low numbers could be attributed to various factors, such as first, that many of the curriculum experts also function as clinical staff, making it more challenging to find a time where all of the participants are available at the same time, and eventually it becomes unfeasible to continuously postpone the FGD to accommodate everyone; second, the number of experts within SA with an interest in both undergraduate health professional education and acute care clinical skills are limited and therefore dramatically limit the number of participants available to participate in the FGD. Finally, and probably the most significant factor was that many of the experts that were eligible to participate in the FGD were also eligible to participate in the semi-structured interviews. I felt that it would confound and inflate the opinions of certain individuals if they participate in both in the FGD and interviews. For this reason, the decision was made to exclude any expert from participating in the interviews if they had participated in the FGD.

Despite all of these challenges, I sought to enhance the validity of the findings of the FGD by implementing the following strategies: 1) grounding all the FGD questions in the theoretical framework, 2) comparing and contrasting the opinions of the FGD contributors with existing literature or theories, and 3) repeating certain questions in both the FGD and the semi-structured interviews, thereby triangulating their responses.

4.4.2. Semi-structured interviews

There are generally three types of qualitative research interviews, namely, structured, semi-structured and unstructured. Structured interviews are likened to verbally administered questionnaires; these consist of a list of predetermined questions that are asked, with limited variation and no scope for follow-up questions to responses that require further elaboration (Gill et al., 2008). Unstructured interviews do not reflect any preconceived theories or ideas and are performed with little or no organisation. Such an interview may simply start with a broad opening question and will then progress based, primarily, upon the initial response (Gill et al., 2008). These interviews are generally very time-consuming and can be difficult to manage as the lack of predetermined interview questions provides little guidance on what to talk about. Unstructured interviews also lend themselves to a grounded theory approach, where the researcher intends building theory from the inductive analysis of the discussion driven by the interviewees themselves.

Finally, semi-structured interviews consist of several research questions that help provide a framework of the areas to be explored, but also allows the interviewer or interviewee to diverge to pursue an idea or response in greater detail (Gill et al., 2008). During semi-structured interviews, the discussion questions are informed by the theoretical framework and research paradigm. This interview format is often used in healthcare, as it provides participants with some direction to stimulate discussion, which can be beneficial. The flexibility of this approach also allows for the discovery or elaboration of information that is important to participants but may not have previously been thought of as pertinent by the research team (Gill et al., 2008).

For this project, I deemed it appropriate to use semi-structured interviews as it allowed me to ask specific critical questions related to the research and aim, but also provided sufficient flexibility for the research participants and moderator to explore points of interest that were not preconceived.

4.5. Rigour

Demonstrating rigour (trustworthiness) is important as it conveys the integrity of the research findings to the reader. Establishing rigour in qualitative research is built on ensuring, credibility, transferability, and dependability (Guba & Lincoln, 1985).
During the research process, I strived for rigour through implementing the following strategies: First and foremost I sought to build sufficient rapport with the participants, this was accomplished by networking with the participants through the local simulation special interest group, allowing sufficient time for discussion, and by checking for accuracy with the

participants during the FGD and interviews. During the FGD and interviews, I would periodically offer verbal interpretations of my understanding of what I perceived the participants to be conveying to check for accuracy and prompted the participants with clarification questions where necessary.

Dependability refers to "the extent to which the findings are consistent in relation to the contexts in which they were generated'' (Stalmeijer et al., 2014, p935). I strove for dependability during the FGD and interviews by conducting them in a standardised manner, this included the following procedures:

1) After completing the information sharing and consent procedures I would start with a broad opening question.
2) This was followed by more specific questions related to the objective of that phase of the study.
3) The session would conclude with another open-ended general invitation for additional comments.

Additionally, dependability was addressed by keeping an audit trail consisting of a complete set of records of the research process. (Mertens, 2005)

Validity or transferability is defined as the extent to which the instrument "measures" what it is supposed to measure. Again, as the purpose of this research was not to measure anything, transferability was ensured by completing a comprehensive literature review when designing the research instruments and later in the review of coded data. Additionally, transferability was addressed by collecting sufficient detailed transcriptions of data followed by detailed reporting on the outcomes of the analysis.

Part B: How I conducted the study

4.6. Research Design

The study used a mixed multimethod approach, consisting of a modified Delphi study* with the relevant stakeholders (phase 1), and a focus group discussion and one-on-one interviews with curriculum experts were used (phase 2).

A mixed-method design can be applied for various reasons, and the five broad purposes for mixed-method studies are as follows:

1) Triangulation: Seeking convergence and corroboration of results from different methods studying the same phenomenon.

2) Complementarity: seeking elaboration, enhancement, illustration, and clarification of the results from one method with the results of the other method.

3) Development: Using the results from one method to help inform the other method.

4) Initiation: Discovering paradoxes and contradictions that lead to a re-framing of the research question.

5) Expansion: seeking to expand the range of enquiry by using different methods for different inquiry components.

For this study, the mixed-method approach was used for multiple reasons. Firstly, it was used for development; i.e. the results from the Delphi study (the competencies required of undergraduate medical students) was used to inform the focus group interviews (which competencies can be addressed through simulation, and to what extent). Secondly, it was used for expansion; the mixed-method approach was used to expand the range of enquiry, for this study this included exploring an expanded range of experts opinion from various fields and disciplines. Lastly, it was used for triangulation as the data generated in Phase 1 was provided to Phase 2 participants seeking convergence, divergence and/or corroboration.

4.7. Study design

The study was conducted in the following manner:

Phase 1:

1) Modified Delphi study with various stakeholders to explore the knowledge, skills and attitudes required by undergraduate medical students in managing acute care cases in adult patients within a South African in-hospital environment.

Objective 1: To identify the competencies required by undergraduate medical students for managing acute care cases within a South African in-hospital environment

Phase 2:

1) Focus group discussion with health education curriculum experts (more than 5 years' experience in curriculum design and experience with clinical skills within a South African tertiary education environment)
2) Semi-structured interviews with health education curriculum experts with expertise in medical simulation (healthcare professionals who are currently responsible for developing and offering acute care training to undergraduate medical students in the South African tertiary education environment.)

Objective 2: To explore what acute care clinical competencies would lend themselves to a medical simulation modality within a South African tertiary education environment

Objective 3: To explore the role, including the limits and possibilities, of medical simulation as an educational modality in developing acute care clinical skills curriculum within a South African tertiary education environment.

During the conception of this study, it was originally envisioned that the FGD and semi structured one-on-one interviews were going to be standalone phases. However due to the low FGD participant numbers it was deemed more appropriate to combine these 2 collections methods into 1 phase. This was possible because as the data collection and analysis developed, areas of overlap became more and more apparent. This finding is not completely unexpected as the clinical skills and medical simulation community in SA is relatively small.

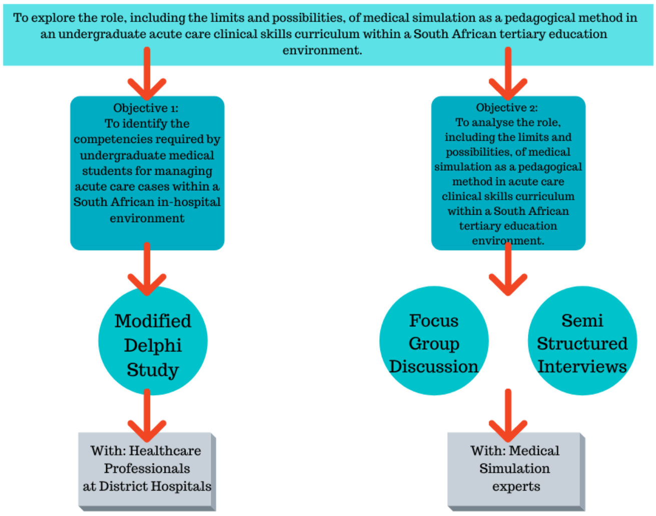


Figure 4: Flow diagram of the study design

4.8. Recruitment and Enrolment

4.8.1. Delphi study participants

Delphi Round 1

The Round 1 participants were recruited in the following manner: emails outlining the research aim and objectives were sent to the HOD's of the four universities that offer EM as a speciality in SA. These emails were then distributed via email and posted on the universities electronic classroom platforms.

Round 1 experts were defined as 'South African Emergency Medicine registrars currently completing the training at one of the four institutions offering an emergency medicine programme in South Africa'. The expert group excluded any foreign qualified EM registrars because they would have completed their undergraduate studies outside of South Africa, and this could potentially confound the results.

Upon reviewing the data, I noticed that the response rate from one of the four universities was particularly low, and because this university constituted a large proportion of the sample population, the decision was made to provide these participants with printed versions of the online survey. An email was sent to the HOD of that university requesting an opportunity to address the EM registrars after one of their classes. This request was granted. On the day in question, I addressed the class and explained the aim and objectives as well as all the relevant ethical considerations applicable to the study. It was stressed that participation would have no bearing on their academic performance, and that participation was voluntary. Altogether (electronic and paper-based), the survey had n:37 respondents (Emergency Medicine registrars), which equates to a 45 % response rate.

Delphi Round 2

During Round 2 of the Delphi study, the competencies (Knowledge, Skills, and Attitudes) from round one were synthesised and provided to a multi-professional healthcare team via an online survey (LimeSurvey®). These participants were recruited via a local (Cape Town, South Africa) special interest simulation group. The purpose of this group is to provide a space for like-minded individuals to network and share information regarding healthcare simulation in SA. An email was sent to this network requesting voluntary participation.

Round 2 experts were defined as 'a healthcare provider with more than 5 years' experience in undergraduate curriculum development and teaching in acute care clinical skills.'

Purposive sampling was used to ensure that the cohort was as diverse as possible. Diversity amongst this cohort was deemed necessary as it reflected the diversity of skills that are required to manage patients in the acute setting. Also, it mitigated the possibility of one speciality being over-represented.

The demographics of the multi-professional healthcare team are presented below.

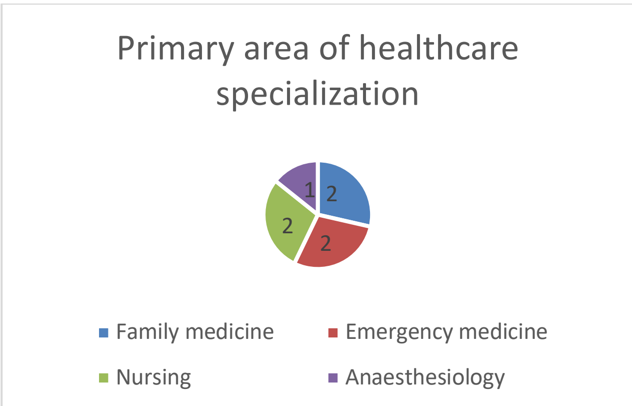


Figure 5. Primary Area of Healthcare Specialization

During Round 3, the Round 2 ratings were circulated back to the contributors of Round One for comment. Any disagreements from Round 1 contributors were forwarded to the curriculum specialist group for consideration.

4.8.2. Focus Group Discussion participants

A non-probability, purposive sampling method was used for this study. Invitations to participate in the voluntary focus group study was sent out via email to the identified experts. Official research participation invitations were sent to the South African Association of Health Educationalists (SAAHE) conference mailing list. Experts, defined as individuals believed by the researcher to have useful knowledge of the topic, were selected from curriculum experts with more than 5 years' experience in clinical skills curriculum design within a South African tertiary education environment.

The first FGD was conducted on the 4th December 2019 at approximately noon. An email invitation was sent to 7 experts who met the inclusion criteria; 3 experts attended the FGD. The table below provides a brief synopsis of the participants.

Participant number	Profession title	Additional notes	Interview Duration
Participant 1 (P1)	Head of Department: Emergency Medicine	Holds various senior roles within emergency medicine. Special interest in education	39 Minutes
Participant 2 (P2)	Technical officer – Simulation centre	Involved in the design and implementation of medical simulation	
Participant 3 (P3)	Lecturer – Emergency Medical care	Extensive simulation experience in South Africa and abroad	

The participants were briefed on the study and the necessary documentation was completed. I facilitated the FGD and was guided by the FGD interview guide (Annexure 2)

4.8.3. Curriculum expert interview participants

A non-probability, purposive sampling method was used for this part of the study. Invitations to participate in the voluntary semi-structured interviews were sent out via email to the identified experts. Official research participation invitations were sent to various universities in South Africa. Experts, defined as medical simulation experts who are responsible for developing and offering clinical skills training for undergraduate medical students in the South African tertiary education environment

Note: Participants who were included during the FGD (Phase 2) were excluded from the semi-structured interviews (Phase 3); this was to minimise the potential for selection bias which could result in one individual's opinion being overstated by them being present in more than one round of data collection.

5. Data Collection

5.1. Delphi study

The data for Round 1 of the Delphi study was initially collected using an online survey platform called 'SurveyMonkey®'. The use of this platform was made available through the University of Cape Town and consists of the user name and password protection. Email invitations to participate in the study were distributed via their respective heads of departments of all four medical schools offering emergency medicine as a specialist programme in South Africa. The platform generated a specific link, which was unique to each participant's email IP address. These printed versions were presented to the participants at the beginning of one of their lectures.

Participants were asked to contribute competencies, which they felt are important under the set headings (Airway, Breathing, Circulation, etc.) with subheadings (Knowledge, Skills, Attitudes) provided (see Appendix 1). During the conception of this study, it was originally envisioned that the participants would not be provided with any headings or sub headings, so as to not influence their contributions. However when the study proposal was submitted to the relevant university ethics committee for review, it was proposed that headings be provided to provide a framework within which participants can frame their contributions. Therefore in a bid to minimise and any undue influence from the inclusion of these headings, I reviewed the contributions of similar studies (Katowa-Mukwato et al., 2014; Perkins et al., 2005) and framed the headings as broadly as possible, to allow the participants the freedom to locate their competencies within these headings.

Free-text boxes were provided below each subheading in which the participant could provide their knowledge, skills or attitude.

All the raw competencies provided by the participants were collected, organised and synthesised by the researcher to create specific competencies from the raw data.

During Round 2 of the Delphi study, the competencies (Knowledge, Skills, and Attitudes) provided during Round 1 were synthesised and provided via an online survey (LimeSurvey®) to a multi-profession healthcare team. The objective of this round was to try and establish a consensus through a 5-point Likert-scale. This scale had the explanations as described in the table below:

1	2	3	4	5
Highly appropriate	Appropriate	Undecided	Inappropriate	Highly inappropriate

The level of 'Consensus' or Agreement/Disagreement was determined using the table below:

Table 4.3. Mean Score of Likert Scale vs. Strength of Agreement

Mean score (Likert score)	Strength of agreement or non-agreement
1 – 1.7	Strong Agreement
1.8 - 2.5	Agreement
2.6 – 3.4	Undecided
3.5 – 4.2	Disagreement
4.3 – 5.0	Strong Disagreement

During Round 3, the competencies that emerged during Round 1 and refined during Round 2 by the multi-disciplinary healthcare profession curriculum experts were circulated back to the Round 1 contributors for comment. The competencies were emailed back to the Round 1 participants, and despite two follow up reminder emails, no responses were received.

The modified Delphi Study proved extremely valuable in exploring the opinions of a diverse group of experts and recognised the diverse range of expertise across a large geographical location.

5.2. Focus group discussion

After completing the Delphi study, the focus group discussion was conducted with n-3 participants. This findings of this FGD contributed to addressing objectives 2 and 3, namely,

2. To explore what acute care clinical competencies would lend themselves to a medical simulation modality within a South African tertiary education environment.

3. To explore the role, including the limits and possibilities, of medical simulation as an educational modality in developing acute care clinical skills curriculum within a South African tertiary education environment.

The focus group discussion was guided by an interview guide Annexure 2.

Table 5.1: Overview of FGD participants

Participant number	Profession title	Additional notes	Interview Duration
Participant 1 (P1)	Head of Department: Emergency Medicine	Holds various senior roles within emergency medicine.	39 Minutes
Participant 2 (P2)	Technical officer – Simulation centre	Involved in various aspects of curriculum development	
Participant 3 (P3)	Lecturer – Emergency Medical care	Extensive simulation experience in South Africa and abroad	

5.3. Expert interviews

Semi-structured interviews were conducted in person with a total of five key experts within the field of health education and medical simulation. These experts are currently employed at four of the medical institutions in South Africa and are all directly involved with curriculum development at the undergraduate level. The table below provides an overview of the interview participants:

Table 5.2. Overview of the interview participants

Participant number	Profession title	Additional notes	Interview Duration
Participant 1 (P1)	Head of Simulation Centre	PhD (Health Professions Education)	52 minutes
Participant 2 (P2)	Chief Technical officer – Simulation centre	Masters (Health Professions Education)	37 minutes
Participant 3 (P3)	Head of Simulation Unit	PhD (Health Professions Education- Clinical simulation)	41 minutes
Participant 4 (P4)	Simulation Coordinator (SSH accredited program)	PhD	57 minutes
Participant 5 (P5)	Academic Coordinator- Rural health care	MBChB	25 minutes

All the interviews were guided by an interview guide (Annexure 3) and were audio-recorded.

6. Data Saturation

Saturation was first described within grounded theory research and can be broadly conceptualised as a criterion for discontinuing data collection or analysis (Saunders et al., 2018). Saturation has attained widespread acceptance as a methodological principle in qualitative research. Despite this, there remains some contestation surrounding how data saturation is conceptualised and operationalised. The specifics around attaining saturation will differ depending on the type of study, theoretical framework, and paradigmatic position as well as assumptions about whether it represents a distinct event or an ongoing process (Saunders et al., 2018; Strauss & Corbin, 1990).

In a recent paper, Saunders et al. (2018), sought to critically explore the concept of saturation and its use in qualitative research. Through engaging with the relevant literature, four distinct types of saturation were proposed (see table below), namely, theoretical saturation, inductive thematic saturation, Priori thematic saturation, and data saturation. Theoretical saturation, which is deeply rooted in grounded theory research, relies on the development of theories and the emerging theory in the analysis phase as a criterion to continue the data collection process. Inductive thematic saturation is similar to theoretical saturation but seeks to refine existing theory through the identification of new codes or themes. This type of saturation is based on the number of codes or themes as opposed to the completeness of existing theoretical categories and saturation is limited to the level of analysis. Priori thematic saturation, whose primary focus is in the sampling phase of the study, relates to the degree to which data reflects existing theory as opposed to developing or refining theory. Finally, the fourth method, namely, data saturation, conceptualises saturation by confining it to the data collection phase of the study and seeks to identify repetition or redundancy of codes without the need to make conceptual links to theory.

Table 4.3. Models of Saturation (Saunders, 2017, p. 1897)

Model	**Overview**	**Primary Focus**
Theoretical saturation	Relates to the development of theoretical categories; related to grounded theory methodology	Sampling

Inductive thematic saturation	Relates to the emergence of new codes or themes	Analysis
Priori thematic saturation	Relates to the degree to which identified codes or themes are exemplified in the data.	Sampling
Data saturation	Relates to the degree to which new data repeat what was expressed in previous data	Data collection

For this thesis, I selected the fourth method, data saturation, as the most appropriate model as data saturation was confined to the data collection phase of the study.

While some authors (Hill et al., 2014; Jackson et al., 2015; Middlemiss et al., 2015) conceptualise saturation across various data sets, Legard et al. (2003) adopt a more individualistic perspective on data saturation whereby saturation is individually orientated as opposed to operating at the level of the data set as a whole. Using this approach, probing continues until the researcher feels that they have reached saturation, i.e. a complete full understanding of the participant's perspective is reached (Legard et al., 2003; Saunders et al., 2018). This approach resonated with me as it recognised the knowledge and expertise of the individual whilst harnessing the collective benefits of conducting interviews. As medical simulation is in its infancy in the South African environment, the paucity of experts heightens the need to emphasize the depth of knowledge of the existing and developing experts in this field. Adopting the data saturation model was beneficial as it acknowledged the relative low FGD participant numbers (see limitations of the study) whilst recognising the depth of the contextual knowledge of the local experts. This being said, while I acknowledge the expertise of the participants, I mitigated for the low FGD participant numbers by combining this individualistic data saturation approach by seeking convergence and/or divergence within and across the data sets, namely the FGD and interviews.

Through in-depth engagement with the interview participants on the relevant study objectives, data saturation was reached. During the interviews, the point of data saturation was 'reached' when the contributions made by the participants were similar despite additional probing by the facilitator. Through engaging with the interview participants on the relevant questions and through active probing, participants reached a point where 'rich' data was accumulated and no new contributions emerged. Additionally, a preliminary analysis was conducted after each interview to explicitly ascertain if I was getting the required information or if new data was being produced.

Finally, as the South African medical simulation community of practise (COP) is in its infancy and developing (at the time of conducting this study), I recognise that the low number of FGD participants could be viewed as a weakness of this study, and recommend that as the medical simulation COP develops and grows that further research on this objective be conducted to review the validity of these findings.

7. Ethical Considerations: Risks and Benefits

This study was presented to the Research Ethics Committee of the Faculty of Health Sciences UCT for approval, HREC No: 365/2018, Annexure 4. Due to the nature of the study, to explore the role of medical simulation curriculum in developing acute care clinical competence in undergraduate medical students in South Africa, there was a potential risk for the research participants to feel some sense of duty or pressure to participate in the study. This risk was mitigated by stressing the voluntary participation both written and verbally during the information sessions. Furthermore, I as the researcher nor my supervisors are involved in teaching or examining the ERs. Hence the risk for feeling pressured to participate was minimal.

During, the conception of this study, it was determined that there was low to no risk of any mental, emotional, and physical harm to any participants of this study; that being said, it was communicated both verbally and in writing that, if any participant felt threatened in any way that they could contact the research supervisors or the UCT HREC. The potential impact and benefits of the study are discussed in Chapter 1: Introduction.

7.1.1. Informed Consent

Ensuring that all the research participants were fully informed when consenting to take part in the study was important. The informed consent procedure was guided by 'The Guidelines for Informed Consent'(Human Research Ethics Committee, Faculty of Health Sciences, 2016). All research participants were provided with an information sheet and consent form before participating in any parts of this study. The information was provided in English, which was deemed appropriate as all the participants involved in this study attended a university that has English as the primary medium of instruction.

7.1.2.Confidentiality

Privacy and confidentiality of the research participants were addressed in the following ways:

Delphi study:

All participants of the Delphi study were provided with unique participant numbers to main their anonymity.

Focus Group Discussions:

Ensuring anonymity during FGDs is not possible as it inherently involves multiple individuals. It was made explicit that anonymity within the focus group discussions cannot be guaranteed and that I appealed to the participants to respect each other's confidentiality. The confidentiality of the research participants was maintained during the write up of the thesis by assigning a number to each participant; during the focus group, any reference to a participant was made via the assigned number.

Semi-structured Interviews:

The confidentiality of the research participants was maintained during the write up of the thesis by assigning a number to each participant; during the interviews, any reference to a participant was made via the assigned number. The data was stored on a password-protected hard drive. Only the primary researcher has access to this file. As participants numbers were used during the interviews, the independent transcriber only had access to pseudonym protected information. The transcripts were kept on a password protected hard drive in my home office during the duration of the study.

Finally, there are no financial biases which the researchers need to declare and all efforts will be made to ensure that personal biases do not influence the process or results of the study. Upon completing the final write up of the thesis, all audio and written data will remain securely stored according to relevant guidelines in UCTs data management policy.

7.1.3. Reimbursement

Providing refreshments is considered good practice when conducting focus groups. As a result, a snack platter, juice, and water were made available during the FGD. No other reimbursement was offered.

Chapter 5: Findings and Discussion

5.1. Introduction

In this chapter, I present the findings and discussion of this thesis. To facilitate the process, the findings are initially presented according to the data collection phases (Phases 1 and 2) in which the data was collected. To complement this process and in a bid to present the data more succinctly; the data was analysed at three levels i.e. Level 1 analysis, Level 2 analysis, and Level 3 analysis.

Level 1 analysis was primarily descriptive in nature, the aim of which was to give a descriptive account of what the data revealed. During Level 2 analysis the aim was to move past a simple description of the data to evaluating the data concerning the literature review and theoretical framework; and during Level 3 analysis the aim was to provide a critical contribution to existing theories applicable to this phenomena through critique and contestation (Samuel, 2019).

Additionally, the data analysis was deductive as the interview questions had been aligned to the research objectives which were underpinned by a theoretical framework. Finally, as the findings and subsequent discussion of any study are greatly influenced by the methodology employed by that study, it is recommended that the reader reads this chapter in conjunction with the methodology chapter.

5.2. Delphi study

The process of data collection for the Delphi study started in September 2018 with the first round and concluded in August 2019 with the third and final round. Round 1 specifically dealt with the qualitative gathering of opinions under the formulated headings. Round 2 focused more on creating consensus among the multi-disciplinary expert panel and refining that consensus through a Likert-scale rating system. Round 3 allowed the contributors of Round 1 an opportunity to comment on the data refined during Round 2 by the multi-disciplinary expert panel.

5.2.1. Delphi study round 1

During Round 1 of the Delphi study, the focus was 'To identify the competencies required by undergraduate medical students for managing acute care cases within a South African in-hospital environment – Objective 1. The survey had n:37 respondents (Emergency Medicine registrars), which equates to a 45 % response rate. The inclusion criteria, as well as the motivation for selecting the EM registrars, is discussed in the methodology chapter.

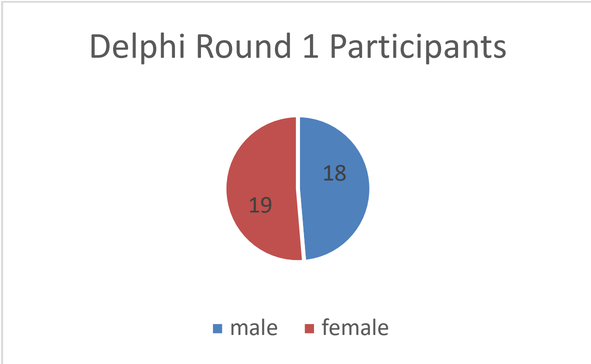


Figure 6: Gender of round 1 Delphi respondents

Participants obtained their undergraduate medical degree from various universities (graph below).

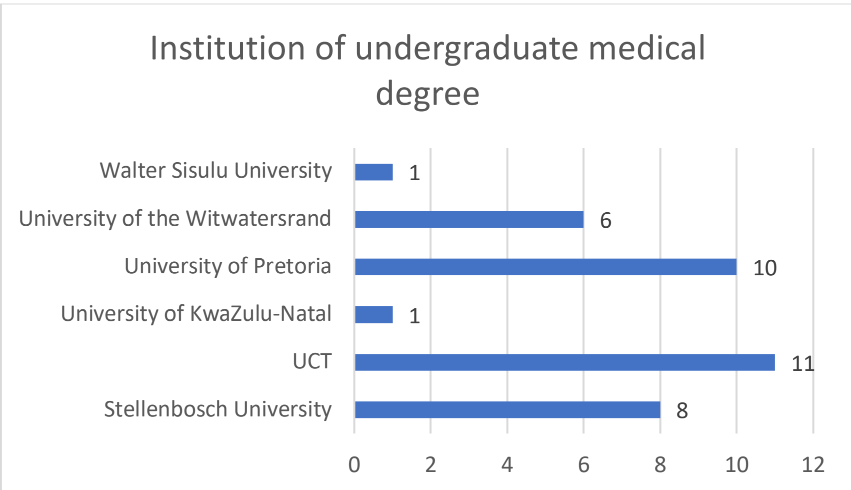


Figure 7: Undergraduate medical institution attended

Theses participants were enrolled at one of the following emergency medicine programmes currently offered in South Africa (see table below):

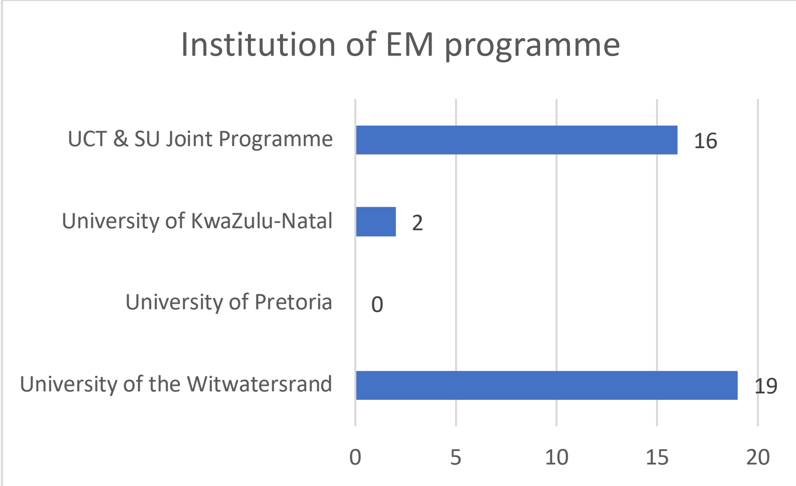


Figure 8: EM specialization programme attended

The demographics of the survey participants represent a diverse spread of the universities offering the MBChB programme as six of the nine medical programmes currently in South Africa were represented. Despite having no participants from the University of Pretoria (UP) participate during Round 1 of the Delphi study; n:10 of the participants from the remaining three of the four programmes which offer EM as a specialist's programme completed their undergraduate medical degree at UP.

The survey (online and paper-based) provided participants with headings and subheadings. Participants were invited to provide "Knowledge"- referring to the cognitive or mental abilities used to process or retain information, "Skills" – referring to the physical abilities to perform activities or tasks , and "Attitudes" – referring to feelings and/or emotions about something or someone, under the various headings.

These contributions were analysed and synthesised and provided to the experts in round 2 of the Delphi study. The process of analysis and synthesis was conducted in the following manner. For example: under the heading "Airway- Knowledge" there were 19 contributions provided. Of these 19, many of these contributions were the same; in cases where there were duplications, the duplication was removed. During this round, no outliers were removed. This process was repeated for all the other headings (Circulation, Confusion and Coma…) and sub-headings (Knowledge, Skills, Attitudes).

The table below depicts the number of corresponding contributions provided by the participants. The motivation for the headings and subheadings is explained in the methodology chapter.

Table 5.1. Acute Care Competencies Contributions per category

	Knowledge contributions	Skills contributions	Attitudes Contributions
Airway and Ventilation	19	10	12
Circulation	17	17	10
Confusion and Coma	10	13	9
Drugs, therapeutics and protocols	10	7	6
Infection and inflammation	12	18	7
Clinical examination, monitoring and investigations	10	11	6
Patient and Societal needs	11	7	9
Trauma	9	19	9
Equipment	8	10	7
Team-working, organisation and communication	8	8	9
Other	0	0	0
Total	**114**	**120**	**84**

5.2.2. Delphi study round 2

During Round 2 of the Delphi study, the competencies provided during Round 1 were synthesised and provided to a multi-profession healthcare team via an online survey. The objective of this round was to try to establish agreement of opinion through a 5-point Likert-scale. As a reminder, the scale had the descriptions as indicated in the table below:

1	**2**	**3**	**4**	**5**
Highly appropriate	Appropriate	Undecided	Inappropriate	Highly inappropriate

The demographics of the multi-professional healthcare team are presented below.

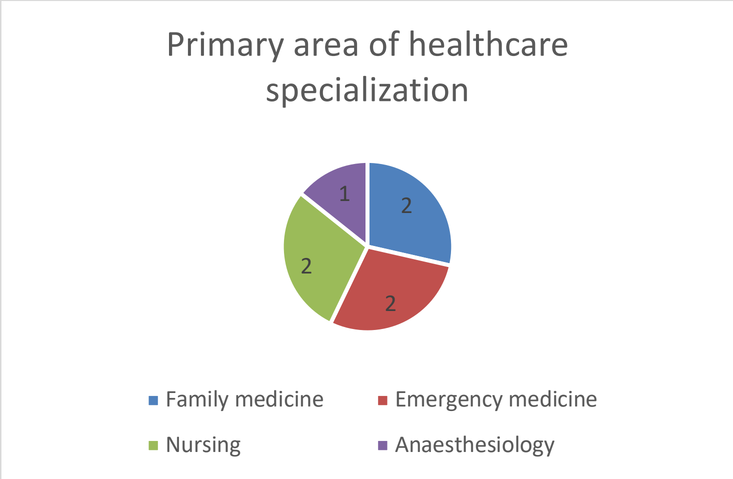


Figure 9: Primary Area of Healthcare Specialization

The information was analysed using the level of agreement/disagreement and the results are presented below:

Table 5.2. Mean Score of Likert Scale vs. Strength of Agreement

Mean score (Likert score)	Strength of agreement or non-agreement
1 – 1.7	Strong Agreement
1.8 - 2.5	Agreement
2.6 – 3.4	Undecided
3.5 – 4.2	Disagreement
4.3 – 5.0	Strong Disagreement

The table below (Table 5.3) presents the results of round 2 of the Delphi study. It relates to the competencies collated during round 1. Furthermore, the table highlights the strength of agreement or no-agreement (Table 5.2) amongst the expert grouping despite their differing healthcare specialities. These results could be attributed to the fact that the curriculum relates to undergraduate medical education as opposed to post-graduate specialist training where greater disparity might be present. These results are discussed further in-depth during level 2 and 3 analysis.

Additionally, even though these experts were allowed to add, remove, or alter the contributions provided by the round one contributors, no additions, removals, and/or alterations were made.

Table 5.3. Results of the round 2 Delphi Study

Airway and Ventilation	Mean Score
Describe the basic anatomy and variations of a patient's airway.	1.1
Demonstrate the ability to effectively evaluate a patient's airway in the acute setting.	1.0
Demonstrate the ability to use oxygen administration using various delivery devices.	1.3
Demonstrate the ability to perform basic airway manoeuvres (Jaw Thrust, head-tilt-chin-lift).	1.0
Demonstrate the ability to inserting basic airway adjuncts.	1.0
Demonstrate the ability to perform adequate bag-valve-mask (BVM) ventilation.	1.0
Demonstrate the ability to perform endotracheal intubation.	1.3
Describe the potential complications associated with intubation.	1.3
Demonstrate the ability to set up a mechanical ventilator for the acutely ill patient.	1.7
Demonstrate the ability to implement lung-protective ventilation strategies in the acutely ill patient.	1.6
Demonstrate the ability to insert a supraglottic airway device.	1.4
Demonstrate the ability to perform surgical Cricothyroidotomy.	2.1
Circulation	
Describe the anatomy and physiology of the circulatory system.	1.1
Demonstrate safe and effective intravenous (IV) cannulation.	1.0
Demonstrate safe and effective Intraosseous (IO) cannulation in:	-
I. Adult patient	2.0
II. Paediatric patient	1.6
Demonstrate safe and effective Central Venous Catheter (CVC) insertion.	2.4
Describe and demonstrate the management of shock.	1.1
Describe and demonstrate the management of hypertensive emergencies.	1.3
Demonstrate the safe and effective use of synchronised cardioversion.	1.4
Demonstrate the safe and effective use of transcutaneous pacing.	2.6
Demonstrate the safe and effective application of vagal manoeuvres.	1.7
Describe the principles of haemorrhage control in the acutely ill patient.	1.0
Demonstrate the management of cardiac arrest.	1.1
Demonstrate the ability to administer fluids (including blood products) during the resuscitation of a critically ill patient.	1.4
Demonstrate the ability to commence inotropic support in the acutely ill patient.	2.1
Confusion and Coma	
Describe the anatomy and physiology of the neurological system.	1.3
Describe the common causes of altered level of consciousness.	1.1
Describe and demonstrate the management of cerebrovascular accident (CVA) emergencies	1.1
Demonstrate the ability to conduct systemic (1.0) a general neurological examination.	1.1

Demonstrate the effective airway management strategies in the confused/comatose patient.	1.3
Demonstrate the ability to effective mechanically ventilate a patient with a traumatic brain injury (TBI).	1.6
Demonstrate the ability to conduct a Glasgow Coma Scale (GCS) assessment.	1.1
Demonstrate the ability to test for brain stem death.	1.9
Demonstrate the ability to safely restrain the confused patient.	1.1
Approach the confused/comatose patient in a non-judgemental manner.	1.3
Know when to call for help.	1.0
Drugs, Therapeutics and Protocols	
Demonstrate the preparation and initiation of various infusions.	1.3
Demonstrate the ability to administer medications via various routes of administration (IV, IM, PO etc.)	1.1
Describe the general prescription principles.	1.1
Demonstrate the ability to interpret and implement an algorithm/protocol.	1.0
Describe the common resuscitation drug dosages.	1.7
Describe the common medications used during rapid sequence intubation (RSI).	1.1
Describe the common medications used during cardiopulmonary resuscitation (CPR).	1.1
Describe the commonly used antibiotics in the management of the acutely ill patient.	1.4
Describe the common emergency protocols (BLS-HCP, ACLS, PALS).	1.4
Demonstrate an awareness and implementation of memory aids (hardcopy and electronic).	1.1
Be mindful that pharmacology is everchanging.	1.4
Infection and inflammation	
Describe the general principles of infection and inflammation.	1.4
Describe the common pathogens.	1.4
Demonstrate the ability to effectively apply an N95 face mask.	1.3
Describe the principles of safe antibiotic stewardship.	1.3
Describe the pathophysiology of sepsis.	1.3
Describe the general principles of infection and infection control.	1.1
Demonstrate the ability to effectively manage a patient in sepsis.	1.0
Demonstrate effective hand washing technique.	1.0
Demonstrate the ability to effectively don appropriate personal protective equipment (PPE).	1.3
Demonstrate aseptic gloving techniques.	1.1
Demonstrate the ability to implement 'goal-directed therapies.'	1.1
Clinical Examination, Monitoring, and Investigations	
Describe the basic surface anatomy.	1.1
Demonstrate the ability to conduct common clinical examination techniques.	1.0
Describe the general patient monitoring techniques (Blood pressure, oxygen saturation etc.).	1.1
Demonstrate how to perform the following procedures:	-

I. Blood culture	1.0
II. Lumbar puncture	1.1
III. Urinalysis	1,0
IV. Abscess drainage	1.4
V. Phlebotomy	1.1
VI. Intravenous cannulation	1.0
VII. Fine needle aspiration	1.9
VIII. Blood gas interpretation	1.3
IX. Ultrasound	2.0
X. ECG application and interpretation	1.3
XI. Chest x-ray interpretation	1.3
Demonstrate effective auscultation technique.	1.1
Patient empathy and respect while conducting an examination.	1.0
Patient and societal needs	
Demonstrate the general principles of breaking bad news.	1.3
Describe the common referral pathways.	1.1
Be culturally and socially aware.	1.3
Demonstrate effective counselling skills.	1.6
Describe 'Batho Pele' principles.	1.7
Demonstrate the approach to a sexual assault victim.	1.1
Describe the signs and symptoms of abuse (child and elderly).	1.4
Describe the general principles of the biopsychosocial approach.	1.1
Demonstrate the principles of confidentiality.	1.3
Describe the principles of ethical medical practice,	1.3
Trauma	
Describe the anatomy and physiology of organ systems.	1.1
Demonstrate the approach to the "trauma" patient.	1.3
Describe the principles of blood transfusion.	1.3
Demonstrate the principles of burn wound management.	1.3
Demonstrate the management of the 'polytrauma' patient.	1.4
Demonstrate airway management techniques in the trauma patient.	1.1
Demonstrate the principles of c-spine immobilization.	1.1
Demonstrate the management of shock.	1.1
Demonstrate how to perform the following procedures:	-
I. Intercostal chest drains (ICD) insertion	1.4
II. Pelvic binding	1.6
III. Fracture splinting	1.3
IV. Basic suturing techniques	1.1
V. Intraosseous (IO) cannulation	1.7
VI. Wound care techniques	1.3
VII. Haemorrhage control methods	1.1
VIII. Needle thoracentesis	1.3
IX. Fracture reductions	1.6
X. Extended focused assessment with sonography for trauma (efast)	2.3

Equipment	
Demonstrate the ability to check common equipment for operation and troubleshooting	1.3
Demonstrate safe and effective usage of the following equipment:	-
I. Manual defibrillator	1.1
II. Mechanical ventilator	1.7
III. Bag-valve-mask (BVM)	1.0
IV. Ultrasound machine	1.9
V. Arterial blood gas (ABG) machine	1.4
VI. Syringe drivers/infusion pumps	1.6
Demonstrate a sense of respect for the equipment.	1.1
Appropriate and judicious use of equipment.	1.3
Teamwork, Organisation, and Communication Skills	
Demonstrate the principles of 'closed-loop' communication.	1.4
Demonstrate conflict resolution skills.	1.4
Describe the principles of debriefing.	1.7
Demonstrate effective skills in giving feedback.	1.4
Demonstrate effective team leader skills.	1.4
Demonstrate the ability to work within a team.	1.3
Demonstrate the ability to adapt to various situations.	1.1
Maintains professional attitudes and relations with colleagues.	1.1

5.2.3. Delphi study round 3

The purpose of Round 3 of the Delphi study was to provide the Round 1 contributors with an opportunity to review the competencies developed through the consensus process of Round 2 experts. The Round 1 contributors were allowed to anonymously comment on these competencies and suggest modifications. The Round 1 contributors were emailed to the email address provided during the recruitment process. Despite the link being available for 14 days, no additional contributions were made by the round 1 contributors. For the purpose of this research, the absence of additional responses during round 3 was interpreted as the round 1 respondents being satisfied with the contributions made in round 2.

5.3.Delphi Study: Level 1 analysis

As Level 1 analysis is primarily descriptive, the aim was to give an in-depth descriptive account of the data. During round 1 of the Delphi study, n=34 emergency medicine registrars contributed a total of n=318 contributions across the "knowledge", "skills", and "attitudes" domains.

The round 2 of the Delphi study produced a diverse range of competencies across various categories. In terms of agreement, all of the competencies had "Strong agreement" or "Agreement" in terms of consensus amongst the round 2 research participants.

5.4. Delphi study: Level two analysis:

Level 2 analysis sought to evaluate the data concerning the reviewed literature and theoretical framework (Samuel, 2019). To this end, seeing as the 'Acute Care Undergraduate Teaching (ACUTE) Initiative' (Perkins et al., 2005) was pivotal in the motivation for conducting this study, it would follow that this is an appropriate point of departure for the Level 2 analysis of the Delphi study. Both studies looked at the acute care clinical skills competencies at an undergraduate level. However, the key distinction was the context within which the study was conducted. The ACUTE Initiative was conducted in the United Kingdom (U.K.) whereas this study was conducted in South Africa. It must be noted that the purpose of this comparison was not to determine whether one curriculum is superior to the other, but rather that geographical location, patient demographics, healthcare system priorities and many other factors all play a role in identifying the competencies required to address the local healthcare needs and that simply transferring competencies developed in another context could be problematic. Furthermore, it must be noted that the ACUTE study was published in 2005, which in itself would account for much of the differences in competencies as the required competencies of a healthcare system changes over time. Despite this, I argue that there is still value in interrogating the original ACUTE initiative study, as it was pivotal in the conceptualisation of Phase 1 of this thesis. To supplement the discrepancies in the original study (namely, geographical location, differences in data collection period) and in the absence of a more recent ACUTE study, I interrogated more recently developed curricula abroad such as the 'Outcomes for graduates-2018' as published by the General Medical Council (GMC) of the UK (GMC, 2018) as well as curricula that are geographically closer such as Zimbabwe (Mtombeni, 2018). Interrogating studies such as the one by Mtombeni et al. was important as it was conducted in an LMIC context, it is important to note that "LMIC" extends past the economic implications, but includes the

social, cultural and in this case colonial implications, I elaborate on this throughout this chapter, and in the literature review chapter.
Finally, as comparisons between other studies was not an objective of the study, the comparisons made with the various studies are not meant to be exhaustive, but rather are used to highlight the importance of local context when developing a curriculum. Additionally, the competencies developed from the Delphi study served as a foundation on which to explore the role that SBME has within undergraduate medical education in South Africa.

During the process of interrogating the data, there were areas of overlap between ACUTE Initiative and the competencies emanating from this study; however, more interestingly, there were distinct areas where they differed. The table (Annexure 5) illustrates the areas of commonality (highlighted in green) and differences (unshaded) under the various headings.
Objective 2 'To explore what acute care clinical competencies would lend themselves to a medical simulation modality within a South African tertiary education environment'). Greater discussion on this is provided during the Phase 2 analysis discussion.

The table depicts similarities across fundamental categories such as 'Airway', 'Breathing and Oxygenation', and 'Circulation', which is somewhat expected as many of these competencies have been considered as core across various medical curricula. For example, competencies such as, 'Demonstrate the ability to effectively evaluate a patient's airway in the acute setting' and 'Demonstrates safe use of simple airway manoeuvres /adjuncts (head-tilt, chin lift, suction, Guedel, Nasopharyngeal airway)' have been the mainstay of undergraduate acute care clinical skills curriculum at many undergraduate medical institutions.

Additionally, it is evident that many of the headings have some striking differences; for example, the list of 'Trauma' competencies developed from the Delphi study is more extensive. Some of the possible explanations could be attributed to the higher trauma-related injuries experienced in South Africa compared to the rest of the world. One study found that in SA, injury-related mortality rates are six times, and road traffic injuries double, the global rate (Saggie, 2013). Consequently, the competencies developed through the Delphi study reflect the competencies necessary to manage the higher levels of trauma experienced in South Africa. These competencies include practical skills such as ‘fracture splinting’, basic suturing, etc. but also more holistic trauma competencies such as ‘management of the polytrauma patient’, and ‘airway management in the trauma patient’.

When interrogating a study conducted within a healthcare system more akin to SA, in terms of resource availability, an M.Med thesis by Mtombeni (2018) titled ‘Identifying the procedural core competencies for undergraduate emergency medicine education at the University of Zimbabwe College of Health Science’, 98 core competencies were described. There were areas of overlap between her study and the competencies developed in this study, particular around ‘Resuscitation’ competencies, as well as ‘Airway, Breathing, and Circulation’ competencies; however because her study only looked at procedural skills, it omitted addressing any of the attitudinal and behavioural competencies required by undergraduate medical students.

Under the heading ‘Patient and societal needs’, this trend continues; as the Delphi study not only presented a more extensive list of competencies, but also a more culturally diverse set of competencies. The list of competencies under this heading included contributions such as, ‘Describe the signs and symptoms of abuse (child and elderly), ‘Demonstrating the common referral pathways’, and ‘Describe the general principles of the biopsychosocial approach’; but also included some uniquely South African contributions such as ‘Describing the ‘Batho Pele’ Principles’.

‘Batho Pele’ which is a Sotho-Tawana word loosely translated as ‘People First’ is a South African governmental initiative first introduced in 1997 to improve the delivery and services to the public; furthermore, it seeks to enhance the quality and accessibility of government services by improving efficiency and accountability to the recipients of public goods and services (“Batho Pele - Putting people first,” 2005; James & Miza, 2015).

Batho Pele requires that these 8 service delivery principles be implemented:(“Batho Pele - Putting people first,” 2005), namely: regular consultation with clients, predetermined set service standards, increased access to services, ensure increased courtesy levels, improved service information, improved service transparency, willingness to remedy failures and mistakes and, increased value for money.

The inclusion of these competencies highlights that the participants recognise the importance of a patient-centred approach to patient care, which has been adopted by an increasing number of medical institutions around the world (Barr et al., 2014).

Also under the heading of “Patient and Societal needs”, one of the major inclusions not represented in the ACUTE Initiative was around Sexual Assault- ‘Demonstrate the approach to a sexual assault victim’, and Abuse – ‘Describe the signs and symptoms of abuse’. As mentioned earlier in this chapter, the omission of these competencies could be attributed to various factors, such as differences in referral pathways, varying patient demographics, and the available allied health resources within a given health system. The point that the researcher wishes to convey is not so much the omission of the competencies in the Acute study, but rather advocate for the inclusion of these specific competencies in the SA curriculum.

Violence against women is a major global health issue (Daher, 2003); The World Health Organization (WHO) estimates that 35% of women worldwide have experienced physical or sexual violence. The highest rates of non-partner sexual violence are in industrialized countries and Africa, with a lifetime prevalence of 12.6% and 11.9%, respectively (Gonsalves et al., 2015; WHO, 2013). Closer to home, South Africa has one of the highest rates of sexual assault against women and children in the world with one in five female homicides and nearly one in ten child homicides identified with an associated sexual crime (Abrahams, Mathews, Lombard, Martin, & Jewkes, 2017).

The inclusion of competencies around sexual assault is supported by the study by Mtombeni (2018) who as part of her core competencies, included ‘Examination of sexual assault victims’ as a core procedural skill for undergraduate medical students at the University of Zimbabwe College of Health Science. Zimbabwe, like South Africa, has a higher incidence of sexual assault as compared to the global figures, as, according to the Zimbabwe National Statistics Agency, Zimbabwe experiences an average 21.2 rape cases per day (ZimFact, 2019). In response, there have been increasing calls advocating for the inclusion of sexual violence education in the undergraduate medical curriculum (Kennedy, 2014) as these victims often present to the emergency department for treatment (Loder & Robinson, 2020).

Also under this heading, one of the competencies suggested by the respondents to the Delphi study was 'Describe the general principles of the biopsychosocial approach'.
The biopsychosocial approach is a philosophical view in which suffering, disease, and illness are viewed through a lens which recognises that multiple levels of organization, from the societal to the molecular, influences it. At a more practical level, it is a perspective of recognising that the patient's subjective experience is an important contributor to accurate diagnosis, health outcomes, and humane care (Epstein et al., 2004). The results of the Delphi study illustrates a more holistic view of patient care which augments procedural skills with societal and cultural aspects of patient care.

When interrogating more recent guidelines published by the GMC- UK, many of the more holistic competencies initially omitted from the ACUTE study have subsequently been included around the concepts of equality and diversity within medicine (GMC, 2016, 2018). This demonstrates an awareness by regulatory bodies that simply addressing the knowledge and skills deficiencies is not sufficient to address the complex needs within a modern healthcare system. The inclusion of these competencies is crucial within modern medicine as is illustrated through the biopsychosocial approach to healthcare which considers the interplay between biological, psychological and social factors and the complex effect these have on illness and disease (Epstein et al., 2004). Consequently, the adoption of a more holistic approach to healthcare education has important implications for an undergraduate medical simulation curriculum as it highlights the urgency for medical simulation curricula to incorporate competencies training which surpasses the traditional procedural skills only training in which medical simulation has historically been utilised.

It must be noted that it is unclear whether the competencies provided by the experts are representative of what is appropriate for an undifferentiated medical practitioner who is yet to complete an internship or whether the competencies provided are as a result of a failing apprenticeship model, one in which students are inadequately supervised and expected to perform skills above their competencies. Either way, the literature suggests that students are performing invasive procedures without the necessary supervision (Bola et al., 2015; Katowa-Mukwato et al., 2014), and I argue that there is an inherent responsibility of medical programmes to adequately prepare their graduates for what they are realistically going to encounter. This was part of the motivation of approaching EM registrars as an initial source of data collection, as they have a lived experience as to what competencies they encountered whilst engaging with the clinical environment.

There is an urgent need to adequately prepare newly qualified medical doctors for practice (Monrouxe et al., 2018). This need is exacerbated within developing world contexts where resources are generally constrained and the healthcare system is under tremendous strain. The current model of medical training within South Africa relies heavily on collaborative work within the clinical environment, meaning that any strain on the healthcare system will most likely result in less than optimal conditions for learning to take place in that system. Through interrogating the findings of the Delphi study as well as the existing literature (albeit scarce), I was able to formulate a comprehensive list of competencies (knowledge, skills, and attitudes) that is locally relevant and addresses the needs of undergraduate medical students.

5.3. Focus group discussion and Semi-structured interviews

Qualitative research requires methodically rigorous approaches to produce meaningful results. Thematic analysis, a data analysis method, is considered a foundational analysis method within the qualitative research paradigm (Nowell et al., 2017). This being said, as is the case with any analysis method, it has its strengths and weaknesses. The degree of flexibility which thematic analysis provides allows it to be modified to suit the requirements of many studies, producing a detailed account of the data (Braun & Clarke, 2006; Nowell et al., 2017). Thematic analysis is useful for exploring the insights of the research participants by highlighting the similarities and differences and generating unanticipated insights (Braun & Clarke, 2006). This positions it ideally for this research as it sought to accomplish just that. Despite thematic analysis affording a degree of flexibility, if the epistemological position is not made clear when developing the themes from the data, it can lead to inconsistency and lack of coherence (Holloway & Todres, 2003).

5.3.1 Analysis process

The data from the FGD and semi-structured interviews were analysed using a 6 Phase process proposed by Nowell et al.(Nowell et al., 2017).

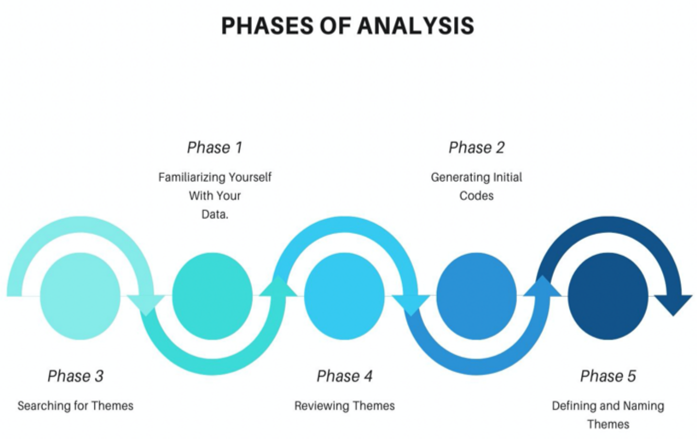


Figure 10: Phase of Data Analysis

Phase 1: Familiarizing yourself with the data

During Phase 1, the emphasis is placed on being immersed and familiarizing oneself with the data. The FGD and interviews were audio-recorded and independently transcribed into

Microsoft Word documents. I did a complete 'read-through' of the transcripts to gain a global impression of what the overall impression of the transcripts was. To become immersed in the data involved the repeated reading of the data, actively searching for meanings and patterns. It is recommended that the researcher reads through the complete data set uninterrupted before commencing the coding process, as ideas and patterns are shaped through familiarising oneself with the various aspects of the data (Braun & Clarke, 2006), being mindful to remain vigilant and honest while providing a true account of the data. Qualitative data comes in various formats (field notes, audio recordings, transcriptions etc.) which can present the researcher with tremendous volume as well as complexity (Dey, 1993). To make the data analysis process more manageable, the transcripts were entered into NVivo 12 software and labelled appropriately.

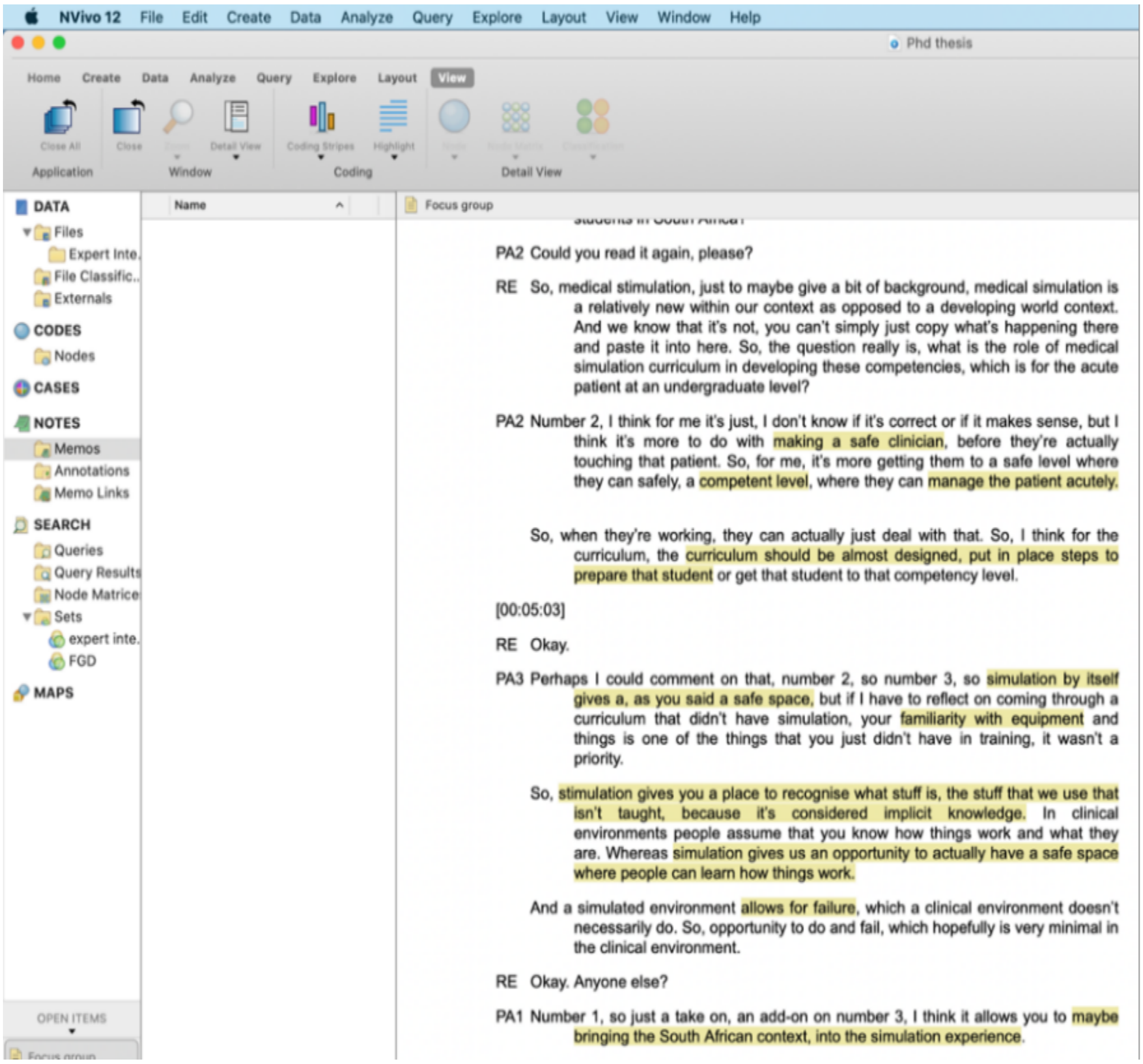
Phase 2: Generating initial codes

Once I had gained a thorough global impression of the data, I proceeded to Phase 2. During this phase, I recorded my initial reactions, which Henning et al. (2004) describe as '*open coding*'. It is important to note that because this study implemented deductive thematic analysis; even this "open coding" was viewed through a constructivism lens. I have provided an annexure of the coding framework to illustrate the this. This phase involves the initial production of codes from the data, a theorizing activity that requires the researchers to keep revisiting the data (Nowell et al., 2017).

Qualitative coding is a process of reflection and a way of interacting with and thinking about data (Savage, 2000). Coding allows the researcher to simplify and focus on specific characteristics of the data (Nowell et al., 2017). During this phase, I moved from unstructured data to the development of ideas about what was going on in the data.

I identified important sections of the data and assigned a 'code' to them using the NVivo 12 software. These important sections were influenced by the research objectives, literature review and theoretical framework.

The image below depicts an example of the initial coding done:



It is recommended to work systematically through the entire data set, whilst providing a full account and equal attention to each data set while identifying aspects in the data items that can form the foundation of themes across the data set (Braun & Clarke, 2006; Nowell et al., 2017). The researcher should ensure that codes have explicit boundaries. The boundaries for this study were influenced by the research aims and objectives. (Nowell et al., 2017).

Phase 3: Searching for themes

During Phase 3, I sorted all the codes identified during the previous phases and collated the potentially relevant codes into themes (Braun & Clarke, 2006; Nowell et al., 2017). A theme as described by DeSantis and Ugarriza (2000) is “an abstract entity that brings meaning and identity to a recurrent experience and its variant manifestations. As such, a theme captures and unifies the nature or basis of the experience into a meaningful whole" (p 362). In other words, themes constructed when combining components or fragments of ideas together, which when viewed in isolation could be relatively insignificant (Nowell et al., 2017). Themes are not dependent on quantifiable measures (as is the case with quantitative research) but rather on whether it is relevant to the research objectives.

Themes can be generated inductively or deductively. Through an inductive approach, the identified themes are directly linked to the data themselves and might not be directed to specific questions presented to the participants, whereas with a deductive approach the analysis is guided by the researchers' theoretical or analytic interest which may provide a more detailed analysis of some aspect of the data (Nowell et al., 2017). The themes for this research project were constructed through a process of deductive thematic analysis as they were guided by the research questions which were informed by the literature review and theoretical framework.

Phase 4: Reviewing themes

This phase commences once a set of themes have been generated, and require additional refinement. The purpose of this phase is to review the coded data extracts for each theme and consider whether the codes form a coherent pattern. The validity of the themes is considered to determine whether the themes accurately reflect their meanings from the data set as a whole (Braun & Clarke, 2006; Nowell et al., 2017). Themes may need to be re-coded as coding is an iterative process (Braun & Clarke, 2006).

Phase 5: Defining and naming themes

During Phase 5, the aim is to determine what aspect of the data each theme captures and identify what is of interest about the themes and why (Braun & Clarke, 2006). Each theme should be accompanied by a detailed analysis, essentially identifying the story that each theme is telling (Braun & Clarke, 2006; Nowell et al., 2017). Theme names need to provide the reader with some indication of what the theme is about (Braun & Clarke, 2006). During this stage, I developed an overall idea of how each theme fits into the overall story in relation to the research questions (Braun & Clarke, 2006).

The table below depicts the theme names:

Table 5.6. Theme names from Phase 2 (FGD and interviews):

<table>
<tr><th></th><th>Theme Name:</th><th>Addresses:</th><th>Objective</th></tr>
<tr><td>1</td><td>Foundational Competencies</td><td rowspan="3">Competencies which lend itself to simulation</td><td rowspan="3">Objective 2</td></tr>
<tr><td>2</td><td>Contextually- Standardised Competencies</td></tr>
<tr><td>3</td><td>Teamwork</td></tr>
<tr><td>4</td><td>Clinical Platform Integration</td><td rowspan="3">Role</td><td rowspan="3">Objective 3</td></tr>
<tr><td>5</td><td>Feedback</td></tr>
<tr><td>6</td><td>Interprofessional Education (IPE)</td></tr>
<tr><td>7</td><td>Human Resource Constraints</td><td rowspan="3">Limits and Possibilities</td><td rowspan="3">Objective 3</td></tr>
<tr><td>8</td><td>Lack of Curriculum Time</td></tr>
<tr><td>9</td><td>Stakeholder Buy-in</td></tr>
</table>

Phase 6: Producing the Report

During this phase, the final Phase, themes should be fully established and the researcher should be ready to embark on the final write up of the report (Braun & Clarke, 2006; Nowell et al., 2017). The onus is on the researcher to ensure that the write-up is a concise, coherent, logical, nonrepetitive, and interesting account of the themes (Braun & Clarke, 2006). In a bid to ensure that the findings are presented in a concise, coherent, logical manner, the findings are presented according to the research objectives, namely:

1) To identify the competencies required by undergraduate medical students for managing acute care cases within a South African in-hospital environment;
2) To explore what acute care clinical competencies would lend themselves to a medical simulation modality within a South African tertiary education environment
3) To explore the role, including the limits and possibilities, of medical simulation as an educational modality in developing acute care clinical skills curriculum within a South African tertiary education environment.

Finally, the use of direct quotes from the data set is essential during the write up of the final report, and quotations can be included to convey meaning to points of interpretation (King, 2004). It is for this reason that direct quotations from the participants have been employed in this thesis write-up. The FGD and semi-structured interviews were analysed using the 6-phase approach outlined above. The following pages provide a detailed account of each theme, as well as the evidence supporting that theme.

5.3.2. Phase 2 analysis: Focus Group and Expert Interview Discussion Findings:

During Phase 2 of this study, a FGD (N:1) and semi-structured interviews (N:5) were conducted with experts (see Methodology Chapter). This phase addressed objectives 2 and 3 of the study, namely,

2. To explore what acute care clinical competencies would lend themselves to a medical simulation modality within a South African tertiary education environment.

3. To explore the role, including the limits and possibilities, of medical simulation as an educational modality in developing acute care clinical skills curriculum within a South African tertiary education environment.

Note: During the conception and early phases of this study, it was envisioned that the FGD and semi-structured interviews would be two separate phases. However, due to the low FGD participant numbers, the decision was made to reanalyse the data across the FGD and interviews. I discuss this further under the headings “Study design” and “Limitations of the study”. The FGD and semi-structured interview participant’s excerpts are represented with the prefix “FG-P” and “I” respectively

Phase 2 – Focus Group Discussion

The table below provides a brief synopsis of the participants.

Participant number	Profession title	Additional notes	Interview Duration
Participant 1 (FG-P1)	Head of Department: Emergency Medicine	Holds various senior roles within emergency medicine. Special interest in education	39 Minutes
Participant 2 (FG-P2)	Technical officer – Simulation centre	Involved in the design and implementation of medical simulation	
Participant 3 (FG-P3)	Lecturer – Emergency Medical care	Extensive simulation experience in South Africa and abroad	

The participants were briefed on the study and the necessary documentation was completed. I facilitated the FGD and was guided by the FGD interview guide (Annexure 2)

Phase 2 – Expert Interviews

Semi-structured interviews were conducted in person with a total of 5 key experts within the field of health education and medical simulation (see methodology chapter). The experts, at the time of writing this thesis, were employed at four of the medical institutions in South Africa and are all directly involved with curriculum development at the undergraduate level.

As a reminder, the table below again provides an overview of the interview participants:

Table 5.6. Semi-structured Interviews participant overview

Participant number	Profession title	Additional notes	Interview Duration
Participant 1 (I-1)	Head of Simulation Centre	PhD (Health Professions Education)	52 minutes
Participant 2 (I-2)	Chief Technical officer – Simulation centre	Masters (Health Professions Education)	37 minutes
Participant 3 (I-3)	Head of Simulation Unit	PhD (Health Professions Education- Clinical simulation)	41 minutes
Participant 4 (I-4)	Simulation Coordinator (SSH accredited program)	PhD	57 minutes
Participant 5 (I-5)	Academic Coordinator- Rural health care	MBChB	25 minutes

All the interviews were guided by the interview guide (Annexure) and were audio-recorded.

5.4 Discussion of Themes

5.4.1. Theme 1: Foundational Competencies

The first theme constructed from the data codes was around the concept of 'Foundation Competencies.' This theme was constructed from the codes; 'foundation,' 'familiarity with equipment' and 'basic competencies.' Quotations below are examples of codes.

As is described in the data analysis process outlined earlier in this chapter, the name of a theme can undergo various revisions.

Annexure 6 provides an illustrative excerpt of my deductive coding framework. This process starts with locating the codes within the theoretical framework, and then progresses until the final theme name is constructed.

During the initial data analysis stages, the researcher presented 'Foundational knowledge' as a theme name. However this name proved inadequate in capturing the breadth of what the participants were expressing, namely, the participants were eluding to more than knowledge.

In an attempt to capture what the participants were saying, the theme name underwent various iterations until it reached ' Foundational competencies'. This theme name seemed more appropriate as the word 'Foundational' spoke to the idea that medical simulation has a role in developing 'new' competencies, and 'Competencies' addressed the fact that it can have a role in addressing knowledge, skills, and attitudes.

Codes	Participant Extracts
FOUNDATION	FG-P 2: [about a medical simulation acute care clinical skills curriculum] *… 'curriculum will allow the student to have a **<u>foundation</u>**.'* FG-P 3: [agreeing with P2] …" *I think what you said about **<u>foundation</u>**…So, I don't learn different things, I have a foundation that's the same and standardised."* FG-P 3: … '*I think knowledge, skill and attitude can be taught, I think simulation as a methodology can teach all of those components if structured appropriately. The challenge is always to create, particularly for things like attitude, you can create foundational levels,'* FG-P3: …'*but there's **<u>foundational</u>** elements that can be taught, even in the pre-clinical years*." FG-P3: …" *I think if we used a task trainer to show how are you doing a **<u>foundational</u>** task, that's a much more clean and discrete thing to assess." …* *I think what you said about foundation, it's also teaching things in a standardised way, that doesn't happen in multiple clinical exposures, so that everyone has the same basics.* *I- 5:* And often through that practical exposure we got the hang of some, at least the common,

	procedures. And I think it's good to introduce them first, that when you do the procedure on a patient you've actually tried to do it before on that model *I- 1: If they are in a busy clinical area and a student is there with them, and they would say to the student, have you ever put in an underwater drain, and the student can say to them, I've seen it in the skills lab, I've done it in the skills lab, but I've not done it myself, then I think that is like music in the ears of the doctor. Because then he knows where he's at and at least it won't be a student that will say, oh, what is this forceps for, and what do you do with whatever.*
FAMILIARITY WITH EQUIPMENT	FG-P3:… *'so simulation by itself gives a, as you said a safe space, but if I have to reflect on coming through a curriculum that didn't have simulation, your familiarity with equipment and things is one of the things that you just didn't have in training, it wasn't a priority.'* FG-P2:…*' it doesn't matter what equipment they have, they can go work in Durban, in Stellenbosch, wherever, whatever equipment they have, they'll be able to apply that knowledge or those key competencies just to figure out how the machine works and then adapt to the situation.'*
BASIC COMPETENCIES	FG-P3…*'if we developed this curriculum, … And if we can get broader agreement that is a core competency for basic healthcare practitioners, that would be ideal.'* *'if we can get a kind of common understanding that everyone, from pre-hospital to emergency care providers or nurses, family practitioners, everyone has the same acute care competencies across the health system, then we will be in a much better place.'* *I- 1- core skills are taught in a simulation scenario, that at least from a curriculum point of view we can*

	tick the box to say that they have done it in a simulated environment.

***** The FGD and semi-structured interview participant's excerpts are represented with the prefix "FG-P" and "I" respectively

As Level 1 analysis is primarily descriptive, the aim was to give an in-depth descriptive account of what the data revealed regarding 'Foundational Competencies' (Samuel, 2019). Under the code 'Foundation' it is evident that competencies were viewed as multi-faceted by the experts; this is illustrated from the extract with reference to a medical simulation acute care clinical skills curriculum being able to provide a 'foundation.' This alludes to the fact that medical students, at this stage of their learning (as part of a 6-year programme) require a set of competencies that can be built on in subsequent years (FG-P2). The significance of this 'foundation' to facilitate a student' transition from one phase to another in the programme will be discussed in Level 2.

This participant further refined the concept of 'foundation' to mean the elaboration of specific elements of knowledge, skills and attitudes that can be taught in clinical skills simulation. FG-P3 then augmented the refinement with the necessity of having a 'task trainer' to demonstrate how a foundation task is being performed. The value of task trainers to the learning process and environment in which clinical learning happens is explained in Level 2 analysis. These ideas were supported by the experts in the interviews who felt that it's important to expose the students to the common procedures in a simulated environment before they interact with patients (I-5), and alluding to the fact that practitioners are more comfortable with supervising students performing invasive procedures when they have already been exposed to it in an simulated environment (I-1). I-1 goes on to allude to the fact that an acute care clinical skills medical skills curriculum could reduce the teaching workload of busy clinical practitioners in the clinical areas, by exposing students to core competencies in the simulated environment.

Under the code 'familiarity with equipment,' FG-P3 remarked that although simulation provided a safe space, it has a role in familiarizing students with the various equipment inherent to the acute care clinical skills environment. FG-P2 picked up on this thought and built on it by expressing that a medical simulation curriculum can have a role in the standardization of knowledge across different geographical locations. The importance of a standardized syllabus is elaborated and explained in the Level 2 analysis.

Finally, under the code ' Basic competencies' FG-P3 elaborated on the concept of competencies within the greater health sciences and expanded it to interprofessional competencies that transcend the silos within which education is traditionally offered. FG-P3 goes on to suggest that the healthcare system would benefit from a commonly shared agreement of core competencies irrespective of professional boundaries. These ideas are supported and elaborated on in theme 6 " Interprofessional education". I-1 provided a different context of "basic competencies" by locating it within a specific curricular programme; they expressed that a medical simulation curriculum allowed institutions to ensure that students are exposed to core competencies, albeit in a simulated environment. When analysing the FGD and semi-structured interviews, generally there was a great deal of convergence between the two data sets as is evident from the above codes and participant extracts, with the semi-structured interviewees largely supporting the ideas expressed in the FGD.

Level 2 Analysis: Evaluating the Data

Level 2 analysis seeks to move the past description of the data to evaluate the data in relation to the reviewed literature (Chapter 2) and the theoretical framework (Chapter 4).

Many undergraduate medical programmes, employ a general structure where the initial years of study are predominantly theory-based, often referred to as the preclinical years. This phase is followed by a clinical phase where increasingly more clinical skills training and patient interactions are introduced. Numerous studies have indicated that the transition from the preclinical to the clinical phase has been shown to be the most stressful period of undergraduate medical education (Godefrooij et al., 2010; Moffat & Morrison, 2001); Moss & McManus, 1992; Radcliffe & Lester, 2003), with some studies demonstrating that a clear skills gap exists in the transition from undergraduate to graduate medical education (Blumenfeld et al., 2020). This could be attributed to various stressors, including the students' frustration by their inability to address clinical problems by applying their knowledge in practise (Godefrooij et al., 2010). The experts alluded to the need for what I termed ‘foundational competencies’ and advocated for the role that an undergraduate medical simulation acute care clinical skills curriculum can have in developing those competencies. These are introductory competencies provided to medical students during the early part of their studies which form the basis on which more cognitively demanding competencies are built.

In drawing from my own experience in teaching clinical skills to undergraduate medical students I noticed that upon entering the clinical skills centre from their preclinical years, novice medical students have had limited exposure to the vast array of equipment which they will encounter in the clinical environments, and this can be overwhelming. By simply familiarising the student to the fundamentals of the equipment, it allows the student to convert largely abstract concepts to concrete concepts through a physical hands-on experience with the equipment. Furthermore, students are able to have a physical representation of how inanimate equipment interacts with the human body and the implications thereof. This all occurs under the guidance of a facilitator who can provide direct feedback to the student within their zone of proximal development (ZPD). I provide a detailed discussion of the concept of Vygotsky’s ZPD and the implications for this study during the Level 3 analysis. The students are able to safely experiment with how that piece of equipment interacts with the simulated patient. While there are variances in equipment-based brands and model types, the fundamentals largely remain the same.

A meta-analysis on simulation-based learning in higher education found that introducing simulation during the earlier years “supports the process of restructuring knowledge into higher-order concepts that can be used directly to solve problems” (Chernikova et al., 2020, p. 504).

The clinical environment is inherently unpredictable, and this is exacerbated in the acute care environment as students are confronted with diverse patient presentations and struggle to apply concepts acquired in an abstract theoretical setting to the diverse clinical environment.

Theoretically, Lave and Wenger (1991) argue that “learning should not be viewed as simply the transmission of abstract and decontextualized knowledge from one individual to another, but a social process whereby knowledge is co-constructed” (p. 904); instead learning should be situated in a specific context and embedded within a particular social and physical environment (Lave & Wenger, 1991); I elaborate on these theoretical relationships during Phase 3 analysis.

FG-P3 suggested that an acute care clinical skills medical curriculum can be of benefit to medical students in that it allows the healthcare educator to introduce some degree of repeatability into the inherently uncontrolled clinical environment. The clinical environment is inherently unpredictable (Watmough, Box, Bennett, Stewart, & Farrell, 2016), and as a result, it is challenging to ensure that students experience specific clinical encounters despite them being rostered within the clinical environment. This could result in a disproportionate number of students not being exposed to certain patient presentations. Medical simulation can address this challenge somewhat, by affording educators the ability to roster students to attend simulated training sessions. This ensures that all the students are exposed to the same patient encounter albeit simulated, as opposed to the 'lucky' few which happened to be in the emergency room when the anaphylactic patient entered, for example. This speaks to the challenge of exposing medical students to clinical encounters which are inherently unpredictable. Additionally, the simulated environment affords the healthcare educator the ability to intentionally remove or add some of the 'noise' of the clinical environment.

The 'noise' in this case is not referring to physical noise as is heard by one's ear (although this can be a part of the noise in the clinical environment) but 'noise' referring to complexities inherent to the clinical environment such as cultural and hierarchical dynamics, language, team dynamics, and many more (Watmough et al., 2016). This 'noise,' albeit crucial to be exposed to and ultimately prepared for is important, however, for the novice student entering the clinical environment can lead to cognitive overload. Cognitive overload refers to the amount of information your working memory can manage at one time (Sweller, 1988). Sweller (1988) remarks that, since working memory has a limited capacity, instructional methods should avoid overloading it with additional activities that don't directly contribute to learning. This 'noise' can then be introduced in a controlled manner to limit the chance of cognitive overload. Wood et al.(1976) refers to this gradual introduction of 'noise' as scaffolding, which forms part of a greater concept which Vygotsky refers to as the 'Zone of Proximal Development (ZPD)' (McLeod, 2018). I elaborate on these theoretical relationships during the discussion of Phase 3 analysis. In a study conducted in the UK, the research team showed how this "noise" could be re-introduced in a controlled manner. The Unexpected medical undergraduate simulation training (UMUST) study exposed final year medical students to unexpected emergency scenarios in the simulation centre. The study found that the programme helped to prepare the students as junior doctors in terms of dealing with emergency situations (Watmough et al., 2016).

The South African healthcare system is severely under-resourced and clinicians are inundated with patient management duties. Despite these pressures, clinicians are still required to perform teaching duties to various undergraduate and postgraduate students. As highlighted by I-1, an acute care clinical skills medical curriculum has the potential to significantly reduce the amount of time required to teach students foundational competencies. This valuable time can then be redirected to teaching competencies which are more optimised for the clinical environment. When positioning these limited teaching opportunities within the context of the South African healthcare system, it becomes apparent that any initiatives which have the ability to optimise the learning experience is essential. Widening access to historically excluded students, as well as increasing the numbers of students for medical training, has introduced additional challenges to training students on the SA clinical platform (Khine & Hartman, 2021; Mayosi & Benatar, 2014). Consultants are having to learn to interact with students from different socio-cultural-economic backgrounds, as well as first-generation university students with varying degrees of English language proficiency as junior undergraduates. The Khine and Hartman study, whilst focussing on postgraduate clinical training, demonstrated the importance of a cognitive apprenticeship model in which relationships between clinical consultants as mentors and students as mentees are actively constructed to overcome legacies of Apartheid social divisions. The necessity of sensitivity and awareness for cross-cultural communication practices to promote learning and develop a CoP, becomes even more important as medical undergraduates are increasingly being prepared for internship in their final, sixth year of study on a geographically distributed clinical training platform, traversing different levels of health care delivery (de Villiers et al., 2017; van Schalkwyk, Couper, Blitz, Kent, & de Villiers, 2020). Relational learning is vital in this context (van Schalkwyk et al., 2020).

As the cognitive apprenticeship model is the predominant model for internship training in SA, it is premised on mediation by the facilitator with participation in the CoP and requires meaningful engagement between the medical student and their consultants (Khine & Hartman, 2021; Lave & Wenger, 1991). Therefore, the potential for a reduction in teaching of foundational competencies which can be addressed in an simulated environment, can be beneficial in two ways. Firstly, it can reduce the teaching load of an already strained medical workforce, and secondly, it has the potential to free-up much needed time to foster relationships between students and consultants of the kind that enhance learning.

In conclusion, simulation enables the healthcare educator to introduce some degree of repeatability which students cannot benefit from in the inherently uncontrolled clinical environment. Additionally, medical simulation as a pedagogy is ideally positioned to develop foundational competencies for undergraduate medical students by providing context to largely abstract concepts, as students transition from pre-clinical to clinical years. In combination with the affordance of controlled 'noise' introduction, cognitive overload can be better managed and student stress reduced which all contribute to enhanced learning. Finally, learning on the clinical training platform can potentially be less stressful for both the clinician and student if foundational competencies have been mastered in a simulated environment. Stress reduction is critical in the SA context where an under-resourced health care system is additionally grappling with the complexity of changing social relations arising from the country's Apartheid history.

5.4.2. Theme 2: Contextually- Standardised Competencies

Level 1: Descriptive Findings

The second theme constructed through engaging with the participants was what I termed 'Contextually- Standardised Competencies.' This was expressed in various ways such as 'Allows for South African context;' 'Programme contextualization,' 'Standardization' and 'Shared Competencies.' The quotations below illustrate the analysis of Theme 2.

Codes	Participant Extracts
ALLOWS FOR SOUTH AFRICAN CONTEXT	FG-P1…*' I think it allows you to maybe bring the South African context, into the simulation experience'*
PROGRAMME CONTEXTUALIZATION	FG-P2…'[with reference to introducing simulation into curriculum] *I think different programmes introduce different contexts or different competencies in different years'*
STANDARDIZATION	FG-P3…' *"it's also teaching things in a standardised way, that doesn't happen in multiple clinical exposures, so that everyone has the same basics. That it's not because I got that particular nurse training me or that particular doctor training me in that environment. So, I don't learn different things, I have a foundation that's the same and standardised."* *I-5: Again, the real-life situation is probably different, ….in terms of standardising that all students get the same kind of scenario, simulation makes a lot of sense.*
SHARED COMPETENCIES	FG-P3…*'If you're thinking about it from a curriculum point of view, like the ability to manage a particular set of* basic competencies, *that if you're a graduate, if you're nurse, a paramedic, a doctor, there's a set of things that everyone can do and knows what the other people can do.'*

***** The FGD and semi-structured interview participant's excerpts are represented with the prefix "FG-P" and "I" respectively

A participant (FG-P1) expressed that an acute care medical simulation programme afforded the healthcare educator the unique ability to bring the South African context into the learning activity, a feat that is difficult to accomplish with other practical teaching modalities. FG-P2 contributed to this idea by suggesting that this (introducing simulation into existing curriculum) can be done at an individual teaching activity level or educational programme level. Alternatively, FG-P3 presented a different view, which at face value is the opposite to what FG-P1 and FG-P2 suggested. FG-P3 emphasized the ability of an acute care clinical skills curriculum having a role in providing a mechanism of standardization across various contexts as opposed to contextualising the learning experience. This view is supported by I-5 from the expert interviews, who expressed that simulation can be of value when seeking standardization, as all the students within a cohort can be exposed to the same patient simulation, something that is extremely challenging to do within the inherently unpredictable clinical platform. Finally, FG-P3 suggested the idea of developing shared interprofessional competencies which transcends professional boundaries. The analysis of the data across the data sets, the FGD and semi-structured interviews had converging ideas between the two data sets, with extracts from the semi-structured interviewees supporting the ideas expressed in the FGD.

Level 2 Analysis: Evaluating the Data

As a point of departure, an important question to address is around the concept of 'context,' and what exactly that means within medical education. From the literature, there exists some confusion around what exactly is meant by context in the medical field (Bates et al., 2019; Koens et al, 2005; Prideaux, 2019).

Bates and Ellaway (2016) identified six recurring patterns that can be used to describe and compare clinical training contexts, namely:

- Patient patterns which include the kinds of patients and presentations encountered;
- Practice patterns which include the different approaches to clinical practice;
- Educational patterns which include the different approaches to teaching and learning and their parent educational programmes and institutions;
- Institutional patterns which include the structures and processes of health care institutions
- Societal patterns which include a community's organisation, cultures, technologies and values; and
- Geographical patterns which include the physical nature of training location.

These patterns aren't mutually exclusive as they can interact and overlap with each other (Bates et al., 2019). Ultimately, because of the complex nature of 'context' as a concept, Bates et al. (2019) present the following definition; Context is "a complex and unpredictable emergent property of these specific patterns, inseparable from any single health care interaction" (p. 16). This definition resonates with me as it adequately portrays the interrelatedness of the concept 'context.'

FG-P1 alluded to the fact that South Africa has unique health challenges and that an acute care clinical skills medical curriculum allows healthcare educators to bring the South African context into their teaching. This is profound as within the South African context, healthcare workers face unique challenges as they grapple with a quadruple burden of disease (Basu, 2018), namely:

- HIV/AIDS epidemic, along with a high burden of tuberculosis (TB)
- High maternal and child mortality;
- High levels of violence and injuries; and
- Non-communicable diseases.

This is coupled with the diversity of patient demographics and the disparity of resources across the various regions in South Africa, which necessitates that medical students be sufficiently prepared for these unique cases. FG-P2 illustrated the multi-layered nature of 'context' by referring to the context from an educational pattern viewpoint as opposed to a patient pattern (FG-P1) while FG-P3 suggested that an acute care clinical skills medical simulation curriculum could have a role to play in terms of standardisation.

At face value, contextualization and standardization are concepts that oppose each other, as contextualization seeks to customise the learning experience to the immediate environment in which it is to be delivered, whereas standardisation seeks to standardise the learning across diverse environments. This tension is not unique to this data set, as literature suggest that it exists within the medical education (Bates et al., 2019; Koens et al., 2005; Prideaux, 2019). On the one hand, standardisation affords various benefits such as fostering best practise, promoting common articulations which in turn can improve patient safety and standardisation can "contribute to greater fairness, equity, reliability and validity in high stakes processes, and can provide stakeholders, including the public, with tangible reassurance and a sense of the stable and timeless" (Bates et al., 2019, p. 15).

On the other hand, contextualisation affords many benefits to the learning and healthcare system alike. Firstly, it affords the learner a myriad of learning opportunities, which can be as vast as the patient demographics within which the training institution is situated. At the healthcare system level, it allows improving alignment between the training institution and the local healthcare needs (Bates et al., 2019). The concept of standardisation and contextualisation becomes more interesting when considering the implications it has for a competency-based medical education (CBME) curriculum. As mentioned in the literature review chapter, a CBME curriculum starts with the desired outcomes required of the learners and works backwards (Frank, Snell, et al., 2010).

One of the reasons CBME has been favoured in recent years is because of the promise of increased social accountability, the premise being that the likelihood that students will enter clinical practice with deficiencies in their knowledge is less (Bates, 2004; Frank, Mungroo, et al., 2010; Frank, Snell, et al., 2010). Standardisation seems attractive as a response by the medical education community to reduce the likelihood of errors and increasing patient safety. However, there is an inherent risk of oversimplifying the complex nature of competence, which if not addressed, can create a false sense of security about graduates capabilities, because competence, to some degree, is inseparable from the context in which it is developed (Bates et al., 2019). Rather than seeing the idea of standardisation and contextualisation as two opposing entities, I argue that there lies a greater opportunity in optimising the interplay between them. For example, when looking at competencies such as cardiac resuscitation; when designing the curriculum to address this gap, the healthcare educator can embrace both standardisation, by drawing from the vast amount of literature on the topic of cardiac resuscitation and emphasise best practise. At the same time, contextualisation can be embraced by incorporating a locally relevant patient presentation or even incorporating locally relevant culturally sensitive ideologies around resuscitation, gender, or organ donation to name but a few examples. On the contrary, it could be argued that you need to teach a standard approach, and then the students will adapt as they progress. I argue that while this approach might be feasible for some competencies, it can be detrimental for others. For example, while it may be appropriate to teach a standardised approach for procedural skills such as IV cannulation, it could be detrimental for teaching behavioural competencies such as the 'Approach to the sexual assault patient' as the latter is heavily influenced by local factors such culture, belief systems, power dynamics and gender to name but a few.

Ultimately, an acute care clinical skills medical simulation curriculum is ideally positioned to fulfil this gap as it affords the healthcare educator the ability to design learning opportunities which can introduce both global standards as well as the local contexts. Finally, the construction of the theme name 'Contextually- Standardised Competencies', which at face value seems like an oxymoron, was intentional as I wanted to portray the interplay between these concepts and suggest that the opportunity for an acute care clinical skills medical simulation curriculum lies within that space.

5.4.3. Theme 3: Teamwork

Level 1: Descriptive Findings

The third theme constructed was around teamwork, with participants referring to the codes; 'Team,' 'Leadership skills' and 'Interprofessional education.'

FG-P2 suggested that an acute care clinical skills medical simulation curriculum could have a role in introducing a student to the pre-existing team dynamics of the new environment. Additionally, FG-P3, suggested that when using medical simulation in an acute care clinical skills medical simulation curriculum, the benefits are extended further than just the individual but include the other members of the team as well as the environment. The participants went on to mention that within the team structure, one of the responsibilities of the team leader was to provide feedback to the team. Finally, FG-P3 voiced that there is a need for IPE in acute care clinical skills competencies as commonly shared understandings can be constructed around acute care competencies. The quotations and codes are depicted below.

Codes	Participant Extracts
TEAMWORK	FG-P2: …" *I think that's one of the big things, is having that **team**, knowing the team very well. And if you're working in an area where you've just been introduced, you can deal with anything, within the type of personality of **team**."*

LEADERSHIP SKILLS	FG-P2: [in reference to teamwork] …" *because that's also a skill that they need to have in the field, they need to be able to debrief people. When they're working as a* ***team*** *leader, they need to be able to have that skill, giving feedback and giving feedback to students, to their staff and their peers."*
	FG-P3: …" *it's* ***team-based*** *or environmental training, it's process training. And while the individual may gain, the focus of the simulation is the entire group, it's the entire environment, that it assesses and learns from."*
INTERPROFESSIONAL EDUCATION (IPE)	FG-*P3: …" the need for inter-professional training of acute care competencies in simulated environments, is having multiple practitioners all part of the same simulated training."* *"Because if we can get a kind of common understanding that everyone, from pre-hospital to emergency care providers or nurses, family practitioners, everyone has the same acute care competencies across the health system, then we will be in a much better place. And everyone knows how the others work."* *… "it has to be inter-professional in the way that it's delivered in one some way. And if we can get broader agreement that is a core competency for basic healthcare practitioners, that would be ideal."* *…"If you're thinking about it from a curriculum point of view, like the ability to manage a particular set of basic competencies, that if you're a graduate, if you're nurse, a paramedic, a doctor, there's a set of things that everyone can do and knows what the other people can do."* *I-5: Also if you work with a multi-disciplinary team to understand what is the role in the resuscitation, of a nurse, of the different disciplines, how can you best utilise, how can you do it if you're only two people, how can you do it if you're five people? And learn*

	those different scenarios with giving feedback in between.

***** The FGD and semi-structured interview participant's excerpts are represented with the prefix "FG-P" and "I" respectively

Level 2 Analysis: Evaluating the Data

The need to develop 'teamwork' competencies within an undergraduate medical curriculum strongly emerged during the FGD and was echoed by I5 during the semi-structured interviews; this was not completely unexpected as medical simulation and team-based training has long been associated. The literature around teamwork and medical simulation is vast (Bradley, 2006; Patterson et al., 2013; Weller, 2004; World Health Organization, 2010), and deficiencies in teamwork have been identified as a major contributor to patient safety concerns (Banerjee et al., 2016; Kohn et al., 1999). The idea that communication and teamwork are essential to medical education is not new as tools such as the Crisis Resource Management (CRM) borrowed from aviation have been widely used to teach teamwork skills to healthcare providers (Rall & Dieckmann, 2005). Research suggests that teams with improved teamwork skills deliver better care (Banerjee et al., 2016). This has resulted in principles of teamwork being introduced into more medical school curricula within South Africa (Cairncross, 2017) and abroad (Lerner et al., 2009; Salas et al., 2009). Unfortunately, at least anecdotally within the South African environment, the cases where teamwork training is offered within an undergraduate medical curriculum is an exception as opposed to the norm.

As is inherent to many healthcare professions, an individual within an acute care environment is expected to function within a team and ensuring that the team functions optimally is important for patient safety. In the acute care environment, this is amplified as patients often present with multiple complex conditions, and the emergency room is often the transition from the prehospital to in hospital environment (Banerjee et al., 2016). Traditionally professions train within educational silos, for example, medical students will train together, and nursing students train together but very rarely do they transcend these disciplinary boundaries and train together at an undergraduate level. To be effective team members, individuals must learn teamwork competencies (Banerjee et al., 2016). A team consists of a small number of people with complementary skills who are committed to a common purpose and perform goals for which they are mutually accountable (Katzenbach & Smith, 1993). This positions an acute care clinical skills medical simulation curriculum ideally as the healthcare educator can design simulations which replicate the clinical environment with IPE teams. However, some important related questions need to be addressed. These include the stage and frequency that IPE education should be included, as well as how it will be assessed. These are all very important questions which are beyond the scope of this thesis.

In conclusion, and interpreting the findings, I referred to my second research objective, namely, to explore what acute care clinical competencies would lend themselves to a medical simulation modality within a South African tertiary education environment. At conception, my objective for this phase of the study was to produce a definitive list of competencies that lends themselves to a medical simulation pedagogy. However, as the research process evolved it became apparent that the utility of such a list is questionable. My perceptions, as researcher, changed throughout the process of this study. The importance of context became apparent. Various contexts can greatly influence the appropriateness of whether a competency can be offered through a medical simulation pedagogy. For example, a generic list could advocate that a medical simulation curriculum could lend itself to developing trauma management competencies by utilizing an autonomous trauma training simulator (Couperus et al., 2020). However, this recommendation clearly needs to be cognisant of the context in which it is to be offered, as resource limitations, student numbers and technical skills shortages would make it unfeasible to make this recommendation in SA.

The importance of context, including culture, socio-economic and socio-political conditions, local patient case mix, healthcare professional team composition, and seasonal variations, suggest that is not possible to list, universally, which competencies are to be addressed by specified simulation modalities. Furthermore, the rate at which content within medical education is increasing made me believe that there is greater utility in providing a framework which educators can consult to determine the appropriateness of a medical simulation pedagogy to develop their competencies. This framework was informed through interrogating the expert findings of the FGD and semi-structured interviews, the available literature, as well as my experience as a health simulation educationalist. Bearing this in mind, the following paragraphs utilise the framework and applies it to the competencies developed during Phase 1 of this study.

What becomes immediately apparent is the scope which medical simulation as pedagogy can have a role in developing acute care clinical competencies. As medical simulation is a term which encompasses various modalities such as task trainers, standardised patients, full-body immersive simulation, etc., the range of competencies are diverse and span a range of categories (airway, trauma, patient and societal needs, for instance). When interrogating the commonalities between the competencies which lend themselves to a medical simulation modality, it becomes apparent that medical simulation pedagogy is particularly proficient at providing a practical demonstration and repeated practice of a skill. Furthermore, it lends itself to competencies which require some form of practical demonstration of the skill by student or demonstration by the facilitator. Fundamentally medical simulation as pedagogy affords the educator the ability to create opportunities for the learner to practice skills within the confines of a re-enactment of a real clinical encounter. This inherently lends medical simulation towards competencies which requires the learner to make sense of complex abstract concepts and practice through physical re-enactment.

The finding that teamwork or collaboration with other healthcare workers is an important competency that can be developed in simulation is supported in the literature. The competency was formulated as “Demonstrate the management of cardiac arrest” in the Delphi study. While developing teamwork using healthcare simulation is not new, when positioning the acquisition of these “Teamwork” in the context of South Africa, which is a highly diverse country in terms of culture and socio-economics, it becomes crucial to ensure that this competency is addressed. A report title “Reconceptualising health professions education in South Africa” recommended that the curriculum be amended to include IPE and collaborative practice competencies (Volmink, 2018). I discuss this further under Theme 6 “Interprofessional Education”.

5.4.4. Theme 4: Clinical Platform Integration

The fourth theme constructed from Phase 2 related to the integration of medical students into the clinical training platform. This theme was constructed by analysing the various codes around the ideas expressed as 'Translational Simulation,' 'Clinical Platform Enhancement,' 'Sequenced Application,' and 'Point-of-care (POC)/ In-situ Simulation.' The theme name was constructed through various iterations; when exploring the ideas expressed by the experts around the transference of skills and POC/In-situ simulation, it became evident that they were referring to not only the transference of skills from pre-clinical to clinical years of study but also the integration of medical students into existing healthcare teams. Furthermore, POC/in-situ simulation is premised on being conducted within the clinical environment. Hence, the researcher constructed the theme name 'Clinical Platform Integration.'

The quotations below depict the codes as well as the extracts from the interviews:

Codes	Participant Extracts
TRANSLATIONAL SIMULATION	I-3: … "It really prepares them for the clinical setup. So, and as they get more senior, the simulations become less, and the clinical more." I-*2: …"I think from my experience, obviously we try to recreate the clinical scenario in our unit as close as possible, but there's always going to be discrepancies. Especially when you look into how the students interact with the existing staff. And it's quite difficult to get the hospital staff in here at the unit. So it's almost easier, if you want to look at that kind of interaction, to take the mannequin over…"* I- *4: It really prepares them for the clinical setup. So, and as they get more senior, the simulations become less, and the clinical more. So in semester six it's more simulation, less clinical. And then as they move on the clinical becomes much more and the simulation less.*

CLINICAL PLATFORM ENHANCEMENT	I-4:… "So we use simulation as an enhancement for the clinical."
SEQUENCED APPLICATION	I-2: …"What we've seen in the past here is that for example we will move from theory into skills, from skills into simulation, from simulation into clinical. But anywhere in between those steps, on a curriculum level, as a student you can come back." [AND] I-3:… "And the same with the clinical. So I think from a perspective level simulation to me fits in kind of between where the students developed their motor skills in certain things, before they're exposed to real patient on a clinical platform."
POC/IN SITU SIMULATION	I-1…[speaking about introducing in situ simulation into the curriculum]… 'And yes, so I'm absolutely in favour of that. I think it's just a case of, again, limited time, limited resources.' I- *4: [speaking about in situ simulation] … 'We've tried. It's been a disaster. Oh no, so we don't do it. I mean, I've tried it twice, and we've gathered up everything, and off we've gone, and then there's been a disaster. Either there's been not quite load shedding, but there's been a problem' …* *[AND]* *FG-P1:in situ simulation has greater value for the team, than it does for the individual, because what you're doing is you're training authentically within the environment. And a lot of it is about process training, not necessarily about, it's about how the team works, how the team processes, how they use things.*
	I-*5…' it's as little bit more real life. It's still not the real patient, but I think because in the situation you see where is the resuscitation trolley, from where must it come, where's our drip sets, who knows where's what? And I think people much more*

	naturally fall into their roles that they would fall in at the time of an emergency.' *… 'But the one time there was a catastrophe, and there was an outside, not quite a mass disaster but there were a lot of patients expected in casualty, so we scooted back with all our machines. And then we tried a paediatric one as well, but we had technical problems…'*

***** The FGD and semi-structured interview participant's excerpts are represented with the prefix "FG-P" and "I" respectively

Level 1: Descriptive Findings

One of the participants (I-3) felt that medical simulation and clinical practice should not be viewed as mutually exclusive but that there is a synergy between training within the simulation centre and training within in the clinical environment and that medical simulation can be used to enhance clinical training. I-2 built on from this by referring to the role that medical simulation can play in moving a student from theory to the practical application of that theory. The participant goes on to say that one of the benefits that medical simulation affords the students is that he or she can continuously practise those skills as required; this simply is not possible or practical within the clinical environment. Finally, the participant echoed I-3's sentiments that medical simulation and clinical practise have a synergistic relationship, one that ensures that patients are not exposed to undue risk by incompetent students practising on them, with I-4 saying that medical simulation enhances clinical platform training.

Additional codes were provided from the data set coded as 'Point-of-Care/ In-situ simulation' (POC) simulation. The idea of introducing "Point-of-Care/ In-situ simulation" (POC) simulation is supported by I-1. FG-P1, however, considered "Point-of-Care/ In-situ simulation" (POC) simulation had greater benefit on a team level as opposed to an individual level. I-2 referred to some of the challenges experienced within the simulation centre, one being that despite all attempts at recreating realism, there were inevitably going to be shortcomings. This is in part due to the dynamic nature of the clinical environment and the interaction between students and healthcare teams. Furthermore, in terms of practicality, the expert expressed that it is often more practical to bring the simulation manikin to the clinical environment, as opposed to bringing the clinical staff to the simulation centre.

I-5 shared these views by, acknowledging that POC simulation was still not the authentic clinical experience, but that it added layers of realism which would be challenging to introduce into the simulation centre such as equipment layouts, existing staff dynamics, systems processes etc., which increased realism for the participants. Despite the optimism and generally positive sentiments towards POC simulation, I-1 expressed that limited time and resources had been significant barriers in initiating POC simulation at their institution. I-4 provided some insights on their experiences with POC simulation, expressing that on the occasions that they attempted to utilise POC simulation, the results were less than favourable. As POC simulation takes place in the clinical environment, it increases the chance of external factors interrupting the teaching activity, in this case, load shedding (this is the term used to describe planned power outages in response to excess power demands on the electricity grid in SA), a sudden increase in-patient admissions and technical difficulties.

In general, there was a great deal of convergence between the two data sets; namely the FGD and semi-structured interviews, with the FGD largely supporting the ideas expressed in the semi-structured interviews.

Level 2 Analysis: Evaluating the Data

Medical simulation and the clinical environment are integrally linked, as medical simulation seeks to replicate what happens within the clinical environment (Rodriguez-Paz et al., 2009). Despite this, the integration of simulation-based medical education into the undergraduate curricula has been challenging (Khamis et al., 2016).

The experts from the interviews felt that the clinical environment and medical simulation as a pedagogy were not mutually exclusive but that they operated synergistically. These views were shared in the literature (Kneebone et al., 2004). Kneebone et al. (2004) argue that a simulated environment offers a safe environment for repeated practise of a range of clinical skills without endangering patients. However, for medical simulation to reach its full potential as a pedagogy, it needs to be implemented alongside clinical practice.

The sentiments provided by I-2 with reference to medical simulation having a role in terms of transitioning the student from theory to clinical practice is supported by the literature. A randomised control study (RCT) which evaluated the effectiveness of clinical simulation compared with classroom teaching in teaching the assessment of the deteriorating patient, found clinical simulation to be a more effective teaching strategy than didactic classroom teaching in undergraduate nursing students (Merriman et al., 2014). Watson et al. (2012) in another RCT suggest that replacing clinical practice time is not at the detriment of the student; this study showed that it is possible to partially replace clinical practice (25%) with real patients with healthcare simulation without compromising the students' attainment of the competencies required to operate with the clinical environment. A meta-analytic comparative review of the effectiveness of traditional clinical education toward skill acquisition goals versus simulation-based medical education (SBME) with deliberate practise (DP) found that SBME with DP to be superior to traditional clinical medical education in achieving specific clinical skill acquisition goals (McGaghie et al., 2011). Finally, a study conducted by Tun (2019) found that relating teaching to clinical practice has the greatest impact on students' learning.

Closer to home, Labuschagne et al. (2014), recommends the integration of medical simulation into the clinical platform as a means to reduce the strain on the clinical platform as a result of the increasing student numbers and decreasing clinical capacity. One of the ways to facilitate this integration whilst limiting the impact on patient safety is through POC/ In situ simulation.

POC/ In Situ Simulation

From the interviews, one of the concerns expressed by the experts was that SBME conducted in the traditional simulation centre often lacked the nuances inherent to the clinical environment, nuances that are critical to preparing students adequately. This concern is shared in the literature, and in response to the desire for increased realism, in-situ simulation-based training has gained traction. During in situ encounters, the simulated encounters occur in the exact setting in which they naturally occur, such as the emergency room, as opposed to the simulation centre (Goldshtein et al., 2020; Weinstock et al., 2009).

A participant referred to the interaction amongst team members, and while it has been demonstrated that knowledge and technical skills are important to adequately prepare healthcare students, non-technical skills have also been shown to affect the overall outcome and are improved through in situ simulation training (Weinstock et al., 2009). Furthermore, by bringing all the pedagogical elements to the actual clinical environment, in situ simulation can expose students to teaching opportunities that they might not have been exposed to, as senior medical students are often integrated into existing medical teams. It also has the advantage of reducing pressures on clinical teachers by not requiring them to leave the clinical environment to attend dedicated teaching activities in the simulation centre.

The participants expressed concern regarding the lack of resources to implement in situ simulation at their facilities, and while these concerns are warranted and justified, it has been demonstrated in the literature that by reducing the setup cost and the need for dedicated space, In situ/ POC simulation affords healthcare educators a mechanism to increase the number of institutions capable of harnessing the power of simulation-based education (Bradley, 2006; Jansen & Waggie, 2018; Weinstock et al., 2009). Interestingly the integration into the clinical platform alludes to a more recent concept in the simulation literature called translational simulation. Brazil (2017) presents 'translational simulation' as a "functional term for how simulation may be connected directly with health service priorities and patient outcomes, through interventional and diagnostic functions, independent of the location of the simulation activity" (p. 1). Brazil (2017) argues for using the 'function' of simulation as opposed to the more historically used descriptors such as fidelity (high fidelity, low fidelity) and location (simulation centre-based, POC/In situ), as these traditional descriptors underplay the importance of outcomes in simulation. She argues that the debate around the location of the simulation activity is unhelpful as the primary focus of simulation should be aimed at health service priorities and patient outcomes irrespective of the location of the simulation activity.

While I support the ideas presented by Brazil (2017) regarding simulation being geared towards health service priorities and patient outcomes, it could be argued that this approach could be problematic for a more junior student. Health service priorities and patient outcomes may be concepts too far removed or abstract during the initial stages of undergraduate medical education. Therefore, I support the notion that simulation activities be guided by the objectives and aims of the teaching activity as opposed to the location of the teaching activity, as both centre-based and in situ simulation have advantages and disadvantages within undergraduate medical education. Ultimately, the onus lies on the educator to interrogate the needs of the learners, which is influenced by the phase at which the student finds him or herself with the curriculum. This phase is an important variable influencing the learner needs, as more junior learners may require more active engagement from educators whereas more senior students require less active engagement from their educators as they enter a CoP.

In conclusion, teaching within the clinical environment presents educators with unique challenges as the two realms have very different primary focuses. At the most basic level, the clinical environment is concerned with patient wellness, in contrast to the undergraduate teaching environment, where the primary focus is learning. The challenge lies in finding a common ground where patient safety is maintained or enhanced while learning takes place. Based on the expert interviews and literature, in situ simulation is a viable modality to facilitate this process.

5.4.5. Theme 5: Feedback

The fifth theme constructed during phase 2 (FGD and interviews) was around an acute care clinical skills medical simulation curriculum providing crucial 'feedback' to students during teaching activities. This theme was constructed by analysing the various codes around the ideas expressed as: immediate feedback, student feedback, team feedback, feedback, formative feedback, and lack of feedback.

Below, the data illustrates the quotations and codes of this theme.

Codes	Participant Extracts

IMMEDIATE FEEDBACK	*I- 5: … "You know, you let the student do the procedure and you say you could have improved there and there and here and here, and here you did something that was unsafe, please do it again.*
STUDENT FEEDBACK	*I-5And having a group of students, then every student gets a turn, and each one can improve on the previous one, observing the mistakes. And I think that's very useful."* *[AND]*
TEAM FEEDBACK	*… "Also if you work with a multi-disciplinary team to understand what is the role in the resuscitation, of a nurse, of the different disciplines, how can you best utilise, how can you do it if you're only two people, how can you do it if you're five people? And learn those different scenarios with giving feedback in between."*
FEEDBACK	*I- 1: … "feedback. I mean, if you look at deliberate practice and how that works, it's about feedback."* *I-1… "It's actually about the feedback."* *I- 2: … "I mean, a lot of things happen in the simulation experience itself, but then afterwards, the debriefing part, the feedback part, is as important."*
FORMATIVE FEEDBACK	*I- 1:… "therefore one has to start with then putting them in there [simulated experience], and then giving them formative feedback…* *FG-P 1: So, for me, I see simulation more as developing that student, because now a student will come in and a novice and then he will leave, by the time he should be leaving he's probably sitting at an advanced beginner level* *FG-P 3: However, I think as you, I mean you mentioned that it is developmental, there's the ability to make assessments and give feedback, when we use it. So, even simulation for learning has observation and judgement and some sort of assessment within it.*

LACK OF FEEDBACK	*[speaking about a conversation a student had with her]… And it was because of the fact that when they practice this out there [clinical environment] they either don't get the opportunity to do it, that is the one potential problem. The other one is they might be doing it and they might be doing it incorrectly and nobody gives them feedback.* *The feedback the one gave me actually made me start this whole project because she said to me, if anybody could have just told me this before, I wouldn't have done this. I've been doing it incorrectly like this for months now'*

***** The FGD and semi-structured interview participant's excerpts are represented with the prefix "FG-P" and "I" respectively

Level 1: Descriptive Findings

The participants expressed that one of the major roles that an acute care clinical skills medical simulation curriculum can play in SA was to provide direct feedback to students across a diverse set of instances. One Participant (I5) expressed that medical simulation affords the educator the ability to observe the student and be able to provide direct feedback on the performance. This allows the educator the ability to correct unsafe technique or lack of understanding, albeit in a simulated environment as and when they occur. The participant expands this thought by referring to group teaching, where feedback can be provided not only by the educator to the student but also amongst the students. Furthermore, within a multidisciplinary team environment, an acute care clinical skills medical simulation curriculum can have a role in providing feedback amongst the different disciplines.

This idea is supported by the participant (I1) who expressed that the purpose of placing the student in a simulated teaching activity is to provide formative feedback. This view is supported by experts from the interviews (FG-P1 and FG-P3) , which expressed strong views of simulation having a developmental, formative role. I2 expressed that during a simulation activity, many things are happening, and that is often difficult to process, therefore, during the debrief, the educator can provide feedback to the students, as well as the students provide feedback to each other. Finally, I2 provided a powerful recollection of an interaction they had with a student as illustration. During this interaction, the student expressed that she had unknowingly been doing a skill incorrectly for months, and had she been provided with the feedback (which she was provided during a simulated activity), she would have corrected it.

In conclusion of the level 1 analysis, there was a great deal of convergence between the two data sets; namely the FGD and semi-structured interviews, with the FGD largely supporting the ideas expressed in the semi-structured interviews.

Level 2 Analysis: Evaluating the Data

In the literature, the feedback has been identified as a major strength of medical simulation as a pedagogy (Akaike et al., 2012; Datta et al., 2012; Kneebone et al., 2005; Motola et al., 2013).

Long-lasting learning can be produced by providing feedback to the student as the student is allowed to develop deeper insight through reflection on their actions (Burns, 2015; Issenberg et al., 2005). Although students can learn through the experience alone, targeted feedback will maximise their learning (Burns, 2015; Gaba, 2004; Hattie & Timperley, 2007). This directed feedback is a pillar of medical simulation as it is ideally positioned to provide feedback to students. The facilitator can directly observe the actions of the learner, provide direct feedback to that learner, and allow the learner to correct their actions based on the feedback provided by the instructor. This is extremely difficult to accomplish using other modalities as there are various challenges which inhibit this from occurring, one of which is timing. An example is when providing feedback to a learner in the clinical platform upon completing the insertion of an IV on a real patient. Ideally, the instructor would allow the student to complete the procedure, then provide feedback once the student has completed it. However, this presents an ethical dilemma as any delay in correcting unsafe practice is unethical and can be detrimental to the patient. Theoretically, this resembles what Vygotsky's refers to as the 'Zone of Proximal Development (ZPD)', this is the "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem-solving under adult guidance, or in collaboration with more capable peers" (Vygotsky, 1978, p.86). Additionally, as the clinical platform is dynamic and unpredictable, there is the risk that competing patient interest could prevent feedback from being delivered after the procedure is complete. On the one hand, the clinical platform is geared towards patient care as its primary focus and not education, and the tension between service delivery and education is documented in the literature (Sholl, 2018; Sholl et al., 2017). On the other hand, medical simulation as a modality is geared towards education as its primary focus; additionally, it allows the facilitator to correct any unsafe practice without exposing the patient to any harm.

From a theoretical perspective, when we interrogate Kolb’s (1984) learning cycle, while actively participating in the simulation activity, students find themselves within the concrete experience component. Feedback and debriefing are situated within the reflective observation, abstract conceptualization and active experimentation components of the learning cycle as students are allowed to process the simulated activity and reflect on their actions to improve future actions (Burns, 2015; Kolb, 1984). Debriefing generally occurs at the end of a simulated activity but can also be woven into the simulation itself (Voyer & Hatala, 2015). Debriefing affords the participants an opportunity to ‘‘reflect on action, identify performance gaps, discuss areas for improvement, and consolidate knowledge and skills so that the latter can be applied in real practice to improve health care and patient outcomes” (Cheng et al., 2014).

Feedback and debriefing can also have negative consequences for the learning experience, particularly if the feedback is given within a vacuum, for instance, if the learning context is not made explicit to the student. For this reason, feedback is most powerful when directed at specific gaps in knowledge or faulty interpretations as opposed to a total lack of understanding (Hattie & Timperley, 2007). This is where the skill of feedback and debriefing comes in, as an inexperienced debriefer could default to providing generalised non-specific feedback during the debrief, which could result in the student feeling threatened or attacked, hampering the learning process. Positioning this potential skill deficiency between intention and outcome is even more complex within an environment such as South Africa where socio- cultural differences have been perpetuated over decades of segregation and injustice. A study by Archer et al.(2021, p.1) identified that students from varying socio-cultural and linguistic backgrounds experienced “feelings of emotional vulnerability, a lack of language proficiency and inadequate role modelling”, and that this was a challenge for applying empathic communication skills during clinical practice. This is a critical finding when considering that communication skills is crucial for providing feedback to patients, learners, and colleagues. Studies within the South African medical education sector have proposed that intercultural communication be incorporated into the curriculum (Bagwandeen & Singaram, 2017; Matthews & Van Wyk, 2018).

Considering the literature as well the feedback provided by the experts, it is clear that an acute care clinical skills medical simulation curriculum as a mechanism for providing feedback and debriefing allows the educator an opportunity to design a teaching environment in which context is provided and the student can reflect on the actions in a safe non-threatening space. This safe space extends past the traditional knowledge and skills domains only and can be crucial in addressing some of the apartheid legacy issues in education. In the past the curriculum was used as a tool not only to reproduce and promote the values, cultural norms, and beliefs of an apartheid society but also as an instrument to maintain and legitimise unequal social, economic and political power relations. By controlling and maintaining dominant beliefs, values and oppressive practices, the curriculum shaped the mindset of the population to sustain the apartheid system (Makgoba, 1997). Confronting the remnants of these sensitive, often engrained issues, which extends into the healthcare system (Mooney & McIntyre, 2008) is important and cannot be ignored. This being said, because of the significant impact that feedback and debriefing can have on the overall effectiveness of the teaching activity, resources need to be allocated to ensure that the facilitators are adequately equipped to effectively provide feedback and debriefing. The types or categories of resources will be discussed under the theme ‘Human Resources Constraints’.

5.4.6. Theme 6: Interprofessional Education (IPE)

The next theme constructed from the interviews pertaining to the role an acute care clinical skills medical simulation curriculum can play within SA was around the concept of IPE. The experts expressed that they believed that such a curriculum has a major role to play in developing IPE competencies. The table below depicts the extracts from the interviews:

Codes	Participant Extracts
PROFESSIONAL COMPETENCIES	*I- 2: … "And not only motor skills, but also your professional competencies. Things like communication, teamwork, how to manage a patient as part of a team of medical... But also wider than that, on an interprofessional level as well. So those are more... Maybe less clinical skills, as such, but more professional attributes, professionalism, collaboration, those kind of things."*
PROFESSIONAL ATTRIBUTES	*I-5: … "Also if you work with a multi-disciplinary team to understand what is the role in the resuscitation, of a nurse, of the different disciplines, how can you best utilise, how can you do it if you're only two people, how can you do it if you're five people? And learn those different scenarios with giving feedback in between."* *I- 4: … "complex patient scenarios where you are asking your fifth and sixth-year students for decision-making, to apply their clinical judgement. To bring it all together in decision-making. And in looking at the scenario and the patient holistically, team leadership, team memberships. And I think that this is where your IPE comes in."*
COLLABORATION	*I- 3: … "we also do inter-professional simulation for all fourth-year students in the whole faculty. So, then we use a simulation where we use simulated patients, where we use... Then we run a simulation for 400 students at the same time. We run 40 simulations simultaneously, 40 SPs. And then we've got medicine, nursing, OT, physio, dietetics, optometry, biokinetics, social work, and radiography in one session."* *And that's usually a diabetic patient, the patient is managed in a team where they work collaboratively. So then the focus and the outcomes is on inter-professional collaboration... So that is for*

	preparation for our students, before they go to community-based education. So we do that once a year. *[In response to a question on the effectiveness of this project]* *Yes. It's definitely. It works very well, it prepares the students very well. The students enjoy it. And we also allow the SPs to give feedback to the students. So it's very powerful if the students get feedback from the SP, say but you didn't talk to me, or you didn't look me in the eyes, or... So that feedback from the SP is just as valuable.* *FG-P 3: Because if we can get a kind of common understanding that everyone, from pre-hospital to emergency care providers or nurses, family practitioners, everyone has the same acute care competencies across the health system, then we will be in a much better place. And everyone knows how the others work.* *…If you're thinking about it from a curriculum point of view, like the ability to manage a particular set of basic competencies, that if you're a graduate, if you're nurse, a paramedic, a doctor, there's a set of things that everyone can do and knows what the other people can do.* *FG-P 1: need for inter-professional training of acute care competencies in simulated environments, is having multiple practitioners all part of the same simulated training.*

***** The FGD and semi-structured interview participant's excerpts are represented with the prefix "FG-P" and "I" respectively

Level 1: Descriptive Findings

The experts expressed a diverse range of thoughts around the role of an acute care clinical skills medical simulation curriculum in developing IPE competencies. I2 expressed that an acute care clinical skills medical simulation curriculum was more than just a culmination of motor skills but included diverse skills such as IPE competencies. These ideas were shared by I5 who recognised that working within an acute care environment involved various disciplines and as such students were exposed to training activities which developed the competencies required to work within those groupings. These skills transcend motor skills but include complex competencies such as IPE competencies. These views were supported by I4, who expressed that there was a need to expose senior students to ‘complex patient scenarios’ to practise clinical decision making; this being a complex skill to master which inherently involves IPE.

The FGD participants (FG-P3 and FG-P1) expressed that desire to establish a common understanding across various disciplines. Finally, I3 provided insights from existing experiences at their institutions, who currently undertook a faculty-wide IPE activity with their fourth-year students. This exercise strategically placed students in a situation that required ‘professional collaboration’ work. The experts provided feedback on the effectiveness of the project, by saying that they believed that it prepared the students well for clinical practice. Finally, the expert explained that the standardised patient (SP) was an integral part of this exercise as it allowed providing feedback to the students from a patient’s perspective.

In general, there was a great deal of convergence between the two data sets; namely the FGD and semi-structured interviews, with the FGD largely supporting the ideas expressed in the semi-structured interviews.

Level 2 Analysis: Evaluating the Data

As a point of departure, it would be fit to define interprofessional education, and while many definitions exist, I felt that the definition which most resonates with me is: ”learning that occurs when two or more professions learn with, from and about each other to facilitate collaboration in practice” (Burch, 2014, p.2). This definition resonates with me because it highlights and places emphasis on the bilateral nature of learning which should occur during IPE. While this may sound obvious, we live in a society with power dynamics and just placing two or more professions in a learning activity does not necessarily mean that this is how it is viewed by all professions involved. For example, during a previous study, I conducted, titled “ The facilitators and barriers to implementing an inter-professional education point of care simulation activity for health care workers in a tertiary hospital in Cape Town”, it was highlighted that the nursing staff felt disempowered when participating in IPE activities, as it appeared that the event was aimed at teaching them only as opposed to the entire IPE group (Jansen & Waggie, 2018).

Despite interprofessional education being recognized as a critical component of health care in modern medicine (Paige et al., 2015), and there is an ever-increasing need for IPE, students within the undergraduate South African healthcare setting rarely train across disciplinary silos. This can result in students entering the clinical environment with preconceived ideas and stereotyped perceptions of their profession and negative stereotypes regarding other professions, which can lead to professional arrogance, hampering the development of collaborative relationships (Burch, 2014).

A mixed-method study on the effect of an interprofessional clinical simulation on medical students in South Africa found that "medical students gained clinical knowledge during the simulation and became aware of their lack of skills, knowledge, and opportunities to acquire and practise skills required for effective teamwork" (Treadwell et al., 2014, p.3). However, the successful implementation of IPE is not without its challenges. Literature suggests that factors such as insufficient adequately trained staff, "non-coordinated and strictly separate curricula of different health care professions", and limited financial resources can all hamper any IPE initiatives (Homeyer et al., 2018).

Despite these challenges, healthcare simulation allows the healthcare educator the opportunity to purposively design IPE simulated activities which capitalise on the strengths of IPE teaching as well as strengths of healthcare simulation. Replicating this on the clinical training platform presents an enormous challenge because of not only the educational boundaries between programmes at different universities but also education boundaries between programmes at the same university. Furthermore, healthcare simulation has been proven to be a powerful pedagogy for the acquisition of individual and team-based training in a safe environment with no risks to patient safety (Paige et al., 2015). Considering the existing literature and the feedback from the expert interviews, I argue that an acute care clinical skills medical curriculum can have a pivotal role in preparing undergraduate medical students for working in an environment such as the acute care environment, that inherently requires collaboration amongst various professions as well as maintain patient safety.

5.4.7. Theme 7: Human Resource Constraints

The next theme constructed was around the human resource constraints. This was raised as a potential barrier to the implementation of an acute care clinical skills medical simulation curriculum with South Africa.

The codes and quotations are depicted in extracts of the interviews.

Codes	Participant Extracts
LACK OF SKILLED PEOPLE	*I*- 1: … "I think for me the biggest barrier is human resources. And it is partly a person. But then also a person that is skilled, because some of these skills are very diverse."
INADEQUATE STAFF NUMBERS	… "the whole thing about what do we see as limited resources, human power to me has been one of the biggest challenges..." … "But from a human resource part, you can imagine how much time this will take from our sisters, and yet we are continuing to do... I would have loved to do it with other skills as well."
HIGH STUDENT: STAFF RATIO	*I*-4: … "deliberate practice is great on paper, it's very difficult to implement with the student numbers and the facilitator numbers being so opposite each other."
LACK OF TRAINING	… "One of my challenges is to get people to do sim properly. To train them properly. To get them in so that I can do it properly." FG-P 2: And that competency with is something that has to be developed in all faculty, but it's also something, you know, being able to do medical simulation.

INADEQUATE STAFF NUMBERS	… "I think our student numbers are huge. 350 are going into fourth year. It's big. Maybe not 300, maybe some are staying behind in third year. But we're looking at huge numbers. And to actually get them all through, and give them enough time in the sim lab, with an adequate debriefing time, and that I think is one of our biggest problems…" *I*- 3: … "So all of those are real problems, and especially at our university we've got lots of vacant posts in the clinical setup. And that really has an impact on the training because there's just not enough people." [AND] … "So for us that's one of the major problems, is there's not enough people. We are lucky, we've got very well-equipped simulation unit, so we can manage relatively large groups here… But for us, I think the main constraint is the people."
ABSENCE OF SYSTEMATIC STAFF TRAINING	*I*- 2: … "the simulations were built around personalities, and because it wasn't based in... So when those people left the university or retired it was a bit of a challenge to get the new guys onboard"

***** The FGD and semi-structured interview participant's excerpts are represented with the prefix "FG-P" and "I" respectively

In general, there was convergence between the two data sets; namely the FGD and semi-structured interviews, with the FGD supporting the ideas expressed in the semi-structured interviews.

Level 1: Descriptive Findings

Numerous experts raised their concerns around the various human resource constraints as a potential barrier to adopting an acute care clinical skills medical simulation curriculum in South Africa. I1 voiced that their biggest constraint was around human resources, partly because of the diverse range of skills required by an educator that utilizes medical simulation as a pedagogy. The participant spoke about the tremendous amount of strain that this placed on the limited amount of staff that is trained in medical simulation pedagogy. Another participant (I4) echoed these views, commenting that the problem was multifaceted, namely that finding appropriately skilled individuals was extremely difficult, and ensuring that training was provided to equip healthcare educators to effectively implement medical simulation as pedagogy and not only technology, was challenging. This participant attributed these factors to increasing student numbers, which placed significant strain on a limited amount of staff. The number of new medical students in South Africa enrolling annually have increased by 34% between 2000 and 2012; this could be an increase of as much as 64 students, when based on a class size of 200 students. (Mayosi & Benatar, 2014). I4 identified the difficulty of providing the necessary on-going training to existing simulation staff; this view was shared by FG-P2, who added that staff should be trained in simulation pedagogy across various faculties. I3 alluded to a greater problem within tertiary institutions, which is the difficulty in attracting appropriately trained staff, I3 supported this view by alluding to their university's current vacancies.

The general views of the participants were that their facilities were adequately equipped with equipment to service their student numbers, however, there was a shortage of appropriately trained people to make optimal use of the facilities and equipment. Finally, P2 expressed that historically at their institution, simulation programmes were built around personalities, and as these people left the institution, they left with the knowledge and skills, which was to the detriment of the simulation programme.

Level 2 Analysis: Evaluating the Data

The lack of specialised human resources has been identified as a threat to the continued expansion of simulation education as a pedagogy (Peterson et al., 2017). As a result, the need for faculty development has become crucially important to implement a sustainable simulation programme. The need for faculty development to address the shortage of specialised skills to effectively facilitate medical simulation in health systems and universities worldwide as pedagogy is becoming increasingly evident in the literature (Irby et al., 2015; Lemoine et al., 2015; Peterson et al., 2017). Studies have shown that up to 30% of South African doctors have emigrated and that 58% were intending to emigrate to Western countries (Mayosi & Benatar, 2014). This was echoed in the expert interviews with many of the experts agreeing that a major constraint to implementing an acute care clinical skills medical simulation curriculum was the lack of clinical staff trained in simulation facilitation.

In a doctoral thesis titled ‘Issues related to implementing high-fidelity simulation in a nursing program,’ the author stressed that 55% of the participants in that study cited faculty development as the biggest barrier to implementing simulation in their environment (Krueger-Ray, 2017). These findings were supported in the literature, as quality faculty development within simulation education has been identified as essential to the sustainability for simulation centres across the world (Irby et al., 2015; Lemoine et al., 2015). Closer to home, Labuschagne et al. (2014) recommend the introduction of ‘train-the-trainer’ courses as a faculty development initiative to address the lack of specialised human resource. More recently in SA, a study conducted within anaesthesia education reported that the main barriers to implementing simulation based education are, lack of protected time, finance, and lack of trained educators (human resource constraints) (Swart et al., 2019). In addition, the need to upskill faculty within South Africa to address the remnants of the Apartheid legacy is crucial, as sensitive issues may arise during simulation activities. Particularly given that these activities should ideally be representative of the clinical environment. Some of the issues simulation facilitators may need to be able to address may include, but are not limited to, complex power dynamics between students and facilitators, an awareness of and sensitivity to socio-cultural differences. (Vandeyar & Killen, 2006).

The findings of these studies challenge the predominant tendency to prioritise technology over faculty development in South Africa, and elsewhere (Sorensen et al., 2017). In the South African context, I have had countless interactions with individuals who were able to secure funding for acquiring expensive manikins, but now face a situation where this equipment remains unused for two main reasons: staff do not have the necessary training and skills to use the equipment, and staff are unsure how to efficiently incorporate the equipment into the existing healthcare system or curriculum.

Apart from the initial purchase cost of the equipment and the often underestimated ongoing associated cost, it is completely unacceptable to have a situation where equipment is not being utilised effectively (Zendejas et al., 2011). A large proportion of the exorbitant costs associated with medical simulation can be attributed to the initial and maintenance costs of high-fidelity manikins, and while high fidelity manikins may appear novel, there is no literature available to suggest that they are superior to their low fidelity counterparts in facilitating learning. This is evident in a recent study by Massoth et al. (2019) who compared high-fidelity vs low-fidelity medical simulation in both undergraduate and postgraduate medical professions. They found that "the use of high-fidelity simulation led to equal or even worse performance and growth in knowledge as compared to low-fidelity simulation, while also inducing undesirable effects such as overconfidence" (Massoth et al., 2019. p1). It is evident from the preceding discussion that there is a much stronger case to be made for a focus on combining appropriate fidelity manikins with faculty development in medical simulation pedagogy to upskill staff rather than acquiring expensive high-fidelity manikins. In resource-constrained societies such as South Africa, this would be a significant contribution to enhancing the learning of acute care clinical skills in undergraduate medical education. Furthermore, through investing in faculty development, facilitators would be upskilled in providing feedback; and this is an invaluable, transferable skill delivered not only in simulated environments, but also in non-simulated clinical training environments. At a theoretical level, given that the facilitator is crucial for creating an environment which is conducive to learning, the human resource constraints may have substantive negative consequences in implementing a medical simulation curriculum within SA. Social constructivism (as presented by Vygotsky) positions the facilitator as crucial in creating an encounter where the learner is placed in a state of disequilibrium within the ZPD. This requires a facilitator which is not only knowledgeable within their content domain but also skilled at simulation pedagogy. The need for such specialised skills highlights the importance of providing faculty development to equip facilitators with the necessary theoretical knowledge to leverage medical simulation as a pedagogy to enrich the learning environment.

5.4.8. Theme 8: Lack of Curriculum Time

The next theme constructed from the expert interviews was concerning the perceived lack of curriculum time available. This was raised as a potential barrier to the implementation of an acute care clinical skills medical simulation curriculum with South Africa. The quotations below depict extracts from the expert interviews:

Codes	Participant Extracts
CURRICULUM TIME	*I- 1: … "But to keep on, and that's why in terms of barriers I think the other one is time in the curriculum."* *I*-5: … *"I think the curriculum is very full."* … *"I think it's just a case of, again, limited time, limited resources."* *I*-2: … *"We tend to do a simulation once, but we don't have time in the schedule for the students to come back and do repeat practice, and kind of make it part of their... So most of the lecturers, mostly because of time constraints, once they've done a simulation with a group of students, that's it…"* … *"from a time resource is getting quite a problem because you don't want a larger and larger group of students being exposed to the same scenario, or the same instance."*
RESISTANCE TO CHANGE	*I*-3: … *"So lecturers are sometimes hesitant to add simulation. And we advocate not to add but rather to replace."*
CURRICULUM STRUCTURE	… "*The problem is the way our curriculum is structured is that the students are placed in a rotation, and say, for instance, eight weeks they will be at obstetrics and gynaecology and then they move on to surgery and move on to internal medicine. And in there, that eight weeks, they have to cover the curriculum for that clinical discipline… Because the problem with add-ons is it's not viable. Especially because the curriculums are so full."* *FG-P 1: structured approach, that needs to be taught through simulation.*

***** The FGD and semi-structured interview participant's excerpts are represented with the prefix "FG-P" and "I" respectively

Level 1: Descriptive Findings

Participants I1 and I5 expressed that a lack of curriculum time was one of their major barriers, followed closely by resource constraints. Participant I2 illustrated the lack of curriculum time by referring to the fact that simulation activities were generally a single event with no repeated practise sessions possible, mainly due to limited time availability of the lecturers. Participant I3 reported that lecturers are hesitant to add additional content to their existing curriculum because of the current structure of many medical programmes in South Africa, which generally consists of clinical rotations. The participant advocated that medical simulation be used as an alternative pedagogy as opposed to an additional pedagogy. The participant said that the problem was confounded by the large student numbers, which resulted in an increased student-facilitator ratio during that teaching activity.

Level 2 Analysis: Evaluating the Data

The lack of curriculum time identified as a significant barrier by the participants is echoed by D'Eon & Crawford (2005). The authors report that there has been an exponential increase in curriculum content within the science disciplines including medicine (D'Eon & Crawford, 2005). This has had various implications for both curriculum planners and students alike. From a curriculum planner perspective, aspects such as what content to include or exclude, and whether the content will be offered through classroom learning or self-directed learning, are but some of the decisions that need to be considered. Curriculum planners are placed in the peculiar position where they need to account for the expanding knowledge base combined with an increase in curricular content and a decrease in teaching time (D'Eon & Crawford, 2005). This exponential increase in content is compounded by the fact that it is easier to insert content into the curriculum than it is to remove it. From a student's perspective, this increase in content can result in information overload, and literature suggests that information overload is detrimental to learning (D'Eon & Crawford, 2005; Harden, 1986; Russel et al., 1984; Sanson-Fisher & Rolfe, 2000).

Densen (2011) suggests that the medical knowledge base is doubling at increasingly shorter time intervals: from 50 years in 1950 to 3.5 years in 2010 to a projected 73 days in 2020 (Densen, 2011; Paige et al., 2015). This has profound implications, particularly when attempting to implement a new modality such as medical simulation within a resource constrained environment (Theme 4 "Human Resource Constraints") such as SA. Considering the increasing content within medical curricula, I3 suggested that medical simulation can be offered as an alternative pedagogy as opposed to an additional pedagogy.

This approach seems feasible, however, it needs to be considered within the greater climate of medical simulation in SA with barriers such as limited skilled personnel and resource constraints. In terms of implementing a healthcare simulation curriculum, a study by Krueger-Ray (2017) found that 55% of the participants reported time as a barrier to implementing simulation. Participants listed aspects such as the time to write scenarios, dedicated faculty training time and time to grow the simulation program (Krueger-Ray, 2017). For medical simulation to be considered an alternative pedagogy as suggested by I-3, a process of comprehensive curriculum review would need to be conducted, that considers both inter- and intra-disciplinary curriculum mapping. This is to ensure that all unnecessary repetition is removed and intentional repetition is reinforced and strengthened. Intentional repetition transcends past simply just repeating the same activity, but requires the facilitator to actively determine the students ZPD, and use that information to bridge the gap in learning.

The findings of this study, as well as the literature around medical simulation and curriculum time, suggest that it is a complex matter which requires input from various stakeholders (Theme 9). I advocate that when developing curriculum, medical simulation as a pedagogy, should be considered from the onset as opposed to trying to retrofit it into a pre-existing curriculum as it entails close attention to educational design. This could avoid a frustrating process and may result in fewer compromises needing to be made.

5.4.9. Theme 9: Stakeholder Buy-in

The final theme constructed from the expert interviews was around the concept of 'stakeholder buy-in.' The theme was proposed by the experts as crucial to implementing an acute care clinical skills medical simulation curriculum with South Africa.

CODES	PARTICIPANT EXTRACTS
ACADEMIC STAFF SUPPORT	*I- 4: … 'I think that it's basically... It's getting the buy-in of the lecturers, of the academic staff who are teaching in those curricular at the moment.'* *… 'Then buy-in of the lecturers, I think it's very important to have a very good relationship with your lecturers. Be open for discussion.'*
RESISTANCE TO CHANGE	*…'They don't see a need to change, maybe, for whatever diffusion of innovation theory, that's whatever reasons they don't want to change. But if that's, I think I've got this challenge, is trying to break into the simulation. Break into their teaching.'* *I-3: … 'I think the main thing is the lecturers. I think they sometimes are afraid of simulation. They are afraid... Even though we are there to help them, we are there to support them, we are there to train them, some people are still afraid of the technology of simulation. So that can be one of the main barriers.'*
CHANGE MANAGEMENT	*… 'I went and I found my sim champions. I went and I spent time down there, in the clinical skills, which is pure task training, going on down there. Maybe with standardised patients. And I spent time there, and I found people who were interested, like [Name removed]. And then I said, come, let's put together something for the students.'*

STAKEHOLDER MANAGEMENT	*… 'And the professor that runs this clinical training grant at the moment is very pro sim, and you've got one of those on your side, you're good.'* *… 'But I've got good relations with the hospitals, as well as private companies, like psychologists.'* *I- 4: … 'What we've done, I was actually here when we started, so it was me and the head of the department of simulation at that stage. And basically we literally went from department to department to introduce our capabilities, or potential capabilities at that stage. And what we've done, we've basically kind of guided the guys to start using simulation, what we call the low hanging fruit. Certain lectures were quite nice to convert into simulation.'* *… 'So we literally sat with them in meetings and helped them convert those. It was quite difficult because some of the clinical training staff weren't exposed to simulation when they were training, wasn't part of their paradigm. When they think about simulation it's some mannequin in a storeroom somewhere where they do CPR.'* *I-2… 'basically just advertising ourselves to move to a state where without having the need to re-curriculum in the sense that the content doesn't change, but we decide with them, this lecture will be a nice simulation, rather strip this two-hour lecture way down, maybe just give them an introduction video or some module to prepare beforehand, and then we move it into a simulation, rather than a two-hour lecture with PowerPoint.'*

STUDENT RELATIONS	*I-1: [speaking about relationships with students] … 'in terms of what is the theoretical knowledge of the students, then if this happens, and then what will the follow be of that? So I think... Well, I would say the key thing is relationships.'*

***** The FGD and semi-structured interview participant's excerpts are represented with the prefix "FG-P" and "I" respectively

Level 1: Descriptive Findings

The participants from the expert interviews expressed that garnering stakeholder buy-in was a crucial aspect for implementing an acute care clinical skills medical simulation curriculum within South Africa. One of the Participants (I4) suggested that stakeholders often do not see the need to change their existing practises, and that it required an individual who believed in what medical simulation as a pedagogy to champion the cause and garner buy-in. The participant drew from her experience of approaching strategically placed individuals to further the medical simulation agenda. The participant went from department to department to advocate for medical simulation and its capabilities, targeting individuals who showed interest in utilising medical simulation.

Participant I3 expressed that one of the barriers to implementing an acute care clinical skills medical simulation curriculum in South Africa were lecturers who had often been afraid of medical simulation both from pedagogy and a technology perspective. Participants supported the views of I4 of garnering stakeholder buy-in by developing and maintaining good relationships with all stakeholders, including students.

Level 2 Analysis: Evaluating the Data

Considering the constructed theme, an appropriate point of departure is to define what exactly is meant by stakeholder engagement. As the term was popularised within the management sciences, I found it appropriate to use a definition from that field. In broad terms, Freeman (1984) defines a stakeholder as "a group and/or individual who can affect or is affected by the achievement of the firm's objectives" (p.16); a more operational definition defines a stakeholder as "any individual, or group of people, or organization, involved in or affected by policymaking, development, implementation, or management" (Brailsford et al., 2009, p. 1841).

These definitions resonate with me as they demonstrate the range of who a stakeholder is or can be. The experts during the interviews referred to stakeholder engagement, however who and what those stakeholders were varied from individual to individual. Despite these variances, all of them had one thing in common, namely, that they can affect or were affected by the potential success or failure of an acute care clinical skills medical curriculum. Despite the experts identifying different stakeholders, they felt that engaging these stakeholders was important for the successful implementation of an acute care clinical skills medical curriculum; this sentiment is shared by Brailsford et al. (2009) who identifies stakeholder engagement as crucial to successfully implementing healthcare simulation. From a curriculum development perspective, Kern (2009) presents a six-step approach to curriculum development where the backbone of Steps 1 and 2 is concerned with engaging various stakeholders. During Step 1, 'Problem identification and general needs assessment', the purpose is to conduct a more holistic stakeholder engagement with civil society, patients, and hospital management for instance. Whereas in Step 2, 'Targeted needs analysis', the purpose is to zone in on individuals or groups that are more directly impacted by the curriculum, for example, lecturers, students, and curriculum advisers. This begs the question: in an age of competing interests and as there are so many vested stakeholders in the implementation of an acute care clinical skills medical curriculum, how, especially during the initial stages of stakeholder engagement, do you decide who to engage first? Again, borrowing from the management sciences, the degree to which managers give priority to competing stakeholder claims is referred to as salience (Brailsford et al., 2009; Mitchell, et al. 1997). They go on to list three attributes which determine salience; namely:

- power to influence,
- legitimacy of influence,
- and urgency of claim.

Mitchel et al. (1997) further classify a definitive stakeholder as one that possesses all three attributes; an expectant stakeholder possesses only two; a latent stakeholder possesses one, and a non-stakeholder possesses none.

This framework could be useful in classifying stakeholders and prioritizing an approach to engage them to facilitate the successful implementation of the curriculum. One should be mindful that stakeholder engagement is not a static process as the level of engagement might change during a project. For example, during the planning phase of implementation in a hospital setting, it might be more appropriate to focus your engagement efforts to senior hospital management as any resistance from them at this stage would stifle progress and could prevent the process from progressing. However, during the stage of conducting the simulations in the hospital, it might be more appropriate to concentrate engagement efforts to lecturers, students, and patients.

Establishing and maintaining good relationships with the stakeholders was identified as crucial for implementing an acute care clinical skills curriculum. These sentiments appear to be supported by the research, albeit limited. The implications of this are crucial within a resource constraint environment as the tolerance for wastage as well as the competition for limited resources are increased. Even more significant is having an awareness and strategy for establishing these relations in the context of socio- cultural diversity, and disparity as a result of colonization and Apartheid which are still present within healthcare systems in South Africa.

Overall, the findings of this study were significant as it affirmed much of what is already known about simulation globally, this despite the study context within which the research was conducted being very different (LMIC vs HIC context). In doing this, the findings of this research supports the notion that research conducted in HIC contexts should not be discarded simply because of its setting, but rather that the research be evaluated on its merits. These merits could be influenced by various limitations such as human resource constraints, curriculum time, and stakeholder buy-in, as was highlighted by this research. This being said, medical simulation affords the greater healthcare education field with some exciting opportunities, particularly in creating environments which foster authentic engagements amongst the diverse students and health workers on the clinical platform.

5.5. Level 3 Analysis:

5.5.1. Level 3 analysis: Delphi Study

In terms of the first objective, which sought to identify the acute care competencies, the theoretical premise for conducting the Delphi study was guided by the curriculum development framework as proposed by Kern et al. (2009). They advocate that during Step 1 – 'Problem identification and general needs assessment' and Step 2 – 'Target needs assessment', the goal is to identify the problem and assess the relevant stakeholders for contributions towards addressing that problem. The value of engaging local stakeholders was demonstrated in the increased relevance of the list of competencies for the South African context when compared with those from elsewhere. The value being a move to a more inclusive curriculum development process as the competencies are informed by the clinicians treating the patients on the frontline and strengthened by a diverse group of curriculum experts. As a result, the list encapsulated what is core to the field irrespective of context, as well as that which is most relevant to the patient profile and prevalence of conditions in South Africa.

The findings of the study further reiterate the migration of the greater medical education community from a purely biomedical approach to patient care to the biopsychosocial approach in medical education (Larivaara et al., 2001). This is particularly significant within the acutely ill patient demographic as there has been a paucity of research within this subset of patients in this regard (Epstein et al., 2004; Matzer et al., 2012). One of the few studies that have explored the biopsychosocial needs of patients presenting to casualties has found that by conducting biopsychosocial screening on this burdened patient group can be helpful in detecting multi-disciplinary healthcare needs (Matzer et al., 2012).

Despite these competencies being provided by the diverse group of stakeholders, it begs the question: are these competencies appropriate for the level of the medical practitioner or are they as a result of the medical practitioner compensating for inadequate supervision during undergraduate studies including internship? Within the framework of inadequate supervision, as demonstrated by the study on the state of internships is SA (Bola et al., 2015), there lies the risk that the results of this study inadvertently provides support to a 'broken' supervision system, a system where acutely ill patients are managed by inexperienced medical students. This desensitization within medical training could be problematic as it can act as an enabler to the status quo as opposed to addressing the system flaws which may exist. This question, albeit valuable, is beyond the scope of this study.

5.5.2. Level 3 analysis: FGD and Interviews

During the following paragraphs I summarise the application of theories to my findings. From a theoretical perspective, the acquisition of clinical skills competencies is complex, as it involves knowledge, skills and attitudes, which are influenced by various complex factors such as culture and value systems, as well the conceptualization of abstract medical information and their application within the clinical environment. As a result, it requires a high degree of abstraction as the student processes and interprets abstract theoretical concepts, internalises them and applies them to the clinical environment. This involves a process of social and cultural interaction which results in the translation from internalised thought to applied physical outer actions within the clinical environment.

Through a process of interrogating the data of this study as well as the literature, I would like to propose that the role of medical simulation within an undergraduate acute care clinical skills curriculum as a mediator for the development of clinical skills competencies within what Vygotsky refers to as the 'Zone of Proximal Development'. Ian Thompson argues that the most powerful form of learning occurs within the ZPD (Thompson, 2013) as the ZPD provides a process through which the internal course of development can be understood (Vygotsky, 1978). As the clinical skills environment is dynamic and everchanging, the opportunity lies not in acquiring the skills, but rather the process of acquiring them. Vygotsky expressed that instruction must be targeted "not so much at the ripe as at the ripening functions" (Vygotsky, 1978). In terms of mediation, Vygotsky states that the development within a ZPD involves social interaction, dialogue, and mediated processes between learners and with their teachers (Vygotsky, 1978).

I argue that it is justified to refer to medical simulation as a mediator, based on Brown et al's (1993) description of what can be conceptualised as contributing mediators in the ZDP, providing support to the learning process therein: " people, adults and children, with various degrees of expertise, … [and] artefacts such as books, videos, wall displays, scientific equipment, and a computer environment intended to support intentional learning" (p. 191). As a result, medical simulation includes not only the technology, in the form of manikins or software programmes (which constitutes tools) but also the skilled simulation facilitators implementing a structured pedagogy which includes providing feedback throughout the teaching activity (which constitutes a process).

Medical simulation is ideally positioned to act as a mediator within the ZPD as its inherent strengths as a pedagogy lies in the fact that the facilitator can directly observe the actions of the learner, provide direct feedback, and allow the student to internalise that feedback. Simulation as a mediator is a powerful process as it allows the student to identify gaps in their knowledge. This affords the student an opportunity to compare their gaps with the gaps identified by the instructor. The gaps identified by the student and the instructor may align perfectly, the instructor may identify additional deficits to the ones identified by the student or the student may self-identify more than the instructor did. The skilled debriefer ensures that all identified deficits (student and instructor) are addressed. This interaction illustrates social constructivism within the ZPD at play when medical simulation is viewed as a mediator and not simply technology.

This positions the simulation facilitator, within the context of a diverse society such as SA, with the opportunity to construct a simulation experience that allows the learners to interact with each other, challenging cultural, religious, linguistic and belief systems, within a safe environment (limits any harm to patients), while being realistic (replicating aspects of the clinical environment) and addressing the medical learning outcomes. Within the literature, medical simulation has established itself as a modality for developing competencies related to communication, teamwork, and feedback. A medical simulation acute care clinical skills curriculum has the potential role of being a catalyst to initiate difficult conversations between students and clinical facilitators (registrars/ consultants) of different social and/or racial backgrounds, these inequalities being a remnant of the Apartheid legacy. The implications of the catalytic role are significant. As experience has shown, these conversations seldom emerge organically, which can also have negative effects on patient care, and thus a more proactive approach is required.

The findings of this study reiterates that feedback is an area where medical simulation can have a crucial role to play within an undergraduate acute care clinical skills curriculum. Within that mediatory scope, I argue that an undergraduate acute care clinical skill medical simulation curriculum has a role in providing direct feedback to the students, which is challenging within the clinical environment. These challenges are exacerbated at the undergraduate level, as the students have limited exposure to the clinical environment and thus rely more on abstracted and decontextualized learning. In addition, the well-documented tension between service delivery demands and education further limits learning opportunities in the clinical environment. This in turn inhibits the iterative learning process that is necessary between abstract representation and concretisation through observation and physical manipulation while ensuring patient safety. Direct feedback allows the facilitator to establish the student's ZPD and make appropriate adjustments, as tasks that are 'too easy' can result in the student being disinterested and tasks that are 'too difficult' may induce anxiety and frustration. Hence, through this mediational role of medical simulation, it can scaffold interaction and development in learning.

Vygotsky views the role of the facilitator as crucial as learning occurs through social interaction with the facilitator who acts as the 'More Knowledgeable Other (MKO)' in this interaction (Vygotsky, 1978). For example, when teaching the skill of intravenous cannulation (IV), the facilitator can physically show the student how the skill is performed on a manikin, which provides a physical representation of abstract concepts (such as visualising the needle entering the vein at the correct angle, visualising how the needle is withdrawn and the catheter left behind, and how fluid is transferred from the IV Bag to the patient). The student is then able to internalise the instructions and demonstration, and use it to guide their performance, whilst giving and receiving continuous feedback; these bilateral interactions are referred to as cooperative or collaborative dialogue (Vygotsky, 1978). This interaction highlights the ability of medical simulation pedagogy to act as a mediator, navigating the student towards proximal development, rather than simply giving tasks and providing answers. Therefore, the role of a more knowledgeable other during a simulated teaching activity will be shared between the facilitator, the students and medical simulation itself as a mediator of learning.

Another area where medical simulation pedagogy can be beneficial within this mediatory role is when one considers the impact that language has on learning. As Vygotsky puts it “the difficulty with scientific concepts lies in their verbalism” (p. 148).

This is somewhat compounded in SA, as SA is a diverse country. McNamee et al. (2019, p.158) found that ‘medical interns in South Africa are often confronted with contextual challenges that are unrelated to their medical knowledge, including multilingual environments’. Students come from varied backgrounds and English, whilst it is the medium of instruction at many universities, is not the primary home language for a large proportion of the undergraduate medical student population. Medical simulation provides these students with a visual representation of the skill as opposed to only relying on verbal communication, which then enables them to internalise what they saw.

In keeping with good practice, literature searches were conducted throughout the thesis process. Three additional publications were found that in certain aspects converge, and/or diverge, and in other aspects reinforce conclusions I have arrived at. Groot et al. (2020) explored the application of Vygotsky’s ZPD in undergraduate medical education. They found that while simulation at the frontier of the ZPD evokes a significant amount of stress, impeding cognitive functioning, it nevertheless also caused constructive friction that leads to a motivating experience in untrained learners. It must be noted that this study specifically looked at how untrained medical students experience the overly challenging simulated case, therefore providing additional insights into the impact of simulation at the edge of the ZPD. This study reinforces that Vygotsky’s ZPD has practical implications for medical simulation, and that educational designers need to carefully consider the zone of students’ preparedness and the level of facilitation needed when they design cases. However as this study was limited to final year medical students, it diverges from the conclusion of an earlier introduction of acute care medical simulation as pedagogy. Earlier introduction is predicated on careful design sequencing at the appropriate cognitive and conceptual levels, as well as availability of trained facilitators in mediating the ZPD.

Kneebone et al. (2004) and Sadideen et al. (2018) explored the role of the ZPD as a useful conceptual framework for learning clinical skills, and reinforces my conclusions that the ZPD provides a useful framework to understand how students may further develop their practical skills learning. However, an area of divergence is that this research was conducted at a post graduate level, which is not homogenous to undergraduate students.

Furthermore, this work fails to provide theoretical depth as to how the ZPD would be useful.

Vygotsky's social constructivist theory around 'Mediation' and 'ZPD' address the need for a skilled facilitator and the collaborative dialogue between the student and facilitator. However, this theory needs to be supplemented by Lave and Wenger's theory of 'Situated learning', because of the multiple locations of learning well described in the literature, and based on my own teaching experience.

For example in South Africa, even though the clinical environment is such an integral part of undergraduate medical education in the final years, undergraduate medical students generally have limited exposure to that environment in earlier years. Consequently they must rely on an abstraction of ideas based on theoretical concepts. This contrasts with postgraduate students who are generally immersed in the clinical environment and thus have more terms of reference when learning new competencies. Hence, the importance of focussing on situated learning to supplement Vygotsky's social constructivist theories as it foregrounds the importance of the physical environment and social interactions in which learning takes place.

This supports the notion that the environment in which undergraduate students learn needs to closely resemble the environment in which the knowledge is to be applied. To address the shortcomings of the theories of Vygotsky (see theoretical framework chapter), and in support of medical simulation as a mediator, I propose the theory of 'Situated Learning' as proposed by Lave and Wenger (1991). While Vygotsky's theory was crucial to recognising the importance of culture, language and belief systems when developing simulation curriculum, Lave and Wenger's situated learning theory provides greater insight into the significance of situating the learning in an authentic environment as well as the acquisition of skills through CoPs. Situated learning advocates that learning takes place in the same context in which it is applied. Lave and Wenger argue that learning should not be viewed as simply the transmission of abstract and decontextualized knowledge from one individual to another, but a social process whereby knowledge is co-constructed. They suggest that such learning is situated in a specific context and embedded within a particular social and physical environment (Lave & Wenger, 1991). Medical simulation, while not always situated in the same context in which learning is applied, seeks to apply learning in similar (to varying degrees of authenticity) environments; for this reason, aspects of situated learning are applicable in support of medical simulation as pedagogy as opposed to simply a technology.

I propose that medical simulation supplements undergraduate clinical skills education as it provides context to the learning, in a group of students where context is generally limited. Furthermore, clinical practice is inherently social and comprises various individuals ideologically working towards a common goal.

I propose that medical simulation can facilitate the introduction of the undergraduate medical student into existing CoPs through deliberate practice and direct feedback as the 'MKO' has the necessary exposure and experience of the existing CoP and can introduce these to the student through scaffolding within the students' ZPD. Additionally, within the group, students can share knowledge amongst each other further decreasing the time taken to enter an existing CoP within the clinical environment. The introduction into the existing CoP is particularly important within resource-constrained environments. Lesser & Storck (2001) identified 4 areas of organizational performance that can be affected by communities of practice:

- Accelerating the learning curve of new employees
- Responding more rapidly to customer needs and inquiries
- Reducing rework and preventing "reinvention of the wheel"
- Spawning new ideas for products and services

Legitimate peripheral participation (LPP) (Lave & Wenger, 1991) is a model that illustrates the learning process by "social participation in a community of practice," where such participation increases gradually in engagement. Interpreting this model, the undergraduate medical student would be considered a legitimate participant on the periphery, as he or she has limited experience and limited exposure to the clinical environment; as the student progresses in exposure and masters their clinical competencies, he or she progresses towards the centre. The centre represents 'legitimacy' to partake with the community and assume full participation as opposed to peripheral participation.

In undergraduate medical education, I propose that medical simulation can have a crucial role to play by allowing students the ability to observe competencies being performed in the clinical environment by 'experts'. By providing them with a mediating tool to deliberately practise their skills using medical simulation in an environment that allows them to practise safely and receive direct feedback, students are positioned away from the patient (the periphery) at the early stages of their learning. Subsequently, they reach a level of competence where they are not a risk to the patient and can continue to refine their skills in the clinical environment, possibly at earlier stages in curricula that have structured and deliberately sequenced simulated learning than programmes with limited or no laboratory simulated learning. Deepening and mastery of clinical skill acquisition on patients continues during internship (Dreyfus, 2004; Kneebone et al., 2004).

Thomas et al.(2014) similarly conclude that early clinical simulation can empower medical students to gain more from their clinical placements. Their work specifically focusses on 'Becoming a Doctor' and experiencing inter-professional clinical simulation which provides increased understanding of their roles as doctors, and better prepares them for when they are immersed in clinical placements.

More recently within nursing simulation education, Andersen et al. (2021) propose the Tag Team Patient Safety Simulation (TTPSS) model, which presents LLP as it's theoretical foundation, and emphasises the importance of a theoretical foundation in instructional design.

The concept of Legitimate Peripheral Participation enables us to capitalise on the existing internship model in SA, which is crucial to the development of medical practitioners; but minimise the risk to patients by utilizing medical simulation as a pedagogy in the undergraduate student during the early stages of their learning curve.

In conclusion, I have argued that medical simulation is ideally positioned to complement clinical practice as a mediation tool for the undergraduate medical student in the South African context through capitalising on the affordances of medical simulation as pedagogy. This allows the educator to immerse the student in an environment akin to the clinical environment but with the added ability to control aspects of that environment (decrease noise and complexity when the student is cognitively overloaded). This allows the educator to facilitate learning in the students' ZPD and facilitate the introduction of undergraduate medical students into existing CoPs whilst maintaining patient safety. These arguments are informed by the findings of this study and the available relevant literature. However, it must be noted that as the simulation community is a CoP, naturally, there is an exchange of knowledge within this CoP. This can take the form of formal knowledge (published articles) and informal knowledge (slides, webinars, meetings etc). While the formal knowledge is more readily accessible, it is more challenging to access the informal knowledge from LMICs contexts.

5.6 SimSmart Framework

At this stage of the thesis process, I am left with the question, what contribution does this thesis bring to students, colleagues and the general simulation community?

Hence, the construction of a SimSmart framework that might assist curriculum developers in conceptualizing the role of simulation curricula in developing acute care clinical skills competencies for undergraduate medical students.

My SimSmart framework, illustrated below, presents five categories, 'Socially accountable; Manage Resources, Appropriate usage, Repetition, and Train-the-Trainers' which curriculum developers need to be cognisant of when implementing a simulation curriculum. These headings were constructed through engaging with the data of this thesis, the literature surrounding curriculum, and the broader issues facing curriculum implementation in diverse environments. Finally, I sought to make the Mnemonic memorable by using the phrase 'SimSMART'; where the 'Sim' refers to simulation, and the SMART, refers to the various components discussed below.

The framework is not designed to be exhaustive but rather provides some important points to consider when implementing a medical simulation curricula. I provide further discussion on my motivations for my selections below.

The table below provides a representation of how the research of this thesis has influenced the formation of this framework, and the subsequent discussion illuminates the educational themes and rationale derived from the literature.

Curriculum Framework

SimSMART				
		Research Themes	Educational Theme	Rationale
S	Socially Accountable	Contextually-Standardised competencies	Social accountability and decoloniality	Transformation; Inclusivity
M	Manage Resources	Human Resources Constraints Stakeholder Buy-in Clinical Platform Integration	Planning for relevant resource allocation	Ensure sustainability of ethically trained graduates
A	Appropriate Usage	IPE and Teamwork Feedback	Situated learning Theory- Lave & Wenger	Functional fidelity as opposed to structional fidelity only Alignment
R	Repetition	Foundational Competencies Clinical Platform Intergration	Scaffolding - Vygotsky Training for transfer Integration - Harden	Reinforce learning
T	Train- The- Trainers	Human Resource Constraints	Initiating educational activities and CPD in simulation pedagogy	Ensuring staff are appropriately skilled in simulation pedagogy

5.6.1 Socially responsive

The need for medical curriculum to become more socially responsible is not new, with various thought leaders advocating for socially responsible medical curriculum over the decades (Faulkner & McCurdy, 2000; Parhar, 2019). Furthermore, there are increasing calls for medical schools to be more socially accountable, as there is a realization that needs of society require more than simply acquiring knowledge and mastery of sophisticated technologies by medical students (Woollard & Boelen, 2012). The WHO defines social accountability as 'the obligation to direct their education, research, and service activities towards addressing the priority health concerns of the community, the region, or nation they have a mandate to serve'. It becomes apparent that to realise this requires medical schools to look beyond the acquisition of clinical knowledge and skills. While social responsibility speak to an awareness of duties regarding society; social accountability speaks to a 'justification for the scope of the actions undertaken and asserts that the attaining of anticipated outcomes and results will be verified'(Woollard & Boelen, 2012, p.23). Additionally, while the social responsive movement evolved from the assumption that innovative approaches in educational processes would result in a proportionate impact on people's health, social accountability widens the scope of innovations to include the relevant planning of human resources for health and the proper insertion of graduates in a supportive working environment. This supports the findings of this research thesis which suggest that human resources and the working environment (context) are crucially important to ensuring that medical students are adequate prepared to manage the patients in their environment.

Globally, this need has been necessitated by widening health care disparities, increasing diversity, and changing patient demographics. Within South Africa, the 2015-2016 national and institutional student-led protests highlighted the underlying unequal matrices of power in the South African landscape. The legacy of the Apartheid government has resulted in structural remnants of inequality that affect the poor and the working class accessing higher education institutions, the majority of whom are black (UCT, 2018). Central to the student protest was the 'decommodification' of higher education (Malabela, 2017; Ndelu, 2017). The concept of 'commodification' of higher education refers to higher education institutions prioritising the generation of profits or surpluses at all costs. This needs to be viewed within the context of continued chronic underfunding via government subsidies of higher education, which has resulted in universities making up the shortfall through increasingly higher fees. This has led to, fees (as opposed to race) becoming a means of segregation in the age of the corporate university, functioning as a way of sustaining historical patterns of segregation (Maldonaldo-Torres). This is evident by the fact that access to and success in universities continues to correlate with race and social class (UCT, 2018).

In response to the student protest, the university of Cape Town (UCT) setup a curriculum change working group to 'engage with faculties, departments, students and other constituencies within the university to initiate deep curriculum conversations in relation to the challenges of transformation, as well as opportunities and debates that the call for decolonisation brought to the university' (UCT, 2018, p.8). One of the major faculties which the working group engaged was the faculty of health science (FHS), which contributes more than close to 50% of the research output generated by the university and attracts close to 50% of the total university research funding. The UCT FHS was at the forefront of faculties grappling with curriculum transformation and inclusivity within SA, which made it an ideal case study for the development of this framework. As part of the 2016 student protests, a group of FHS undergraduate students (which houses the medical programme) drafted a list of 34 demands. These demands spanned a wide spectrum of issues including 'healthcare provision for students, transport problems, safety concerns, the right to protest, complaints of victimisation, dissatisfaction with teaching approaches and assessments methods, and the high cost of tuition' (UCT, 2018, p34). From these interactions, many important questions emerged including: 'Why is the standard of success in the Bachelors of Medicine and Surgery (MBChB) programme often measured as the ability to function in the best medical institutions in the USA (or the UK)? Are students, as measured against this 'standard', able to function equally effectively at a rural clinic in South Africa? Why is English privileged, and why are the indigenous languages not valued, especially considering that approximately 70% of the population access health care in the public sector, and that most of these patients are not mother-tongue English speakers?' (UCT, 2018, p36).

This working group presented a set of recommendations which included:

- Authentic engagement drives meaningful curriculum change. This takes time and involves ongoing conversations with different stakeholders.
- Meaningful curriculum change requires leadership that has a proven track-record in addressing inequities in the academy, and that is sensitive to what it means and feels like to be marginalised.
- In order not to discard what works and to avoid pushing the institution into implosion, it is important to blend formal structures with new emergent structures.
- When the intent is to decolonize the mind, texts from the epistemologically disenfranchised that otherwise would be excluded, should become core-reading material.
- Knowledge production must always be regarded as potentially violent towards marginalized communities. This must be mitigated by individuals and groups from marginalized communities increasingly becoming drivers of research, as members of the academy. Institutional racism, ableism, sexism and heteronormativity need to be addressed with honesty and courage.

- Knowledge must be understood as both situational and relational, with questions rather than method, driving knowledge production. Trans-disciplinarity must be encouraged.
- A pedagogy of being and doing should be embraced, so that pedagogic relationships are imbued with a consciousness that is inclusive, socially just and constructive
- Assessment should be re-conceptualised as social practice in order to surface challenges that accompany it. Practices that encourage assessment *for* learning should be encouraged.
- Colonial lies embedded in disciplines, must be exposed and disrupted.
- Students must continue to play a critical role in informing meaningful curriculum change.

Curriculum development is intricately linked to the socio-political context within which it exists. As a result, curriculum developers both within SA and globally need to mindful of the socio-political context in which they are embedded, its inherent moral codes, and act to determine the regulative discourse for content and pedagogy. The formulation of these recommendations highlights the importance of contexts and decoloniality in the development of curriculum.

5.6.2. Manage resources

Resources, or the lack thereof present a major challenge for developing and sustaining a successful medical simulation curriculum globally. Within the South African context, the need to effectively manage resources is even more crucial because of the inequitable distribution and implementation of resources. These resources can include human resources, material resources and financial resources, all of which are in short supply. Despite this short supply, there is evidence that healthcare simulation can be effectively implemented in low-resource settings (Martinerie et al., 2018). The data from this thesis suggests that a human resources constraints presents significant threats to the development of simulation curricula in SA; these findings are in line with the greater simulation literature (D'Eon & Crawford, 2005; Peterson et al., 2017). This being said, conceptualising medical simulation as an alternative pedagogy as opposed to an additional pedagogy (see Chapter 5, Theme 8, page 140) and prioritizing faculty development (see Chapter 5, Theme 7, page 136) present a feasible approach to managing these challenges. Finally, establishing and maintaining good relationships with the stakeholders is crucial for developing simulation curriculum, particularly within a resource constrained environment as the tolerance for wastage is limited, and the competition for limited resources is increased. Through these relationships more informed decisions can be made regarding the acquisition of the most appropriate simulation equipment, efficient utilization of these scarce resources such as simulators and skilled staff; and alignment between what happens in the simulation centres and the clinical areas.

5.6.3. Appropriate Usage

> *'Mo[re] money Mo[re] problems'- this is the title of a 90s rap song by the late great rapper, the Notorious B.I.G.*

The title of this song reminds of the predicament many novice simulation educators find themselves in when acquiring simulators and developing medical simulation curriculum. The novice simulation educator's potential lack of insight that simulation based education is a modality and not a technology, leads to an assumption that the higher the structural fidelity, i.e. the technological complexity of the simulator the greater the educational effectiveness. However, this is often not the case, as there have been many studies that have shown that an increase in structural fidelity does not automatically translate into increases in educational effectiveness (Allen et al., 1991; Finan et al., 2012; Hamstra et al., 2014; Massoth et al., 2019). Though it is natural to assume that this increase in technology and 'realism' would have a positive effect on learning outcomes. However, there is currently no evidence in the literature that high fidelity is more advantageous than low fidelity simulation concerning knowledge or skills acquisition (Cheng et al., 2015; Finan et al., 2012). Considering the evidence surrounding fidelity; it may be more beneficial to consider the required fidelity of a simulation event relative to the demands and nature of the clinical skill (functional fidelity), as opposed to the physical resemblance to a human patient only (structural fidelity) (Hamstra et al., 2014). By considering the functional fidelity, and through the effective orientation of the learner to the context and structural fidelity, the educator and learner can transfer fidelity into the simulation scenario, therefore ensuring that there is alignment between the learning outcomes and the educational modality. Furthermore, medical simulation has an established presence in providing feedback and developing IPE (Paige et al., 2015) and teamwork competencies (Akaike et al., 2012; Datta et al., 2012; Kneebone et al., 2005; Motola et al., 2013). Literature suggests that targeted feedback will maximise student learning (Burns, 2015; Gaba, 2004; Hattie & Timperley, 2007). The role of an acute care clinical skills medical simulation curriculum as a mechanism for providing feedback and debriefing is to allow the educator an opportunity to design a teaching environment that provides the context that allows the student to reflect on their actions in a safe non-threatening space.

Additionally, Lave and Wenger's Situated Learning Theory (see Theoretical framework chapter), proposes that learning should take place in the same contextual environment in which it is to be applied. As students within an acute care environment are expected to function within a team (and often an interprofessional team), ensuring that these teams function optimally is important for patient safety.
It is important for curriculum developers to recognise the strengths of medical simulation in developing these competencies and actively review existing and new curricula to leverage these strengths.

5.6.4. Repetition

"Repetition is the First Principle of All Learning"

(Bruner, 2001)

One of the challenges faced by medical students is the lack of opportunities for repeated practise when engaging with medical simulation pedagogy. This is often as a result of a cramped curriculum (D'Eon & Crawford, 2005), and/or little to no integration between different programmes, departments and/or faculties, this is what Harden refers to as 'isolation'(Ronald M. Harden, 2000).

As medical simulation seeks to replicate a clinical environment, the integration of the clinical environment and the medical curriculum is a necessary starting point. However, the integration *within* medical simulation needs to also reflect the inter- and multi-disciplinary nature of health care practice, for example, educational design in simulation that integrates the revisiting of the essential basic medical sciences, the bio-psycho-social-cultural approach, public health issues, ethics, and the role of other health professionals in health care. Globally, medical curricula have been restructuring since the 1980s to graduate students who can practice holistic health care, hence the work by Harden et al (2000) on the 'Integration Ladder'; as well as promoting medical schools that are socially accountable and actively engaged in their respective contexts (Woollard and Boelen, 2012). Consequently, students need practice opportunities to 'test' the application, particularly of the basic medical sciences to clinical skills with simulated patients, once they enter clinical exposure in second or third year, as occurs in SA. If practice opportunities are collaboratively designed by curriculum developers in medical simulation that is core, rather than an add on, the potential to reduce unnecessary and unproductive repetition opens up opportunities for creative or intended repetition in key areas.

Systematic planning for repeated practise opportunities is based on Bruner's (2001) conception of learning as a process of slow engagement with ideas where gradually the engagement reaches critical mass where the student actually acquires the idea. Moreover, it is crucial that this repeated practise is transferred to the clinical area; this speaks to a concept known within the literature as 'training transfer'. Training transfer is defined as 'the effective and continuing application, by trainees to their jobs, of the knowledge and skills gained in training'(Kerins, Smith, Stirling, Wakeling, & Tallentire, 2021, p.1).
The inherent strengths of simulation is that it allows for repeated deliberate practise, creating environments conducive for reflection, self-paced discovery, and consistency and clarity of thought (Bruner, 2001). Intentional repetition and feedback are crucial for successful acquisition of skills in simulation trainings (Bosse et al., 2015).
Furthermore, when developing medical simulation curriculum, it is important to conceptualise the relationship between practising within the simulation centre, and solidifying those skills by practising within the clinical environment once competency has been established within a simulated environment. As a failure to continuously practise those skills (in the clinical environment), could have unfavourable outcomes for patient care (Arlington et al., 2017; Ersdal et al., 2013). Furthermore, the WHO, as part of a report on 'Transforming and scaling up health professionals' education and training' recommend the

use of simulation methods to improve competence, however for the improvements to last, students need to be afforded an opportunity to practise their skills in the clinical environment sooner rather than later (World Health Organization, 2013).

Scaffolding (see chapter Theoretical Framework chapter) is crucial to the development of a comprehensive simulation curriculum as simulation has many modalities within it and the optimising the sequence of introduction the different modalities supports the learner in building on previous experiences.

It is crucially important for curriculum developers engaging with medical simulation curricula to critically engage with the when, where (simulation centre, clinical environment, or combination), and for how long; when planning practise opportunities.

5.6.5. Train-the-Trainers

The lack of specialised human resources has been identified as a threat to the continued expansion of simulation education pedagogy (Peterson et al., 2017). As a result, the need for faculty development has become crucially important to implement a sustainable simulation programme. The need for faculty development or Training-the-Trainers programmes to address the shortage of specialised skills to effectively facilitate medical simulation in health systems and universities worldwide as pedagogy is becoming increasingly evident in the literature (Irby et al., 2015; Lemoine et al., 2015; Peterson et al., 2017).

Within the SA environment, the need to upskill faculty to address the remnants of the Apartheid legacy is amplified, as sensitive issues may arise during simulation activities. These issues may include but are not limited to, complex power dynamics between students and facilitators, an awareness of and sensitivity to socio-cultural differences (Vandeyar & Killen, 2006).

Considering the findings of this research as well as the literature (Sorensen et al., 2017), I would advocate for the prioritization of faculty development as opposed to the acquisition of expensive technology without the relevant faculty development to optimise these technologies.

Chapter 6: Conclusions

6.1. Introduction

Through conducting this study, I set out to explore the role, including the limits and possibilities, of medical simulation as an educational modality in developing acute care clinical skills curriculum within a South African tertiary education environment. In essence, the initial conceptualisation of this study was built on the assumption that medical simulation has a role in developing an undergraduate acute care clinical skills curriculum, however, I was unsure as to what the extent, or if that role is positive or negative, given my early experiences with simulation. During this chapter I summarise and synthesise the conclusions of this thesis. Thereafter I address the limitations and recommendations as well as future research relevant to this study.

6.1. Phase 1 Conclusions:

The main contribution of Phase 1 is that it is the first study in SA to generate a set of comprehensive competencies for managing acutely ill patients at the district level for undergraduate medical students (Annexure 5).

Medical training institutions have a responsibility to equip their students for societal healthcare needs. The findings of the Delphi study illustrated the value of engaging with medical practitioners at the forefront of societal engagement such as practising medical practitioners, who on a day-to-day basis are exposed to the healthcare needs of society. This was illustrated with the inclusion of competencies such as 'Demonstrate the approach to a sexual assault victim', which is a response to a societal problem in South Africa, namely the high levels of sexual assault.

6.3. Phase 2 Conclusions:

Phase 2 of this study, a FGD and semi-structured interviews were conducted with experts (see Methodology Chapter). This phase addressed objectives 2 and 3 of the study, namely,

> 2. To explore what acute care clinical competencies would lend themselves to a medical simulation modality within a South African tertiary education environment;

3. To explore the role, including the limits and possibilities, of medical simulation as an educational modality in developing acute care clinical skills curriculum within a South African tertiary education environment.

The findings of phase 2 are significant as they illuminate the potential role medical simulation can play, as opposed to its current implementation in SA. Currently the implementation of simulation is unevenly distributed across SA (predominantly within the main city centres), with simulation being treated as an add-on as opposed to being integrated into the existing curriculum. Medical simulation has the potential to have a role as a powerful mediator, as defined by Vygotsky, to facilitate the integration of medical students into the clinical platform. Simulation and clinical environments address different needs, so positioning simulation's mediator role alongside clinical experiences as opposed to replacing it, allows them to address different needs that should be leveraged to ensure that the student is adequately prepared for clinical practice. While I acknowledge that this is not an easy task, it is crucial that curriculum developers continuously work towards realising this as opposed to simply compartmentalizing these two environments.

The South African healthcare system is severely under-resourced and clinicians are inundated with patient management duties. Despite these pressures, clinicians are still required to perform teaching duties to various students. An acute care clinical skills medical simulation curriculum has the potential role to significantly reduce the amount of time required to teach students foundational competencies. When positioning these limited teaching opportunities within the context of the South African healthcare system this valuable time can then be redirected to teaching competencies which are more optimally delivered in the clinical environment. Students mastering foundational competencies in a simulated environment may potentially result in a less stressful learning environment within the clinical training platform for both the clinician and student. Stress reduction is critical in the SA context where an under-resourced health care system is additionally grappling with the complexity of changing social relations arising from the country's Apartheid history.

The findings of this study relating to fidelity and faculty development have important pragmatic implications , for curriculum developers within resource constrained settings, that include financial and human resources. The literature and empirical data from this thesis converge in recommending prioritization of upskilling facilitators in medical simulation pedagogy as opposed to acquiring expensive simulators without the requisite skilled individuals to utilise them. This is not to say that more expensive simulators do not have a place, however the required fidelity should be determined by functional fidelity as opposed to structural fidelity only. This would require a complete reconceptualization of how simulation is currently implemented in South Africa. The current implementation is generally as an add-on as opposed to being designed for sequenced integration into existing curriculum by facilitators who are trained in education and aware of the importance social relations and how they impact on learning and training. The findings of this research is of crucial importance at a societal level, as it pertains to the development of skills required to manage a vulnerable patient population, namely acutely ill patients. The current prevalent approach of 'see one, do one, teach one' for developing competencies simply is not acceptable within modern medicine due to the increased associated patient risks. Unsupervised students cannot be allowed to practise invasive clinical skills on patients before they have been found competent to perform those skills. However, it leaves a significant void within the development of clinical skills competencies. Medical simulation as a pedagogy affords the educator and student a methodology which emphasises patient safety to develop these crucial skills in a controlled environment that is safe for the student and patient.

Furthermore, I propose the SimSMART as framework that curriculum developers can use when implementing medical simulation into existing or new curriculum. Whilst this framework was developed with SA curriculum developers in mind, I would argue that this framework could be beneficial to the greater simulation community as many of the challenges which this framework attempts to address are not unique to a particular context, or discipline within medicine, as was previously discussed in the WHO recommendations regarding simulation training.

Finally, the selection of social constructivism (Vygotsky) and Lave and Wenger's situated learning theories have been immensely valuable in redefining medical simulation as pedagogy as opposed to a technology. The work of these theorists allowed me to argue the acquisition of clinical skills via medical simulation pedagogy as a process as opposed to output. This process is one where the learner is exposed to various aspects of the clinical environment (across various degrees of realism) in a safe controlled manner and allowed to internalise and make meaning of those interactions. This process is facilitated, to varying degrees of proximity, by a medical simulation educator. As outlined in the previous chapter, if this concept of 'process' as opposed to technology is adopted, it has the potential to enable an earlier introduction and smoother transition into the existing 'apprenticeship-type' or internship learning than is currently the case without medical simulation integrated within a curriculum. This would be of significant value in SA where many of the internship placements have clinical supervision constraints, as previously discussed in Chapter 5 - Theme 4: Clinical Platform Integration.

This being said, as both of these theories were developed in a context different to healthcare medical simulation, there is a theoretical limitation that I wish to express.
Lave and Wenger, argue that learning should take place in the same context in which they are to be applied, and medical simulation often takes place in similar but not the same context to which it is to be applied.
The findings of this study were significant for multiple reasons; firstly, it affirmed much of what is already known about simulation globally, this despite the study context within which the research was conducted being very different (LMIC vs HIC context). In doing this, the findings of this research supports the notion that research conducted in HIC contexts should not be discarded simply because of that fact or ideologically, but rather that the research be evaluated on its merits. These merits could be influenced by various factors such as human resource constraints, curriculum time, and stakeholder buy-in, as was highlighted by this research.
Vygotsky's ZPD, concept of mediation and Lave and Wenger's concepts of Situated Learning and Legitimate Peripheral Participation have recently emerged as theorisations worthy of examining the learning within simulation setting as discussed in chapter 5. These works have reinforced my main arguments. Vygotsky's social constructivist theory, and in particular his work around 'mediation' and the 'ZPD' was crucial in constructing my thoughts around the mediatory characteristics of medical simulation within a student's ZPD, as it recognised and acknowledged the importance of culture, language and belief systems when developing simulation curriculum. The broadening of the conceptual focus from

cognitive development to include socio-linguistic and cultural phenomena is particularly relevant in societies that are characterised by deep social and economic differences, as is South Africa. This theoretical positioning was augmented by Lave and Wenger's situated learning theory, which advocates for situating learning in an authentic environment within CoPs; the authenticity of the replicated environment being determined by functional fidelity as opposed to structural fidelity only. These theories, in combination, enable the leveraging of the established and ever-growing evidence for medical simulation, particularly within the domains of communication, teamwork, and feedback. There is a growing body of emerging research in SA, on students' perceptions and experiences of the effects of social division on training and learning between students and educators on the clinical platform.
Pragmatically, for curriculum developers within South Africa; the findings of this thesis contribute to addressing these socio-cultural-economic differences and the ways in which they play out and impact learning and training in highly unequal societies. Educators should not ignore that medical education is a microcosm of the greater society within which it is located, and unless addressed explicitly and integrated within an acute care curriculum framework, patient safety could potentially be compromised.
Though I have found no published examples of the theorisation of simulation as modality in ZPD, I acknowledge that there may be contributions within the Simulation CoP that is exchanged in non-published formats that would not necessarily be as accessible to educators within LMICs. The continuous literature search did not yield any theorisation of simulated learning in LMICs, but the paper published by Groot et al. studying the impact of simulation applied in the ZPD leads me to believe that the concept must be known in HIC setting or wider Simulation CoP through the informal transfer of tacit knowledge. Therefore, I believe my theoretical contribution is to the SA and LMIC contexts, where Vygotskian and Lave and Wenger theorisation of simulation and learning are absent.

In closing, the curriculum framework generated in this research underscores the value of inclusive participation of multiple stakeholders in UG medical education (which was beyond the scope of this thesis) and the necessity of making explicit participants' philosophical and theoretical assumptions and theories of learning if the curriculum implemented in practice is to meet SA societal needs.

6.5. Limitations of the study

Despite my attempts to make the study as robust as possible, some limitations need to be declared.

On a macro level, in terms of the overall limitations of the study, the study never intended to be an exhaustive, step-by-step guide to implementing an undergraduate acute care clinical skills curriculum.

Regarding the Delphi study, an important limitation of the study was the selection of the Round 1 contributors to the study, namely, the EM registrars. It could be argued that by enlisting registrars to provide undergraduate competencies could be problematic; however, the decision to include EM registrars was both intentional and necessitated. The researcher felt that the EM registrars are ideally positioned to contribute to this study as the study was particularly looking at the clinical skills competencies for the acutely ill patient, which is an area of interest for EM registrars. Secondly, as it is mandatory to complete internship and community service in South Africa before registering as a medical practitioner, all the EM registrars have a lived experience as to the undergraduate clinical competencies required to manage an acutely ill patient within South Africa.

Despite this, the researcher mitigated the risks of the EM registrars providing clinical skills competencies which are inappropriate for the undifferentiated medical practitioners in the following ways. Firstly, during the recruitment process, the researcher emphasized that the competencies contributions provided are intended for an undergraduate clinical skills curriculum and was also physically communicated in the information sheet (Annexure 1). Secondly, the researcher enlisted a multi-professional team of undergraduate curriculum experts during Round 2 of the Delphi study, who were able to add, remove, or alter the contributions provided by the Round 1 contributors, if there was consensus amongst the experts. Finally, from a regulatory body standpoint, the Health Professions Council of South Africa (HPCSA) is particularly restrictive in sharing information on its members, which makes accessing any information to recruit participants extremely challenging and unlikely.

Considering all these factors, the EM registrars represented the most appropriate subset of participants under the circumstances.

Regarding the FGD, the researcher acknowledges that the number of participants who participated in the FGD was limited, despite an exhaustive recruitment process being adhered to (see methodology chapter). It must be noted that there is no definitive literature on the optimal number of participants in an FGD, however, it was the intention of the researcher to recruit more than what was included in the FGD. The numbers could be attributed to various factors, such as that many of the curriculum experts also function as clinical staff and it became challenging to find a time when all the participants were available at the same time. Eventually, it became unfeasible to continuously postpone the FGD to accommodate everyone. Furthermore, as the number of experts in SA with an interest in both undergraduate health professions education and acute care clinical skills are limited, it dramatically limited the number of participants available to participate in the FGD. Finally, and probably the biggest factor, was that many of the experts who were eligible to participate in the FGD were also eligible to participate in the semi-structured interviews. As the researcher felt that it would confound and inflate the opinions of certain individuals if they participate in both, the decision was made to exclude any expert from participating in the interviews if they had participated in the FGD.
It must be noted that the study was conducted within an interpretivist paradigm, which by implication views data as multi-layered and recognises the unique and valuable insights provided by each of the experts during the FGD. Also, as the purpose of this study was not generalisability, but rather critical analysis of the data, the FGD numbers become less significant, as the FGD afforded a mechanism to analyse the data provided by a relatively small but growing community of practice in SA.

Despite all these challenges, the researcher ensured that the findings of the FGD were valid by implementing the strategies of grounding all the FGD questions in the theoretical framework; by comparing and contrasting the opinions of the FGD contributors with existing literature and theories and semi structured interviews experts; and by repeating certain questions in both the FGD and the semi-structured interviews, thereby triangulating their responses.

6.6. Recommendations and Future Research

As medical simulation is relatively new in SA, there are great opportunities to conduct further research in this area. On a macro level, as the body of evidence surrounding medical simulation increases, it is heavily concentrated in the global north. Apart from geographical location, many of these countries are situated in healthcare economies which are very different from those of developing countries and the use of high technology simulation solutions are more feasible.

As a result, I propose that further research within developing world contexts critically interrogate medical simulation pedagogy and investigate the efficacy of low cost, high fidelity-low technology solutions in a bid to increase the scalability of medical simulation in medical education in these contexts. On a micro level, this research approached medical simulation as a blanket term due to the paucity of research within our context. While this is valuable and an important initial step, I welcome additional research that seeks to dissect medical simulation pedagogy into its various modalities (task trainer, standardised patients, fully immersed simulations and so forth) to further explore the role of these modalities in undergraduate medical education in a developing world context. This detailed exploration of the various simulation modalities could provide additional insights into the when, for whom, how, and why modalities do or do not work as posed by Cook at el. (Cook, 2014).

References:

Abrahams, N., Mathews, S., Lombard, C., Martin, L. J., & Jewkes, R. (2017). Sexual homicides in South Africa: A national cross-sectional epidemiological study of adult women and children. *PLoS ONE*, *12*(10), 1–13. https://doi.org/10.1371/journal.pone.0186432

Ahmed, A. K. (2019). *The Rise of Fallism: #RhodesMustFall and the Movement to Decolonize the University* (Colombia University). Retrieved from http://ez.sun.ac.za/login?url=https://search.proquest.com/docview/2187693841?accountid=14049%0Ahttp://sun-primo.hosted.exlibrisgroup.com/openurl/27US/27US_SP?genre=dissertations+%26+theses&atitle=&author=Ahmed%2C+Abdul+Kayum&volume=&issue=&spage=&date=201

Akaike, M., Fukutomi, M., Nagamune, M., Fujimoto, A., Tsuji, A., Ishida, K., & Iwata, T. (2012). Simulation-based medical education in clinical skills laboratory. *The Journal of Medical Investigation*, *59*(1,2), 28–35. https://doi.org/10.2152/jmi.59.28

Al-Hlq, A. (2010). Simulation-based medical teaching and learning. *Journal of Family and Community Medicine*, *17*(1), 35–40.

Allen, J., Buffardi, L., & Hays, R. (1991). *The Relationship of Simulator to Task and Performance Variables*. Alexandria,VA.

Amineh, R., & Hanieh, A. (2015). Review of constructivism and social constructivism. *Journal of Social Sciences, Literature and Languages*, *1*(1), 9–16. Retrieved from hps://pdfs.semanticscholar.org/3890/3f4a7255496f75124d639e14e9b810c17370.pdf

Amosun, S. L., Hartman, N., Van Rensburg, V. J., Duncan, E. M., & Badenhorst, E. (2012). Processes in widening access to undergraduate Allied Health Sciences education in South Africa. *African Journal of Health Professions Education*, *4*(1), 34–39. https://doi.org/10.7196/ajhpe.138

Andersen, P., Guinea, S., Reid-Searl, K., & Levett-Jones, T. (2021). Designing Tag Team Patient Safety Simulation: An instructional design approach. *Clinical Simulation in Nursing*, *59*, 1–9. https://doi.org/10.1016/j.ecns.2021.05.001

Anderson, S., & Morrison, R. (1993). Lessons learned from a historical review of piloted aircraft simulations. *AIAA*, *93*(93–3517).

Archer, E., & Meyer, I. S. (2021). Applying empathic communication skills in clinical practice: medical students’ experiences. *South African Family Practice*, *63*(1), 1–5.

https://doi.org/10.4102/safp.v63i1.5244

Arlington, L., Kairuki, A. K., Isangula, K. G., Meda, R. A., Thomas, E., Temu, A., … Nelson, B. D. (2017). Implementation of “helping babies breathe”: A 3-year experience in Tanzania. *Pediatrics*, *139*(5). https://doi.org/10.1542/peds.2016-2132

Bagwandeen, C. I., & Singaram, V. S. (2017). Effects of demographic factors on provision of feedback in postgraduate medical education. *South African Journal of Higher Education*, *32*(1), 31–48. https://doi.org/10.20853/32-1-1657

Banerjee, A., Slagle, J. M., Mercaldo, N. D., Booker, R., Miller, A., France, D. J., … Weinger, M. B. (2016). A simulation-based curriculum to introduce key teamwork principles to entering medical students. *BMC Medical Education*, *16*(1), 1–12. https://doi.org/10.1186/s12909-016-0808-9

Barbour, R. (2005). Making sense of focus groups. *Med Educ*, *39*(7), 742–750.

Barr, J., Ogden, K., & Rooney, K. (2014). Committing to patient-centred medical education. *Clinical Teacher*, *11*(7), 503–506. https://doi.org/10.1111/tct.12196

Barrows, H. (1993). An overview of the uses of standardized patients for teaching and evalualting clinical skills. *Academic Medicine*, *68*, 443–451.

Basu, D. (2018). Diseases of public health importance in South Africa. *Southern African Journal of Public Health*, *2*(3), 48–48. https://doi.org/10.7196/SHS.2018.V2.I3.72

Bates, J, & Ellaway, R. H. (2016). Mapping the dark matter of context: a conceptual scoping review. *Medical Education*, *50*(8), 807–816.

Bates, Joanna, Schrewe, B., Ellaway, R. H., Teunissen, P. W., & Watling, C. (2019). Embracing standardisation and contextualisation in medical education. *Medical Education*, *53*(1), 15–24. https://doi.org/10.1111/medu.13740

Bates, R. (2004). A critical analysis of evaluation practice: The Kirkpatrick model and the principle of beneficence. *Evaluation and Program Planning*, *27*(3), 341–347. https://doi.org/10.1016/j.evalprogplan.2004.04.011

Batho Pele - Putting people first. (2005). Retrieved February 20, 2020, from South Afrcan Government website: http://www.info.gov.za/aboutgovt/publicadmin/bathopele.htm

Beal, M. D., Kinnear, J., Anderson, C. R., Martin, T. D., Wamboldt, R., & Hooper, L. (2017). The Effectiveness of Medical Simulation in Teaching Medical Students Critical Care Medicine. *Simulation in Healthcare: The Journal of the Society for Simulation in Healthcare*, *12*(2), 104–116. https://doi.org/10.1097/SIH.0000000000000189

Bell, J. (2005). *Doing your research project: A guide for first-time researchers in education, health and social science* (4th editio). Berkshire, England: Open University Press.

Benner, P. (2004). Using the Dreyfus Model of Skill Acquisition to Describe and Interpret Skill Acquisition and Clinical Judgment in Nursing Practice and Education. *Bulletin of Science, Technology and Society*, *24*(3), 188–199. https://doi.org/10.1177/0270467604265061

Binstadt, E. S., Walls, R. M., White, B. A., Nadel, E. S., Takayesu, J. K., Barker, T. D., … Pozner, C. N. (2007). A Comprehensive Medical Simulation Education Curriculum for Emergency Medicine Residents. *Annals of Emergency Medicine*, *49*(4). https://doi.org/10.1016/j.annemergmed.2006.08.023

Blumenfeld, A., Velic, A., Bingman, E. K., Long, K. L., Aughenbaugh, W., Jung, S. A., & Liepert, A. E. (2020). A Mastery Learning Module on Sterile Technique to Prepare Graduating Medical Students for Internship. *MedEdPORTAL : The Journal of Teaching and Learning Resources*, *16*, 10914. https://doi.org/10.15766/mep_2374-8265.10914

Bola, S., Trollip, E., & Parkinson, F. (2015). The state of South African internships: A national survey against HPCSA guidelines. *South African Medical Journal*, *105*(7), 535–539. https://doi.org/10.7196/SAMJnew.7923

Bosse, H. M., Mohr, J., Buss, B., Krautter, M., Weyrich, P., Herzog, W., … Nikendei, C. (2015). The benefit of repetitive skills training and frequency of expert feedback in the early acquisition of procedural skills. *BMC Medical Education*, *15*(1), 1–10. https://doi.org/10.1186/s12909-015-0286-5

Bradley, P. (2006). The history of simulation in medical education and possible future directions. *Medical Education*, *40*(3), 254–262. https://doi.org/10.1111/j.1365-2929.2006.02394.x

Brady, S. R. (2015). Utilizing and Adapting the Delphi Method for Use in Qualitative Research. *International Journal of Qualitative Methods*, *14*(5), 160940691562138. https://doi.org/10.1177/1609406915621381

Brailsford, S. C., Bolt, T., Connell, C., Klein, J. H., & Patel, B. (2009). Stakeholder engagement in health care simulation. *Proceedings - Winter Simulation Conference*, 1840–1849. https://doi.org/10.1109/WSC.2009.5429190

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*, 77–101. https://doi.org/10.1191/ 1478088706qp063oa

Brazil, V. (2017). Translational simulation: not ‘where?’ but ‘why?’ A functional view of in situ simulation. *Advances in Simulation*, *2*(1), 1–5. https://doi.org/10.1186/s41077-017-0052-3

Bruner, R. F. (2001). Repetition is the First Principle of All Learning. *Social Science Research Network (SSRN)*, (November), 1–4. Retrieved from http://ssrn.com/abstract=224340

Burch, V. (2014). Interprofessional education – is it 'chakalaka' medicine? *African Journal of Health Professions Education*, *6*(769), 7196. https://doi.org/10.7196/AJHPE.424

Burns, C. L. (2015). Using debriefing and feedback in simulation to improve participant performance: an educator's perspective. *International Journal of Medical Education*, *6*, 118–120. https://doi.org/10.5116/ijme.55fb.3d3a

Cairncross, J. (2017). *The facilitators' perspective of interprofessional education at the Faculty of Health Sciences, University of the Free State*. University of Free State.

Cameron, D., Blitz, J., & Durrheim, D. (2002). Teaching young docs old tricks – was Aristotle right? An assessment of the skills training needs and transformation of interns and community service doctors working at a district hospital. *South African Medical Journal*, *92*(4), 276–278.

Carey, S., Zaitchik, D., & Bascandziev, I. (2015). Theories of development: In dialog with Jean Piaget. *Developmental Review 38(1):36-54.*, Vol. 38, pp. 36–54.

Chauhan, B. F., Jeyaraman, M., Mann, A. S., Lys, J., Skidmore, B., Sibley, K. M., … Zarychanksi, R. (2017). Behavior change interventions and policies influencing primary healthcare professionals' practice-an overview of reviews. *Implementation Science*, *12*(1). https://doi.org/10.1186/s13012-016-0538-8

Cheng, A., Eppich, W., Grant, V., Sherbino, J., Zendejas, B., & Cook, D. a. (2014). Debriefing for technology-enhanced simulation: A systematic review and meta-analysis. *Medical Education*, *48*(7), 657–666. https://doi.org/10.1111/medu.12432

Cheng, A., Grant, V., Dieckmann, P., Arora, S., Robinson, T., & Eppich, W. (2015). Faculty development for simulation programs: Five issues for the future of debriefing training. *Simulation in Healthcare*, *10*(4), 217–222. https://doi.org/10.1097/SIH.0000000000000090

Cheng, A., Hunt, E. A., Lang, E., Lin, Y., Lockey, A., & Bhanji, F. (2015). The use of high-fidelity manikins for advanced life support training—A systematic review and meta-analysis. *Resuscitation*, *93*, 142–149. https://doi.org/10.1016/j.resuscitation.2015.04.004

Chernikova, O., Heitzmann, N., Stadler, M., Holzberger, D., Seidel, T., & Fischer, F. (2020).

Simulation-Based Learning in Higher Education: A Meta-Analysis. *Review of Educational Research*, *90*(4), 003465432093354. https://doi.org/10.3102/0034654320933544

Chimhuya, S., Mbuwayesango, B., Aagaard, E. M., & Nathoo, K. J. (2018). Development of a neonatal curriculum for medical students in Zimbabwe - A cross sectional survey. *BMC Medical Education*, *18*(1), 1–9. https://doi.org/10.1186/s12909-018-1194-2

Chiniara, G., Cole, G., Brisbin, K., Huffman, D., Cragg, B., Chiniara, G., … Working, G. (2013). Simulation in healthcare : A taxonomy and a conceptual framework for instructional design and media selection Simulation in healthcare : A taxonomy and a conceptual framework for instructional design and media selection. *Medical Teacher*, *35*(May 2016). https://doi.org/10.3109/0142159X.2012.733451

Chiniara, G., Cole, G., Brisbin, K., Huffman, D., Cragg, B., Lamacchia, M., & Norman, D. (2013). Simulation in healthcare: A taxonomy and a conceptual framework for instructional design and media selection. *Medical Teacher*, *35*(8). https://doi.org/10.3109/0142159X.2012.733451

Chung, W. W. Y. (2000). A Review of Approaches to Determine the Effectiveness of Ground-Based Flight Simulations. *AIAA Modeling and Simulation Technologies Conference*, (AIAA-2000-4298). https://doi.org/doi:10.2514/6.2000-4298

Cohen, E. R., Feinglass, J., Barsuk, J. H., Barnard, C., O'Donnell, A., McGaghie, W. C., & Wayne, D. B. (2010). Cost savings from reduced catheter-related bloodstream infection after simulation-based education for residents in a medical intensive care unit. *Simulation in Healthcare : Journal of the Society for Simulation in Healthcare*, *5*(2), 98–102. https://doi.org/10.1097/SIH.0b013e3181bc8304

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciencies* (2nd editio). NJ: Erlbaum: Hillsdale.

Cohen, L., Manion, L., & Morrison, K. (2011). *Research methods in education* (7th editio). London: Routledge.

Colman, N., Doughty, C., Arnold, J., Stone, K., Reid, J., Dalpiaz, A., & Hebbar, K. B. (2019). Simulation-based clinical systems testing for healthcare spaces: from intake through implementation. *Advances in Simulation*, *4*(1), 1–9. https://doi.org/10.1186/s41077-019-0108-7

Cook, D. a. (2014). How much evidence does it take? A cumulative meta-analysis of outcomes of simulation-based education. *Medical Education*, *48*(8), 750–760.

https://doi.org/10.1111/medu.12473

Cook, D., Hatala, R., & Brydges, R. (2011). Technology-Enhanced Simulation for Health Professions Education: A Systematic Review and Meta-analysis. *JAMA*, *306*(9), 978–988.

Cooper, J. B., & Taqueti, V. R. (2008). A brief history of the development of mannequin simulators for clinical education and training. *Postgraduate Medical Journal*, *84*(997), 563–570. https://doi.org/10.1136/qshc.2004.009886

Couper, I., Hugo, J., & Mash, B. (2006). Building consensus on clinical procedural skills for South African family medicine training using the Delphi technique. *South African Family Practice*, *48*(10), 14.

Couperus, K., Young, S., Walsh, R., Kang, C., Skinner, C., Essendrop, R., … Gorbatkin, C. (2020). Immersive Virtual Reality Medical Simulation: Autonomous Trauma Training Simulator. *Cureus*, *12*(5). https://doi.org/10.7759/cureus.8062

Crabtree, B., & Miller, W. (1999). *Doing qualitative research*. Thousand Oaks, CA: Sage Publications, Inc.

Creswell, J. . (2003). *Research design. Qualitative, quantitative and mixed methods approaches*. CA: Thousand Oaks.

Custer, R., Scarcella, J., & Stewart, B. (1999). *Journal of Vocational and Technical Education*. *15*(2).

D'Eon, M., & Crawford, R. (2005). The elusive content of the medical-school curriculum: A method to the madness. *Medical Teacher*, *27*(8), 699–703. https://doi.org/10.1080/01421590500237598

Daher, M. (2003). World report on violence and health. *Journal Medical Libanais*, *51*(2), 59–63. https://doi.org/10.1007/bf03405037

Datta, R., Upadhyay, K. K., & Jaideep, C. N. (2012). Simulation and its role in medical education. *Medical Journal Armed Forces India*, *68*(2), 167–172. https://doi.org/10.1016/S0377-1237(12)60040-9

Davids, N. (2012). *Understanding Facilitator Practice in the Problem-Based Learning Classroom*. University of Cape Town.

de Villiers, M. R., Blitz, J., Couper, I., Kent, A., Moodley, K., Talib, Z., … Young, T. (2017). Decentralised training for medical students: Towards a South African consensus. *African Journal of Primary Health Care and Family Medicine*, *9*(1), 1–6.

https://doi.org/10.4102/phcfm.v9i1.1449

De Witt, J. K., Perusek, G. P., Lewandowski, B. E., Gilkey, K. M., Savina, M. C., Samorezov, S., & Edwards, W. B. (2010). Locomotion in simulated and real microgravity: Horizontal Suspension vs. Parabolic flight. *Aviation Space and Environmental Medicine*, *81*(12), 1092–1099. https://doi.org/10.3357/ASEM.2413.2010

Decker, S. I., Anderson, M., Boese, T., Epps, C., Mccarthy, J., Motola, I., … Scolaro, K. (2015). Standards of Best Practice : Simulation Standard VIII : Simulation-Enhanced Interprofessional Education (Sim-IPE). *Clinical Simulation in Nursing*, *11*(6), 293–297. https://doi.org/10.1016/j.ecns.2015.03.010

Densen, P. (2011). Challenges and opportunities facing medical education. *Transactions of the American Clinical and Climatological Association*, *122*(319), 48–58.

Dieckmann, P., Friis, S. M., Lippert, a., & Ostergaard, D. (2012). Goals, Success Factors, and Barriers for Simulation-Based Learning: A Qualitative Interview Study in Health Care. *Simulation & Gaming*, *43*(5), 627–647. https://doi.org/10.1177/1046878112439649

Dieckmann, Peter, Molin Friis, S., Lippert, A., & Ostergaard, D. (2009). The art and science of debriefing in simulation: Ideal and practice. *Medical Teacher*, *31*(7), e287–e294. https://doi.org/10.1080/01421590902866218

Dirzu, S. (2017). Medical simulation – a costly but essential teaching tool. *Romanian Journal of Anaesthesia and Intensive Care*, *24*(1), 5–6. https://doi.org/10.5681/rdme.2012.002

Dreyfus, S. E. (2004). The Five-Stage Model of Adult Skill Acquisition. *Bulletin of Science Technology & Society*, *24*, 177–181. https://doi.org/10.1177/0270467604264992

Epstein, R., Borrell-Carrio, F., & Suchman, A. (2004). The Biopsychosocial Model 25 Years Later: Principles, Practice, and Scientific Inquiry. *Annals Of Family Medicine*, *2*(6), 576–582. https://doi.org/10.1370/afm.245.Department

Ersdal, H. L., Vossius, C., Bayo, E., Mduma, E., Perlman, J., Lippert, A., & Søreide, E. (2013). A one-day “Helping Babies Breathe” course improves simulated performance but not clinical management of neonates. *Resuscitation*, *84*(10), 1422–1427. https://doi.org/10.1016/j.resuscitation.2013.04.005

Eubank, B. H., Mohtadi, N. G., Lafave, M. R., Wiley, J. P., Bois, A. J., Boorman, R. S., & Sheps, D. M. (2016). Using the modified Delphi method to establish clinical consensus for the diagnosis and treatment of patients with rotator cuff pathology. *BMC Medical Research Methodology*, *16*(1), 1–15. https://doi.org/10.1186/s12874-016-0165-8

Eva, K. (2010). The value of paradoxical tensions in medical education research. *Medical Education*, *44*(1), 3–4.

Fanning, R. M., & Gaba, D. M. (2007). The role of debriefing in simulation-based learning. *Simulation in Healthcare : Journal of the Society for Simulation in Healthcare*, *2*(2), 115–125. https://doi.org/10.1097/SIH.0b013e3180315539

Faulkner, L. R., & McCurdy, R. L. (2000). Teaching medical students social responsibility: The right thing to do. *Academic Medicine*, *75*(4), 346–350. https://doi.org/10.1097/00001888-200004000-00010

Finan, E., Bismilla, Z., Whyte, H. E., LeBlanc, V., & McNamara, P. J. (2012). High-fidelity simulator technology may not be superior to traditional low-fidelity equipment for neonatal resuscitation training. *Journal of Perinatology*, *32*(4), 287–292. https://doi.org/10.1038/jp.2011.96

Flick, U., Von Kardorff, E., & Steinke, I. (2004). *A Companion to Qualitative Research* (U. Flick, E. Von Kardorff, & I. Steinke, Eds.). Sage Publications, Inc.

Floding, M., & Swier, G. (2011). Legitimate Peripheral Participation: Entering A Community of Practice. *Reflective Practice: Formation and Supervision in Ministry*, *31*. Retrieved from http://journals.sfu.ca/rpfs/index.php/rpfs/article/view/116

Frank, J. R., Mungroo, R., Ahmad, Y., Wang, M., De Rossi, S., & Horsley, T. (2010). Toward a definition of competency-based education in medicine: A systematic review of published definitions. *Medical Teacher*, *32*(8), 631–637. https://doi.org/10.3109/0142159X.2010.500898

Frank, J. R., Snell, L. S., Cate, O. Ten, Holmboe, E. S., Carraccio, C., Swing, S. R., … Harris, K. A. (2010). Competency-based medical education: theory to practice. *Medical Teacher*, *32*(8), 638–645. https://doi.org/10.3109/0142159X.2010.501190

Freeman, R. (1984). *Strategic Management: A Stakeholder Approach*. Englewood Cliffs, NJ.: Prentice-Hall.

Frehywot, S., Vovides, Y., Talib, Z., Mikhail, N., Ross, H., Wohltjen, H., … Scott, J. (2013). E-learning in medical education in resource constrained low- and middle-income countries. *Human Resources for Health*, *11*(1), 1–15. https://doi.org/10.1186/1478-4491-11-4

Gaba, D. M. (2004). The future vision of simulation in health care. *Quality and Safety in Health Care*, *13*(SUPPL. 1), 2–10. https://doi.org/10.1136/qshc.2004.009878

Gauger, V., Rooney, D., Kovatch, K., Richey, L., Powell, A., Berhe, H., & Zopf, D. (2018). A Multidisciplinary International Collaborative Implementing Low Cost, High Fidelity 3D Printed Airway Models To Enhance Ethiopian Anesthesia Resident Emergency Cricothyroidotomy Skills. *International Journal of Pediatric Otorhinolaryngology*, *114*, 124–128.

Genn, J. M. (2001). AMEE medical education guide no. 23 (part 1): Curriculum, environment, climate, quality and change in medical education - A unifying perspective. *Medical Teacher*, *23*(4), 337–344. https://doi.org/10.1080/01421590120063330

Gervais, J. (2016). The operational definition of competency-based education. *The Journal of Competency-Based Education*, *1*(2), 98–106. https://doi.org/10.1002/cbe2.1011

Gill, P., Stewart, K., Treasure, E., & Chadwick, B. (2008). Methods of data collection in qualitative research: Interviews and focus groups. *British Dental Journal*, *204*(6), 291–295. https://doi.org/10.1038/bdj.2008.192

Glassman, M. (2001). Dewey and Vygotsky: Society, Experience, and Inquiry in Educational Practice. *Educational Researcher*, *30*(4), 3–14. https://doi.org/10.3102/0013189X030004003

GMC. (2016). Promoting excellence - equality and diversity considerations. In *General Medical Council*. https://doi.org/10.1108/17542730810867254

GMC. (2018). Outcomes for graduates. *GMC Publications*, *1*(1), 8. Retrieved from https://www.gmc-uk.org/education/undergraduate/undergrad_outcomes.asp

Godefrooij, M. B., Diemers, A. D., & Scherpbier, A. J. J. a. (2010). Students' perceptions about the transition to the clinical phase of a medical curriculum with preclinical patient contacts; a focus group study. *BMC Medical Education*, *10*, 28. https://doi.org/10.1186/1472-6920-10-28

Goldie, J. (2006). AMEE Education Guide no. 29: evaluating educational programmes. *Medical Teacher*, *28*(3), 210–224. https://doi.org/10.1080/01421590500271282

Goldie, J. (2012). The formation of professional identity in medical students: Considerations for educators. *Medical Teacher*, *34*(9). https://doi.org/10.3109/0142159X.2012.687476

Goldshtein, D., Krensky, C., Doshi, S., & Perelman, V. S. (2020). In situ simulation and its effects on patient outcomes: A systematic review. *BMJ Simulation and Technology Enhanced Learning*, *6*(1), 3–9. https://doi.org/10.1136/bmjstel-2018-000387

Gonsalves, G. S., Kaplan, E. H., & Paltiel, A. D. (2015). Reducing sexual violence by increasing the supply of toilets in Khayelitsha, South Africa: A mathematical model. *PLoS ONE*, *10*(4), 1–12. https://doi.org/10.1371/journal.pone.0122244

Green, R. A. (2014). *The Delphi Technique in Educational*. https://doi.org/10.1177/2158244014529773

Greenhalgh, T., & Peacock, R. (2005). Effectiveness and efficiency of search methods in systematic reviews of complex evidence: Audit of primary sources. *British Medical Journal*, *331*(7524), 1064–1065. https://doi.org/10.1136/bmj.38636.593461.68

Groot, F., Jonker, G., Rinia, M., Ten Cate, O., & Hoff, R. G. (2020). Simulation at the Frontier of the Zone of Proximal Development: A Test in Acute Care for Inexperienced Learners. *Academic Medicine*, *95*(7), 1098–1105. https://doi.org/10.1097/ACM.0000000000003265

Grossman, P., Compton, C., Igra, D., Ronfeldt, M., Shahan, E., & Williamson, P. (2009). Teaching practice: A cross-professional perspective. *Teachers College Record*, *111*(9), 2055–2100.

Guba, E. G., & Lincoln, Y. S. (1985). *Naturalistic inquiry*. Newbury Park, CA: Sage Publications, Inc.

Hamstra, S. J., Cook, D. A., Zendejas, B., Hatala, R., & Brydges, R. (2014). Reconsidering Fidelity in Simulation-Based Training. *Academic Medicine*, *89*(3), 387–392. https://doi.org/10.1097/acm.0000000000000130

Harden, R.M. (1986). Approaches to curriculum planning. *Medical Education*, *20*, 458–466.

Harden, Ronald M. (2000). The integration ladder: A tool for curriculum planning and evaluation. *Medical Education*, *34*(7), 551–557. https://doi.org/10.1046/j.1365-2923.2000.00697.x

Hartman, N., Kathard, H., Perez, G., Reid, S., Irlam, J., Gunston, G., … Ige, B. (2012). Health sciences undergraduate education at the university of Cape Town: A story of transformation. *South African Medical Journal*, *102*(6), 477–480.

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research*, *77*(1), 81–112. https://doi.org/10.3102/003465430298487

Henning, E., Van Rensberg, W., & Smit, B. (2004). *Finding your way in qualitative research*. Pretoria: Van Schaik.

Hill, C. ., Baird, W. ., & Walters, S. . (2014). Quality of life in chiildren and adolescents with osteogenesis imperfecta: a qualitative interview based study. *Health Quality Life*

Outcomes, *12*(54).

Hirshon, J. M., Risko, N., Calvello, E. J., Stewart de Ramirez, S., Narayan, M., Theodosis, C., … for the Acute Care Research Collaborative at the University of Maryland Global Health Initiative. (2013). Health systems and services: the role of acute care. *Bulletin of the World Health Organization*, *91*(5), 386–388. https://doi.org/10.2471/BLT.12.112664

Homeyer, S., Hoffmann, W., Hingst, P., Oppermann, R. F., & Dreier-Wolfgramm, A. (2018). Effects of interprofessional education for medical and nursing students: Enablers, barriers and expectations for optimizing future interprofessional collaboration - a qualitative study. *BMC Nursing*, *17*(1), 1–10. https://doi.org/10.1186/s12912-018-0279-x

Hsu, C., & Ohio, T. (2007). *The Delphi Technique : 12*(10).

Human Research Ethics Committee, Faculty of Health Sciences, U. of C. T. (2016). *Informed Consent: Standard Operating Procedure*. Retrieved from http://www.uct.ac.za/sites/default/files/image_tool/images/116/documents/research/Informed Consent SOP January 2016.docx

Hunt, E. a., Shilkofski, N. a., Stavroudis, T. a., & Nelson, K. L. (2007). Simulation: Translation to Improved Team Performance. *Anesthesiology Clinics*, *25*(2), 301–319. https://doi.org/10.1016/j.anclin.2007.03.004

Imel, S. (2011). Writing a literature review. In *The Handbook of Scholarly Writing and Publishing*. San Francisco, Calif: Jossey-Bass.

Irby, D., O'Sullivan, P., & Steinert, Y. (2015). Is it time to recognize excellence in faculty development programs? *Medical Teacher*, (1–2).

Issenberg, S. B. (2006). The scope of simulation-based healthcare education. *Simulation in Healthcare : Journal of the Society for Simulation in Healthcare*, *1*(4), 203–208. https://doi.org/10.1097/01.SIH.0000246607.36504.5a

Issenberg, S. B., McGaghie, W. C., Petrusa, E. R., Lee Gordon, D., & Scalese, R. J. (2005). Features and uses of high-fidelity medical simulations that lead to effective learning: a BEME systematic review. *Medical Teacher*, *27*(1), 10–28. https://doi.org/10.1080/01421590500046924

Issenberg, S. B., Ringsted, C., Ostergaard, D., & Dieckmann, P. (2011). Setting a research agenda for simulation-based healthcare education: a synthesis of the outcome from an utstein style meeting. *Simulation in Healthcare : Journal of the Society for Simulation in*

Healthcare, *6*(3), 155–167. https://doi.org/10.1097/SIH.0b013e3182207c24

J, M., & K, M. (2001). More on medical student stress. *Medical Education*, *35*, 617–618.

Jackson, M., Harrison, P., Swinburn, B., & Lawrence, M. (2015). Using a qualitative vignette to explore a complex public health issue. *Qualitative Health Research*, *25*(10), 1395–1409.

James, S., & Miza, T. M. (2015). Perceptions of professional nurses regarding introduction of the Batho Pele principles in State hospitals. *Curationis*, *38*(1), 1–9. https://doi.org/10.4102/curationis.v38i1.1128

Jansen, M., & Waggie, F. (2018). The facilitators and barriers to implementing an inter-professional education point of care simulation activity for health care workers in a tertiary hospital in Cape Town. *The Society in Europe for Simulation Applied to Medicine (SESAM)*. Bilbao, Spain.

Jeffries, P., Dreifuerst, K., Kardong-Edgren, S., & Hayden, J. (2015). Faculty development when initiating simulation programs: lessons learned from the national simulation study. *J Nurs Regul*, *5*(4), 17–23.

Jha, A. K., Larizgoitia, I., Audera-Lopez, C., Prasopa-Plaizier, N., Waters, H., & Bates, D. W. (2013). The global burden of unsafe medical care: Analytic modelling of observational studies. *BMJ Quality and Safety*, *22*(10), 809–815. https://doi.org/10.1136/bmjqs-2012-001748

Kahn, K., Tolhurst-Cleaver, S., White, S., & Simpson, W. (2011). *Simulation in healthcare education. Building a simulation programme: A practical guide (AMEE Guide No. 50: Curriculum Planning)*. Dundee: Association for Medical Education in Europe (AMEE).

Karpov, Y. V., & Haywood, H. C. (1998). Two Ways to Elaborate Vygotsky's Concept of Mediation: Implications for Instruction. *American Psychologist*, *53*(1), 27–36. https://doi.org/10.1037/0003-066X.53.1.27

Katowa-Mukwato, P., Andrews, B., Maimbolwa, M., Lakhi, S., Michelo, C., Mulla, Y., & Banda, S. S. (2014). Medical students' clerkship experiences and self-perceived competence in clinical skills. *African Journal of Health Professions Education*, *6*(2), 155. https://doi.org/10.7196/ajhpe.358

Katzenbach, J., & Smith, D. (1993). *The wisdom of teams: Creating the high performance organization*. Cambridge: HarperBusiness.

Kaufman, D. M. (2018). Teaching and learning in medical education: How Theory can Inform

Practice. *Journal of Medical Education*, *37*(7), 37–69. https://doi.org/10.1002/9781118472361.ch2

Kennedy, K. (2014). The case in favour of educating medical students about sexual violence. *Medical Teacher*, *36*(3), 267–268. https://doi.org/10.3109/0142159X.2014.875618

Kerins, J., Smith, S. E., Stirling, S. A., Wakeling, J., & Tallentire, V. R. (2021). Transfer of training from an internal medicine boot camp to the workplace: enhancing and hindering factors. *BMC Medical Education*, *21*(1), 1–12. https://doi.org/10.1186/s12909-021-02911-5

Kern, D., Thomas, P., & Hughes, M. (2009). *Curriculum Development for Medical Education: A Six-Step Approach* (Second Edi). Baltimore, Maryland: The Johns Hopkins University Press.

Khamis, N. N., Satava, R. M., Alnassar, S. A., & Kern, D. E. (2016). A stepwise model for simulation-based curriculum development for clinical skills, a modification of the six-step approach. *Surgical Endoscopy*, *30*(1), 279–287. https://doi.org/10.1007/s00464-015-4206-x

Khine, A., & Hartman, A. (2021). Significance of relationships in the cognitive apprenticeship. *African Journal of Health Professions Education*, *13*(1), 36–40.

King, N. (2004). *Using templates in the thematic analysis of text*. London, UK: Sage.

Kitzinger, J. (1994). The methodology of focus groups: The importance of interaction between research participants. *Soc Health Illn*, *16*(1), 103–121.

Kitzinger, J. (1995). Qualitative research: Introducing focus groups. *Br Med J*, *311*, 299–302.

Kizakevich, P. N., Lux, L., Duncan, S., Guinn, C., & McCartney, M. L. (2003). Virtual simulated patients for bioterrorism preparedness training. *Studies in Health Technology and Informatics*, *94*, 165–167. https://doi.org/10.3233/978-1-60750-938-7-165

Kneebone, R. L., Kidd, J., Nestel, D., Barnet, a., Lo, B., King, R., … Brown, R. (2005). Blurring the boundaries: Scenario-based simulation in a clinical setting. *Medical Education*, *39*(6), 580–587. https://doi.org/10.1111/j.1365-2929.2005.02110.x

Kneebone, R. L., Scott, W., Darzi, a., & Horrocks, M. (2004). Simulation and clinical practice: Strengthening the relationship. *Medical Education*, *38*(10), 1095–1102. https://doi.org/10.1111/j.1365-2929.2004.01959.x

Koens, F., Mann, K. V., Custers, E. J. F. M., & Ten Cate, O. T. J. (2005). Analysing the concept of context in medical education. *Medical Education*, *39*(12), 1243–1249.

https://doi.org/10.1111/j.1365-2929.2005.02338.x

Kohn, L., Corrigan, J., & Donaldson, M. (Eds.). (1999). *To err is human: building a safer health system*. Washington, DC: National Academy Press.

Kolb, D. (1984). *Experiential learning: experience as a source of learning and development*. Englewood Cliffs, NJ.: Prentice Hall.

Krueger-Ray, S. (2017). Issues Related to Implementing High-Fidelity Simulation in a Nursing Program. *Issues Related to Implementing High-Fidelity Simulation in a Nursing Program*, 1. Retrieved from http://search.ebscohost.com.libezproxy.dundee.ac.uk/login.aspx?direct=true&db=jlh&AN=130413251&site=ehost-live&scope=site

Kuhn, T. (1962). *The structure of scientific revolutions*. Chicago, Illinois: University of Chicago Press.

Labuschagne, M. J., Nel, M. M., Nel, P. P. C., & Van Zyl, G. J. (2014). Recommendations for the establishment of a clinical simulation unit to train South African medical students. *African Journal of Health Professions Education*, *6*(2), 138. https://doi.org/10.7196/ajhpe.345

Lakshini, S. (2015). *Learning processes and identity construction of newly qualified doctors: a narrative study*. University of KwaZulu-Natal.

Larivaara, P., Kiuttu, J., & Taanila, A. (2001). *Scandinavian Journal of Primary Health Care The patient-centred interview: the key to biopsychosocial diagnosis and treatment*. *3432*. https://doi.org/10.1080/02813430119395

Lave, J. (1991). Situating learning in communities of practice. *Perspectives on Socially Shared Cognition*, *2*, 63–82.

Lave, J. (2008). Epilogue: Situated learning and changing practice. In A. Amin & J. Roberts (Eds.), *Community, economic creativity, and organization* (pp. 283–296). New York: Oxford University Press.

Lave, J., & Wenger, E. (1991). *Situated Learning. Legitimate peripheral participation*. Cambridge: University of Cambridge Press.

Legard, R., Keegan, J., & Ward, K. (2003). In-depth interviews. In *Qualitative Research Practice: A Guide for Social Science Students and Researchers* (pp. 139–169). London: Sage.

Lemoine, J., Chauvin, S., Broussard, L., & Oberleitner, M. (2015). Statewide interprofessional faculty development in simulation-based education for health professions. *Clinical Simulation in Nursing*, *11*(3), 153–162.

Lerner, S., Magrane, D., & Friedman, E. (2009). Teaching teamwork in medical education. *Mount Sinai Journal of Medicine*, *76*, 318–329.

Leslie, K., Baker, L., Egan-Lee, E., Esdaile, M., & Reeves, S. (2013). Advancing faculty development in medical education: A systematic review. *Academic Medicine*, *88*(7), 1038–1045. https://doi.org/10.1097/ACM.0b013e318294fd29

Lesser, E. L., & Storck, J. (2001). Communities of practice and organizational performance. *IBM Systems Journal*, *40*(4), 831–841. https://doi.org/10.1147/sj.404.0831

Loder, R. T., & Robinson, T. P. (2020). The demographics of patients presenting for sexual assault to US emergency departments. *Journal of Forensic and Legal Medicine*, *69*(November 2019), 101887. https://doi.org/10.1016/j.jflm.2019.101887

Maitra, A., Lin, S., Rydel, T. A., & Schillinger, E. (2021). Balancing forces: Medical students' reflections on professionalism challenges and professional identity formation. *Family Medicine*, *53*(3), 200–206. https://doi.org/10.22454/FamMed.2021.128713

Makgoba, M. (1997, November 27). "Academics should also face the music" (a comment on the Truth and Reconciliation Commission). *The Star*.

Marsh, C. (2009). *Key concepts for understanding curriculum* (Fourth edi). Abingdon: Routledge.

Martinerie, L., Rasoaherinomenjanahary, F., Ronot, M., Fournier, P., Dousset, B., Tesnière, A., … Gronnier, C. (2018). Health care simulation in developing countries and low-resource situations. *Journal of Continuing Education in the Health Professions*, *38*(3), 205–212. https://doi.org/10.1097/CEH.0000000000000211

Massoth, C., Röder, H., Ohlenburg, H., Hessler, M., Zarbock, A., Pöpping, D., & M, W. (2019). High-fidelity is not superior to low-fidelity simulation but leads to overconfidence in medical students. BMC medical education. *BMC Med Educ.*, *19*(29), 1–8.

Matlala, S. (2021). Educators' perceptions and views of problem-based learning through simulation. *Curationis*, *44*(1), 1–7. https://doi.org/10.4102/curationis.v44i1.2094

Matsika, A., Nathoo, K., Borok, M., Mashaah, T., Madya, F., Connors, S., … Hakim, J. G. (2018). Role of faculty development programs in medical education at the university of Zimbabwe college of health sciences, Zimbabwe. *Annals of Global Health*, *84*(1), 183–189. https://doi.org/10.29024/aogh.5

Matsumoto, E., Hamstra, S., Radomski, S., & Cusimano, M. (2002). The effect of bench model fidelity on endourological skills: A randomized controlled study. *Urology*, *167*, 1243–1247.

Matthews, M., & Van Wyk, J. (2018). Towards a culturally competent health professional: A South African case study. *BMC Medical Education*, *18*(1), 1–11. https://doi.org/10.1186/s12909-018-1187-1

Matzer, F., Wisiak, U. V., Graninger, M., Söllner, W., Stilling, H. P., Glawischnig-Goschnik, M., … Fazekas, C. (2012). Biopsychosocial Health Care Needs at the Emergency Room: Challenge of Complexity. *PLoS ONE*, *7*(8). https://doi.org/10.1371/journal.pone.0041775

Maxwell, J. . (2005a). *Qualitative research design: An interactive approach* (2nd editio). Thousand Oaks, CA: Sage Publications, Inc.

Maxwell, J. . (2005b). *Qualitative Research Design: An Interactive Approach* (2nd ed). Thousand Oaks, CA: Sage Publications, Inc.

Mayosi, B. M., & Benatar, S. R. (2014). Health and Health Care in South Africa — 20 Years after Mandela. *The New England Journal of Medicine*, *371*(14).

McGaghie, W. C. (2009). Lessons for Continuing Medical Education From Simulation Research in Undergraduate and Graduate Medical Education. *CHEST Journal*, *135*(3_suppl), 62S. https://doi.org/10.1378/chest.08-2521

McGaghie, W. C. (2015). Varieties of integrative scholarship: Why rules of evidence, criteria, and standards matter. *Academic Medicine*, *90*(3), 294–302. https://doi.org/10.1097/ACM.0000000000000585

Mcgaghie, W. C., Issenberg, S. B., Barsuk, J. H., & Wayne, D. B. (2014). A critical review of simulation-based mastery learning with translational outcomes. *Medical Education*, *48*(4), 375–385. https://doi.org/10.1111/medu.12391

Mcgaghie, W. C., Issenberg, S. B., Cohen, E. R., Barsuk, J. H., & Wayne, D. B. (2011). *Does Simulation-Based Medical Education With Deliberate Practice Yield Better Results Than Traditional Clinical Education ? A Meta-Analytic Comparative Review of the Evidence*. *86*(6), 706–711. https://doi.org/10.1097/ACM.0b013e318217e119

McGaghie, W. C., Issenberg, S. B., Cohen, E. R., Barsuk, J. H., & Wayne, D. B. (2012). Translational educational research: A necessity for effective health-care improvement. *Chest*, *142*(5), 1097–1103. https://doi.org/10.1378/chest.12-0148

McGaghie, W. C., Issenberg, S. B., Petrusa, E. R., & Scalese, R. J. (2010a). A critical review of simulation-based medical education research: 2003-2009. *Medical Education*, *44*(1), 50–63. https://doi.org/10.1111/j.1365-2923.2009.03547.x

McGaghie, W. C., Issenberg, S. B., Petrusa, E. R., & Scalese, R. J. (2010b). A critical review pf simulation based medical education research.2003-2009. *Medical Education*, *44*, 50–63.

McKimm, J. (2007). *Curriculum design and development*. https://doi.org/10.1111/j.1465-3435.2011.01482.x

McLeod, S. (2018). Lev Vygotsky. Retrieved December 19, 2019, from Simple Pschology website: https://www.simplypsychology.org/vygotsky.html

McNamee, L. S., & Rule, P. N. (2019). Dispositions of newly qualified doctors encountering a language-related dilemma in South Africa. *Southern African Linguistics and Applied Language Studies*, *37*(2), 158–170. https://doi.org/10.2989/16073614.2019.1632722

Mduma, E., Ersdal, H., Svensen, E., Kidanto, H., Auestad, B., & Jeffrey, P. (2015). Frequent brief on-site simulation training and reduction in 24-h neonatal mortality—An educational intervention study. *Resuscitation*, *93*, 1–7.

Merriman, C. D., Stayt, L. C., & Ricketts, B. (2014). Comparing the Effectiveness of Clinical Simulation versus Didactic Methods to Teach Undergraduate Adult Nursing Students to Recognize and Assess the Deteriorating Patient. *Clinical Simulation in Nursing*, *10*(3), e119–e127. https://doi.org/10.1016/j.ecns.2013.09.004

Mertens, D. (2005). *Research and evaluation in education and psychology: integrating diversity with qualitative, quantitative and mixed methods* (Second edi). USA: Sage Publications, Inc.

Merton, R., & Kendall, P. (1946). The focussed interview. *Am J Psychol*, *51*(6), 541–557.

Meyers, M. . (2008). Qualitative Research in Business & Management. *SAGE Publications*.

Michels, M. E. J., Evans, D. E., Blok, G. A., Michels, M. E. J., Evans, D. E., & Blok, G. A. (2016). *What is a clinical skill ? Searching for order in chaos through a modified Delphi process What is a clinical skill ? Searching for order in chaos through a modified Delphi process*. (May). https://doi.org/10.3109/0142159X.2012.669218

Middlemiss, T., Lloyd-Williams, M., Laird, B. ., & Fallon, M. . (2015). Symptom control trials in patients with advanced cancer: a qualitative study. *Pain Symptom Management*, *50*(5), 642–649.

Miles, M., & Huberman, A. (1994). *Qualitative data analysis: An expanded source book* (2nd editio). Newbury Park. CA: Sage Publications, Inc.

Mitchell, R. K., Agle, B. R., & Wood, D. J. (1997). Toward a theory of stakeholder identification and salience: Defining the principle of who and what really counts. *Academy of Management Review*, *22*(4), 853–886. https://doi.org/10.5465/AMR.1997.9711022105

Monekosso, G. (2014). A brief history of medical edu- cation in Sub-Saharan Africa. *Academic Medicine*, *89*(8), S11–S15.

Monrouxe, L. V., Bullock, A., Gormley, G., Kaufhold, K., Kelly, N., Roberts, C. E., … Rees, C. (2018). New graduate doctors' preparedness for practice: A multistakeholder, multicentre narrative study. *BMJ Open*, *8*(8). https://doi.org/10.1136/bmjopen-2018-023146

Mooney, G., & McIntyre, D. (2008). South Africa: a 21st century apartheid in health and health care? *The Medical Journal of Australia*, *189*(11–12).

Moran, M. (2010). Enlightenment via simulation. *Journal of Endourology(Vol. 24, Issue 1)*, *24*(1).

Moss, F., & McManus, I. (1992). The anxieties of new clinical students. *Medical Education*, *26*, 17–20.

Mossenson, A. I., Tuyishime, E., Rawson, D., Mukwesi, C., Whynot, S., Mackinnon, S. P., & Livingston, P. (2020). Promoting anaesthetisia providers' non-technical skills through the Vital Anaesthesia Simulation Training (VAST) course in a low-resource setting. *British Journal of Anaesthesia*, *124*(2), 206–213. https://doi.org/10.1016/j.bja.2019.10.022

Motola, I., Devine, L. A., Chung, H. S., Sullivan, J. E., & Issenberg, S. B. (2013). Simulation in healthcare education: A best evidence practical guide. AMEE Guide No. 82. *Medical Teacher*, *35*(10), 142–159. https://doi.org/10.3109/0142159X.2013.818632

Mtombeni, S. (2018). *Identifying procedural core competencies for undergraduate emergency medicine education at the University of Zimbabwe College of Health Science*. University of Cape Town.

Nelissen, E., Ersdal, H., Mduma, E., Evjen-Olsen, B., Twisk, J., Broerse, J., … Stekelenburg, J. (2017). Clinical performance and patient outcome after simulation-based training in prevention and management of postpartum haemorrhage: An educational intervention study in a low-resource setting. *BMC Pregnancy and Childbirth*, *17*(1), 1–9. https://doi.org/10.1186/s12884-017-1481-7

Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic Analysis: Striving to Meet the Trustworthiness Criteria. *International Journal of Qualitative Methods*, *16*(1), 1–13. https://doi.org/10.1177/1609406917733847

Ntuli, C. D. (2012). Intercultural misunderstanding in South Africa: An analysis of nonverbal communication behaviour in context. *Intercultural Communication Studies*, *21*(2), 20–31. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=ufh&AN=91549129&site=ehost-live%5Cnhttp://0-content.ebscohost.com.libraries.colorado.edu/ContentServer.asp?T=P&P=AN&K=91549129&S=R&D=ufh&EbscoContent=dGJyMMTo50Sep644v+bwOLCmr02ep7JSs6e4TK6WxWXS&Conten

O'Brien, B. C., & Battista, A. (2020). Situated learning theory in health professions education research: a scoping review. *Advances in Health Sciences Education*, *25*(2), 483–509. https://doi.org/10.1007/s10459-019-09900-w

Paige, J. T., Garbee, D. D., Brown, K. M., & Rojas, J. D. (2015). Using Simulation in Interprofessional Education. *Surgical Clinics of North America*, *95*(4), 751–766. https://doi.org/10.1016/j.suc.2015.04.004

Parhar, G. (2019). Socially Responsible Physicians. *University of British Columbia Medical Journal*, *10*(2), 9–10.

Patterson, M. D., Geis, G. L., LeMaster, T., & Wears, R. L. (2013). Impact of multidisciplinary simulation-based training on patient safety in a paediatric emergency department. *BMJ Quality and Safety*, *22*(5), 383–393. https://doi.org/10.1136/bmjqs-2012-000951

Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks.

Peña, A. (2010). The Dreyfus model of clinical problem-solving skills acquisition: a critical perspective. *Medical Education Online*, *15*, 1–11. https://doi.org/10.3402/meo.v15i0.4846

Perkins, G. D. (2007). Simulation in resuscitation training. *Resuscitation*, *73*(2), 202–211. https://doi.org/10.1016/j.resuscitation.2007.01.005

Perkins, G. D., Barrett, H., Bullock, I., Gabbott, D. A., Nolan, J. P., Mitchell, S., … Bion, J. F.

(2005). The Acute Care Undergraduate TEaching (ACUTE) Initiative: Consensus development of core competencies in acute care for undergraduates in the United Kingdom. *Intensive Care Medicine*, *31*(12), 1627–1633. https://doi.org/10.1007/s00134-005-2837-4

Peterson, D. T., Watts, P. I., Epps, C. A., & White, M. L. (2017). Simulation Faculty Development: A Tiered Approach. *Simulation in Healthcare*, *12*(4), 254–259. https://doi.org/10.1097/SIH.0000000000000225

Pizam, A., & Mansfeld, Y. (2009). *Consumer behaviour in travel and tourism*. London: Taylor and Francis group.

Prideaux, D. (2019). The global–local tension in medical education: turning ‘think global, act local’ on its head? *Medical Education*, *53*(1), 25–31. https://doi.org/10.1111/medu.13630

Pringle, K., Mackey, J. M., Modi, P., Janeway, H., Romero, T., Meynard, F., … Levine, A. C. (2015). A short trauma course for physicians in a resource-limited setting: Is low-cost simulation effective? *Injury*, *46*(9), 1796–1800. https://doi.org/10.1016/j.injury.2015.05.021

Puri, L., Das, J., Pai, M., Agrawal, P., Fitzgerald, J. E., Kelley, E., … Aggarwal, R. (2017). Enhancing quality of medical care in low income and middle income countries through simulation-based initiatives: Recommendations of the Simnovate Global Health Domain Group. *BMJ Simulation and Technology Enhanced Learning*, *3*(March 2017), S15–S22. https://doi.org/10.1136/bmjstel-2016-000180

Rabiee, F. (2004). Focus-group interview and data analysis. *The Proceedings of the Nutrition Society*, *63*(4), 655–660. https://doi.org/10.1079/PNS2004399

Radcliffe, C., & Lester, H. (2003). Perceived stress during undergraduate medical training: a qualitative study. *Medical Education*, *37*, 32–38.

Rall, M., & Dieckmann, P. (2005). Simulation and patient safety: The use of simulation to enhance patient safety on a systems level. *Current Anaesthesia and Critical Care*, *16*(5), 273–281. https://doi.org/10.1016/j.cacc.2005.11.007

Raney, J. H., Morgan, M. C., Christmas, A., Sterling, M., Spindler, H., Ghosh, R., … Walker, D. M. (2019). Simulation-enhanced nurse mentoring to improve preeclampsia and eclampsia care: An education intervention study in Bihar, India. *BMC Pregnancy and Childbirth*, *19*(1), 1–9. https://doi.org/10.1186/s12884-019-2186-x

Ratner, C. (2012). Subjectivism. In L. Given (Ed.), *The SAGE Encyclopedia of Qualitative Research Methods* (pp. 840–843). Thousand Oaks, CA: Sage Publications, Inc.

Ringsted, C., Hodges, B., & Scherpbier, A. (2011). ‘The research compass’: An introduction to research in medical education: AMEE Guide No. 56. *Medical Teacher*, *33*(9), 695–709. https://doi.org/10.3109/0142159X.2011.595436

Rodriguez-Paz, J. M., Kennedy, M., Salas, E., Wu, a W., Sexton, J. B., Hunt, E. a, & Pronovost, P. J. (2009). Beyond “see one, do one, teach one”: toward a different training paradigm. *Postgraduate Medical Journal*, *85*(1003), 244–249. https://doi.org/10.1136/qshc.2007.023903

Rosen, K. R. (2008). The history of medical simulation. *Journal of Critical Care*, *23*(2), 157–166. https://doi.org/10.1016/j.jcrc.2007.12.004

Roussin, C. J., & Weinstock, P. (2017). SimZones: An Organizational Innovation for Simulation Programs and Centers. *Academic Medicine*, *92*(8), 1114–1120. https://doi.org/10.1097/ACM.0000000000001746

RUSSELL, I. ., HENDRICSON, W. ., & HERBERT, R. . (1984). Effects of lecturing information density on medical student achievement. *Journal of Medical Education*, *57*, 881–889.

Sadideen, H., Plonczak, A., Saadeddin, M., & Kneebone, R. (2018). How educational theory can inform the training and practice of plastic surgeons. *Plastic and Reconstructive Surgery - Global Open*, *6*(12), 1–8. https://doi.org/10.1097/GOX.0000000000002042

Saggie, J. (2013). Trauma: South Africa’s other epidemic. *SAMJ: South African Medical Journal*, *103*(9), 589–590. Retrieved from http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S0256-95742013000900002&nrm=iso

Salas, E., Rosen, M., & King, H. (2009). Integrating teamwork into the “DNA” of graduate medical education: Principles for simulation-based training. *Journal of Graduate Medical Education*, *1*, 243–244.

Samuel, M. (2019). *The Research Wheel* (pp. 30–37). pp. 30–37. UKZN, School of Education.

SANSON-FISHER, R., & ROLFE, I. (2000). The content of undergraduate health professional courses: a topic largely ignored? *Medical Teacher*, *22*, 564–567.

Saunders, B., Sim, J., Kingstone, T., Baker, S., Waterfield, J., Bartlam, B., … Jinks, C. (2018). Saturation in qualitative research: exploring its conceptualization and operationalization. *Quality and Quantity*, *52*(4), 1893–1907.

https://doi.org/10.1007/s11135-017-0574-8

Sharma, S., Boet, S., Kitto, S., & Reeves, S. (2011). Interprofessional simulated learning: The need for “sociological fidelity.” *Interprof Care*, *25*, 81–83.

Sholl, S. (2018). Balance or tension? Walking the tightrope between training and patient care. *Medical Education*, *52*(3), 248–249. https://doi.org/10.1111/medu.13511

Sholl, S., Ajjawi, R., Allbutt, H., Butler, J., Jindal-Snape, D., Morrison, J., & Rees, C. (2017). Balancing health care education and patient care in the UK workplace: a realist synthesis. *Medical Education*, *51*(8), 787–801. https://doi.org/10.1111/medu.13290

Sockett, H. (1976). *Designing the Curriculum*. London: open books.

Sørensen, J. L., Østergaard, D., LeBlanc, V., Ottesen, B., Konge, L., Dieckmann, P., & Van der Vleuten, C. (2017). Design of simulation-based medical education and advantages and disadvantages of in situ simulation versus off-site simulation. *BMC Medical Education*, *17*(1), 1–9. https://doi.org/10.1186/s12909-016-0838-3

Stalmeijer, R. E., McNaughton, N., & Van Mook, W. N. K. A. (2014). Using focus groups in medical education research: AMEE Guide No. 91. *Medical Teacher*, *36*(11), 923–939. https://doi.org/10.3109/0142159X.2014.917165

Strauss, A. L., & Corbin, J. (1990). *Basics of Qualitative Research: Grounded Theory Procedures and Techniques.* CA: Thousand Oaks.

Swart, R., Duys, R., & Hauser, N. D. (2019). Sass: South African simulation survey – a review of simulation-based education. *Southern African Journal of Anaesthesia and Analgesia*, *25*(4), 12–20. https://doi.org/10.36303/sajaa.2019.25.4.2191

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science*, *12*(2), 257–285. https://doi.org/10.1016/0364-0213(88)90023-7

Taba, H. (1962). *Curriculum Development: Theory and Practise*. New York: Harcourt, Brace, & World.

Tavakol, M., & Sandars, J. (2014a). Quantitative and qualitative methods in medical education research: AMEE Guide No 90: Part I. *Medical Teacher*, *36*(9), 746–756. https://doi.org/10.3109/0142159X.2014.915298

Tavakol, M., & Sandars, J. (2014b). Quantitative and qualitative methods in medical education research: AMEE Guide No 90: Part II. *Medical Teacher*, *36*(10), 838–848. https://doi.org/10.3109/0142159X.2014.915297

Teunissen, P. W. (2010). On the transfer of theory to the practice of research and education.

Medical Education, *44*(6), 534–535. https://doi.org/10.1111/j.1365-2923.2010.03637.x

The World Bank. (n.d.). World Bank Country and Lending Groups. Retrieved April 8, 2019, from https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

Thomas, L., Reedy, G., & Gill, E. (2014). Becoming A Doctor: How Simulated Practice Can Legitimise Medical Students' Participation In Clinical Practice. *BMJ Simulation and Technology Enhanced Learning*, *1*(A80).

Thompson, I. (2013). The mediation of learning in the zone of proximal development through a co-constructed writing activity. *Research in the Teaching of English*, *47*(3), 247–276.

Treadwell, I., Rooyen, M. Van, Med, M. F., Chb, M. B., Havenga, H., & Theron, M. (2014). *The effect of an interprofessional clinical simulation on medical students*. *6*(1), 3–5. https://doi.org/10.7196/AJHPE.231

Tyler, R. (1949). *Basic Principles of Curriculum and Instruction*. Chicago, Illinois: University of Chicago Press.

UCT. (2018). *Curriculum Change Framework*.

Unesco, I. B. of E.-. (n.d.). Curriculum. Retrieved December 15, 2019, from http://www.ibe.unesco.org/en/geqaf/core-resources/curriculum

Valsiner, J., & van der Veer, R. (n.d.). Lev Vygotsky and Alexander Luria 1930: Tool and symbol in child development. Retrieved June 23, 2020, from The Vygotsky Reader website: https://www.marxists.org/archive/vygotsky/works/1934/tool-symbol.htm

van Schalkwyk, S., Couper, I., Blitz, J., Kent, A., & de Villiers, M. (2020). Twelve tips for distributed health professions training. *Medical Teacher*, *42*(1), 30–35. https://doi.org/10.1080/0142159X.2018.1542121

Vandeyar, S., & Killen, R. (2006). Teacher-student interactions in desegregated classrooms in South Africa. *International Journal of Educational Development*, *26*(4), 382–393. https://doi.org/10.1016/j.ijedudev.2005.09.007

Vapio, L., Farnan, J. M., & Park, Y. S. (2017). Summary: Research Diseases Need Holistic Care. *Academic Medicine*, *92*(11).

Volmink, J. (2018). Reconceptualising health professions education in South Africa. *South African Journal of Science*, *114*(7–8). https://doi.org/10.17159/sajs.2018/a0281

Voyer, S., & Hatala, R. (2015). Debriefing and Feedback: Two sides of the same coin?

Simulation in Healthcare, *10*(2), 67–68. https://doi.org/10.1097/SIH.0000000000000075

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes.* Cambridge, MA: Harvard University Press.

Vykotsky, L. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Watmough, S., Box, H., Bennett, N., Stewart, A., & Farrell, M. (2016). Unexpected medical undergraduate simulation training (UMUST): Can unexpected medical simulation scenarios help prepare medical students for the transition to foundation year doctor? *BMC Medical Education*, *16*(1). https://doi.org/10.1186/s12909-016-0629-x

Watson, K., Wright, A., Morris, N., Mcmeeken, J., Rivett, D., Blackstock, F., … Jull, G. (2012). Can simulation replace part of clinical time? Two parallel randomised controlled trials. *Medical Education*, *46*(7), 657–667. https://doi.org/10.1111/j.1365-2923.2012.04295.x

Wayne, D. B., Butter, J., Siddall, V. J., Fudala, M. J., Wade, L. D., Feinglass, J., & McGaghie, W. C. (2006). Mastery learning of advanced cardiac life support skills by internal medicine residents using simulation technology and deliberate practice. *Journal of General Internal Medicine*, *21*(3), 251–256. https://doi.org/10.1111/j.1525-1497.2006.00341.x

Weinstock, P. H., Kappus, L. J., Garden, A., & Burns, J. P. (2009). Simulation at the point of care: Reduced-cost, in situ training via a mobile cart. *Pediatric Critical Care Medicine*, *10*(2), 176–181. https://doi.org/10.1097/PCC.0b013e3181956c6f

Weller, J. M. (2004). Simulation in undergraduate medical education: bridging the gap between theory and practice. *Medical Education*, *38*, 32–38. https://doi.org/10.1046/j.1365-2923.2004.01739.x

Wenger, E. (1998). *Communities of Practice: Learning, Meaning, And Identity* (1st editio). Retrieved from word: http://www.ewenger.com/theory/%5Cnhttp://books.google.com/books?hl=en&lr=&id=heBZpgYUKdAC&pgis=1

WHO. (2013). *Global and regional estimates of violence against women: prevalence and health effects of intimate partner violence and non-partner sexual violence*.

Wood, D., Bruner, J., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychology and Child Psychiatry, 17*, 89–100.

Woodcock, T., Adeleke, Y., Goeschel, C., Pronovost, P., & Dixon-Woods, M. (2020). A modified Delphi study to identify the features of high quality measurement plans for healthcare improvement projects. *BMC Medical Research Methodology*, *20*(1), 1–9. https://doi.org/10.1186/s12874-019-0886-6

Woolfolk, A. (2004). *Educational Psychology* (9th editio). Boston: Allyn and Bacon.

Woollard, B., & Boelen, C. (2012). Seeking impact of medical schools on health: meetingthe challenges of social accountability. *Medical Education*, *46*, 21–27.

World Health Organization. (2010). Framework for Action on Interprofessional Education & Collaborative Practice. *Practice*, 1–63. https://doi.org/10.1111/j.1741-1130.2007.00144.x

World Health Organization, (WHO). (2013). Transforming and Scaling up health professionals' education and training. *WHO Publication*, 124. Retrieved from https://www.who.int/hrh/resources/transf_scaling_hpet/en/

Yi, S., Umuhire, O. F., Uwamahoro, D., Guptill, M., & Cattermole, G. N. (2017). Developing and implementing a global emergency medicine course: Lessons learned from Rwanda. *Education for Health: Change in Learning and Practice*, *30*(3), 203–210. https://doi.org/10.4103/efh.EfH_72_17

Yura, H., & Torres, G. (1986). *Faculty-Curriculum Development: Curriculum Design by Nursing Faculty*. New York: National League for Nursing.

Zendejas, B., Wang, A. T., & Brydges, R. (2011). Cost : The missing outcome in simulation-based medical education research : A systematic review. *Surgery*, *153*(2), 160–176. https://doi.org/10.1016/j.surg.2012.06.025

ZimFact. (2019). Yes, 22 women are raped in Zimbabwe daily. Retrieved June 8, 2020, from https://zimfact.org/are-22-women-raped-in-zimbabwe-daily/

Annexures:

Annexure 1: Information sheets

Information sheet

My name is Marvin Jeffrey Jansen. I am conducting this study for my doctoral thesis in Health Sciences Education. This information sheet contains details of the study and will tell you what the data collected from you will be used for.

Title of Study: The role of medical simulation curriculum in developing acute care clinical competence in undergraduate medical students in a South Africa

Study Aim: To establish the competencies required by medical practitioners to manage acute care cases and analyse the role of Simulation Enhanced Medical Education in the development of acute care clinical skills training for undergraduate medical students, in a South African tertiary education environment.

What the data from the interview will be used for:

The data from the interview will be audio-taped and transcribed verbatim. To ensure that the information that you provide cannot be identified as coming from you, the researcher will code all the information. This coded information will be categorized into themes.

Confidentiality agreement:

All information shared by you in the interview will remain confidential. The researcher will also maintain confidentiality through the use of codes or pseudonyms when reporting any of the data.

Selection of participants:

You were selected for this study because of your expertise as an expert within the field of medical simulation, which puts you in a good position to offer rich insights into the topic.

What is required of participants?

Participation is completely voluntary and all information that you share in the interview will be treated with strict confidentiality. The researcher, her supervisor Nadia Hartman and her co-supervisor David Grant will be the only people who are aware of your participation in this study (their contact details are at the end of this information sheet.

The interview will last an hour to an hour and a half and will audio-recorded. The date, time and venue for the session will be decided to most convenience you. The audio-recorded data will be transcribed verbatim. It will then be sent to you, so you may check that the researcher has not misinterpreted any of your contributions made during the focus group session. Corrections will be made to any misinterpretations.

You are free to choose to not answer a specific question at any time during the study and do not need to produce a reason why. You are also free to withdraw from the study at any time.

What will the benefit be to the participants?

In taking part in this study you are actively contributing to a greater understanding and awareness of developing and implementing a simulation enhanced acute care undergraduate curriculum. There will be no remuneration for participation in this study.

What risks will be involved?

Informational risk:

Any information shared by you in the interview will be treated as confidential. You will not be identifiable in any reports or a thesis where the information is used.

Should you have any further queries or want to discuss the interview process, please contact the researcher's supervisor or co supervisor, on the details listed below.

Researcher:

Mr Marvin Jeffrey Jansen

+27 83 479 0808

Email: marvinjansen78@yahoo.com

Supervisor:

Dr Nadia Hartman (PhD)

Faculty of Health Sciences, University of Cape Town

Email: nadia.hartman@uct.ac.za

Co supervisor:

Dr David Grant

Email: Dj.Grant@bristol.ac.uk

Annexure 2: FGD interview guide

FOCUS GROUP INTERVIEW

Moderator:

The topic is: The role of medical simulation curriculum in developing acute care clinical competence in undergraduate medical students in a South Africa

You have been selected because of your expertise in curriculum design and experience with clinical skills within a South African tertiary education environment

Guidelines:

- There are no right or wrong answers.
- The session will be tape recorded, so speak clearly.
- To maintain confidentiality; refer to the number in front of the person; state your number when you are speaking.
- We ask that you turn off your cellular phone during the interview.
- The facilitator will guide discussion.

You have been provided with the results of the Delphi study; please answer these questions in relation to this:

a) Can the competencies be addressed by medical simulation?
b) What type/from of medical simulation?
c) Initial introduction? should it be introduced during the pre-clinical or clinicals years?
d) Should it be offered facilitator led and/or self-directed?

Process Flow:

Participants will be provided with the competences developed from the Delphi study and discuss, whether these competences can be offered through a medical simulation modality, and if so, to what extent.

Thank You!!

Annexure 3: Semi structured interview guide

Interview Guide

The topic is: The role of medical simulation curriculum in developing acute care clinical competence in undergraduate medical students in a South Africa

You have been selected because of your expertise in curriculum design and experience with clinical skills within a South African tertiary education environment

Guidelines:

- There are no right or wrong answers.
- The session will be tape recorded, so speak clearly.
- We ask that you turn off your cellular phone during the interview.

Opening Question:

1) Can you provide me with an overview of your experience within the field of medical simulation within the South African tertiary environment?
2) What is the role medical simulation curriculum in developing acute care clinical competence in undergraduate medical students in a South Africa?

Additional Questions:

3) In your opinion what are some of the barriers currently facing medical simulation in contributing to developing acute care clinical competence in undergraduate medical students in a South Africa?

4) In your opinion; what are some of the resources; and how do we go out about identify and procuring some the resources needed to develop an undergraduate medical simulation curriculum?

5) In your opinion how would you initiate the introduction of a new medical simulation curriculum?

6) What is the role of assessment in a medical simulation curriculum within a developing world context?

7) Feedback has been identified as an important component medical simulation, how do we facilitate the process of obtaining feedback from a) learners, b) the programme?

8) In your opinion, how would be address the challenge of programme evaluation of a medical simulation curriculum within a developing world context?

9) Any other comments?

Annexure 4 : UCT HREC Ethics Approval Letter

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

Room E53-46 Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 406 6492
Email: sumayah.ariefdien@uct.ac.za
Website: www.health.uct.ac.za/fhs/research/humanethics/forms

23 July 2018

HREC REF: 365/2018

Dr N Hartman
Health Science Education
E52-25
OMB

Dear Dr Hartman

PROJECT TITLE: THE ROLE OF MEDICAL SIMULATION CURRICULUM IN DEVELOPING ACUTE CARE CLINICAL COMPETENCE IN UNDERGRADUATE MEDICAL STUDENTS IN SOUTH AFRICA (PhD Candidate - Mr M Jansen)

Thank you for your response letter, addressing the issues raised by the Human Research Ethics Committee (HREC).

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

Approval is granted for one year until the 30 July 2019.

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.
(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

We acknowledge that the student: Mr Marvin Jansen will also be involved in this study.

Please quote the HREC REF in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval, where necessary, before the research may occur.

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, FHS HUMAN RESEARCH ETHICS COMMITTEE

Federal Wide Assurance Number: FWA00001637.
Institutional Review Board (IRB) number: IRB00001938

Annexure 5: Comparison between Acute Care Undergraduate Teaching (ACUTE) Initiative and Delphi Study

Acute Care Undergraduate Teaching (ACUTE) Initiative	Delphi Study
Trauma	
Describes or demonstrates a systematic approach to the assessment and immediate treatment of the victim of trauma	*Demonstrate the approach to the 'trauma' patient.
Describes the principles of recognition and initial management of patients with suspected spinal injuries	*Demonstrate the principles of c-spine immobilization.
	Describe the anatomy and physiology of organ systems.
	*Demonstrate the management of the 'polytrauma' patient.
	*Demonstrate airway management techniques in the trauma patient.
	Describe the principles of blood transfusion.
	*Demonstrate the management of shock.
	*Demonstrate the principles of burn wound management.
	Demonstrate how to perform the following procedures:
	*I. Intercostal chest drains (ICD) insertion
	*II. Pelvic binding
	*III. Fracture splinting
	*IV. Basic suturing techniques
	*V. Intraosseous (IO) cannulation
	*VI. Wound care techniques
	*VII. Haemorrhage control methods
	*VIII. Needle thoracentesis
	*IX. Fracture reductions
	*X. Extended focused assessment with sonography for trauma (e-fast)
Patient and societal needs	
Describes the importance of and methods for achieving adequate pain control	Be culturally and socially aware.
Describes key aspects of in-patient safety	Describe the common referral pathways.
Describes the ethical and legal implications of attempting/not attempting resuscitation	Describe the principles of ethical medical practice.
Describes the principles of consent in the acutely ill patient	*Demonstrate principles of confidentiality.
Describes the importance of and methods for achieving adequate pain control	*Demonstrate the approach to a sexual assault victim.
Demonstrates respect for patient dignity	Describe 'Batho Pele' principles.
	Describe the signs and symptoms of abuse (child and elderly).
	Describe the general principles of the biopsychosocial approach.
Team-working, organization and communication	
Describes/demonstrates how to recognize one's own limitations and when to call for help	*Know when to call for help.

Describes/demonstrates the principles of breaking bad news	*Demonstrate the general principles of breaking bad news.
Describes/demonstrates the principles of good communication skills	Describe the principles of debriefing.
Demonstrates the ability to work as part of a multi-professional team	*Demonstrate the ability to work within a team
Demonstrates the ability to extract and critically appraise literature	*Demonstrate effective team leader skills.
Demonstrates good time keeping, punctuality	*Demonstrate effective skills in giving feedback.
Describes how to deal with the personal emotional issues surrounding critical incidents, breaking bad news, post-incident stress etc.	*Demonstrate the ability to adapt to various situations.
Describes the role of early warning scoring systems and/or ICU outreach	*Maintains professional attitudes and relations with colleagues.
	*Demonstrate effective counselling skills.
	*Demonstrate conflict resolution skills.
	*Demonstrate the principles of 'closed loop' communication.
Infection and inflammation	
Adheres to the basic principles of infection control measures including handwashing	Describe the general principles of infection and inflammation.
Describes the recognition and immediate resuscitation of a patient with sepsis	*Demonstrate the ability to effectively manage a patient in sepsis.
Describes a rational approach to antibiotic prescribing in the patient with sepsis	Describe the principles of safe antibiotic stewardship.
	*Demonstrate the ability to effectively apply a N95 face mask.
	Describe the pathophysiology of sepsis.
	Describe the general principles of infection and infection control.
	Describe the common pathogens.
	*Demonstrate effective hand washing technique.
	*Demonstrate the ability to effectively don appropriate personal protective equipment (PPE).
	*Demonstrate aseptic gloving techniques.
	*Demonstrate the ability to implement 'goal directed therapies.'
Drugs, therapeutics and protocols	
Describes how to recognize and initiate treatment for an acute attack of asthma	*Demonstrate the preparation and initiation of various infusions.
Describes how to recognize and initiate treatment for diabetic emergencies	*Demonstrate the ability to administer medications via various routes of administration (IV, IM, PO etc.)
Describes how to recognize and initiate treatment for acute heart failure	Describe the general prescription principles.
Describes how to recognize and initiate treatment for an anaphylactic reaction	*Demonstrate the ability to interpret and implement an algorithm/protocol.
Describes the causes, presentations and treatment of oliguria	Describe the common resuscitation drug dosages.
Describes the indications and dosages of drugs used in the management of a cardiac arrest	Describe the common medications used during rapid sequence intubation (RSI).
Describes how to recognize and initiate resuscitation of a patient with an acute abdomen	Describe the common medications used during cardiopulmonary resuscitation (CPR).
Describes how to recognize and initiate treatment for meningococcal septicemia	Describe the commonly used antibiotics in the management of the acutely ill patient.

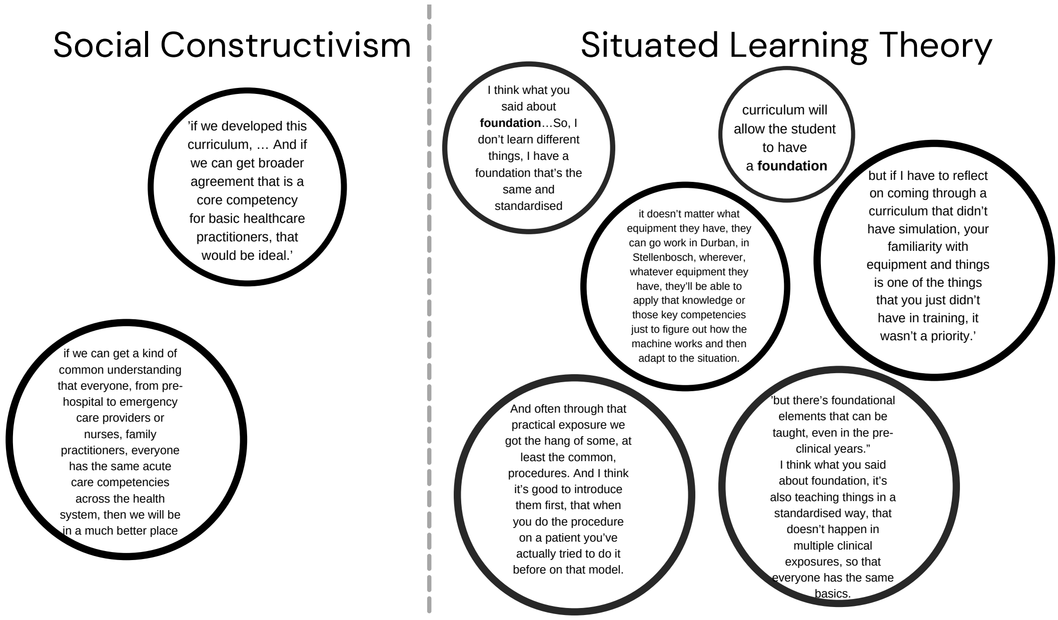
Describes how to recognize and initiate treatment for a pneumonia	Describe the common emergency protocols (BLS-HCP, ACLS, PALS).
Describes how to recognize and initiate treatment for common drug overdoses	*Demonstrate an awareness and implementation of memory aids (hardcopy and electronic).
Describes how to recognize and initiate treatment for acute coronary syndromes	Be mindful that pharmacology is everchanging.
Describes how to recognize and initiate treatment for an acute exacerbation of chronic obstructive pulmonary disease	
Describes the common causes and treatment of life-threatening hypo-/hyper-natraemia and kalaemia	
Describes the role of vasoactive drugs in treatment of the shocked patient	
Confusion and coma	
Describes the common causes of altered consciousness	Describe the common causes of altered level of consciousness.
Demonstrates a systematic approach to the assessment of the acutely ill patient with altered consciousness	*Approach the confused/comatose patient in a non-judgemental manner.
Describes how to recognize and initiate treatment of status epilepticus	*Describe and demonstrate the management of cerebrovascular accident (CVA) emergencies
Demonstrates the recovery position	*Demonstrate the ability to conduct systemic a general neurological examination.
	*Demonstrate the effective airway management strategies in the confused/comatose patient.
	*Demonstrate the ability to effective mechanically ventilate a patient with a traumatic brain injury (TBI).
	*Demonstrate the ability to conduct a Glasgow Coma Scale (GCS) assessment.
	*Demonstrate the ability to test for brain stem death.
	*Demonstrate the ability to safely restrain the confused patient.
	Describe the anatomy and physiology of neurological system.
Equipment	
Demonstrates how to correctly set up an intravenous infusion	*Demonstrate the ability to check common equipment for operation and troubleshooting
Demonstrates how to correctly prepare and give an intravenous drug	Demonstrate safe and effective usage of the following equipment:
Demonstrates how to correctly set up and administer high flow and controlled oxygen therapy	i. *Manual defibrillator
Demonstrates how to set up and use an oxygen/air driven nebulizer and describes indications for use of either device	ii. *Mechanical ventilator
Describes how to set up, insert and manage a chest drain	iii. *Bag-valve-mask (BVM)
	iv. *Ultrasound machine
	v. *Arterial blood gas (ABG) machine
	vi. *Syringe drivers/infusion pumps
	Demonstrate a sense of respect for equipment.
	Appropriate and judicious use of equipment.
Clinical examination, monitoring and investigations	

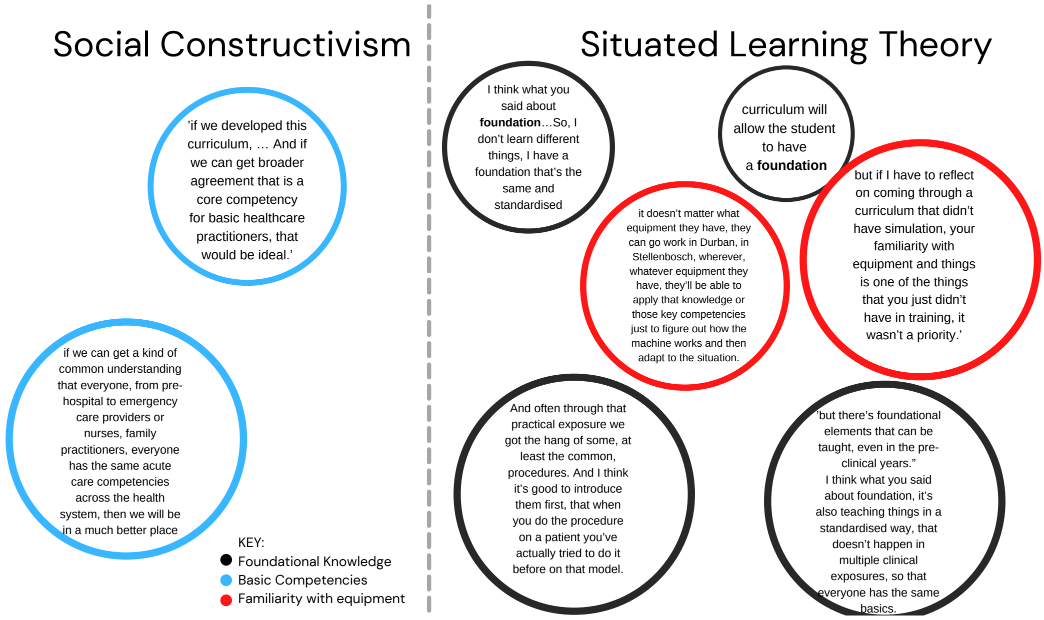
Describes normal physiological ranges for basic vital signs including pulse, blood pressure, SpO2, respiratory rate, urine output and body temperature	Describe the basic surface anatomy.
Demonstrates a systematic approach to the clinical assessment and timely management of the critically ill patient	*Demonstrate the ability to conduct a common clinical examination technique.
Demonstrates safe handling and disposal of sharps and clinical waste	Describe the general patient monitoring techniques (Blood pressure, oxygen saturation etc.).
Demonstrates a systematic approach to 3- and 12-lead ECG interpretation, recognizing common and important abnormalities	Demonstrate how to perform the following procedures:
Demonstrates a systematic approach to chest X ray interpretation recognizing common and life-threatening abnormalities	I. *Blood culture
Measures arterial blood pressure correctly using a manual method	II. *Lumbar puncture
Describes the importance of repeated and timely reassessment of the acutely ill patient	III. *Urinalysis
Demonstrates/describes how to obtain an arterial blood gas	IV. *Abscess drainage
Describes a systematic approach to arterial blood gas analysis	V. *Phlebotomy
Describes the principles and limitations of pulse oximetry	VI. *Intravenous cannulation
Demonstrates the rationale use of common laboratory tests and investigations in the critically ill patient	VII. *Fine needle aspiration
Describes the pathophysiological processes underlying critical illness	VIII. *Blood gas interpretation
Describes the indications and complications of arterial line insertion	IX. *Ultrasound
Describes the principles and limitations of central venous pressure monitoring	X. *ECG application and interpretation
Describes the principles and limitations of invasive arterial pressure monitoring.	XI. *Chest x-ray interpretation
Demonstrates/describes how to perform urinary catheterization	*Demonstrate effective auscultation technique.
	*Patient empathy and respect while conducting an examination.
Circulation	
Describes the clinical features of shock	Describe the anatomy and physiology of circulatory system.
Describes potentially reversible causes of a cardiac arrest	*Demonstrate safe and effective intravenous (IV) cannulation.
Demonstrates the immediate management of a simulated witnessed in-hospital cardiac arrest	*Demonstrate safe and effective Intraosseous (IO) cannulation in:
Describes how to recognize and treat common peri-arrest arrhythmias	I. *Adult patient
Demonstrates peripheral venous cannulation including attention to patient comfort and infection control	*Demonstrate safe and effective Central Venous Catheter (CVC) insertion.
Demonstrates effective external chest compressions	*Describe and demonstrate the management of shock.
Describes effective fluid resuscitation	*Describe and demonstrate the management of hypertensive emergencies.

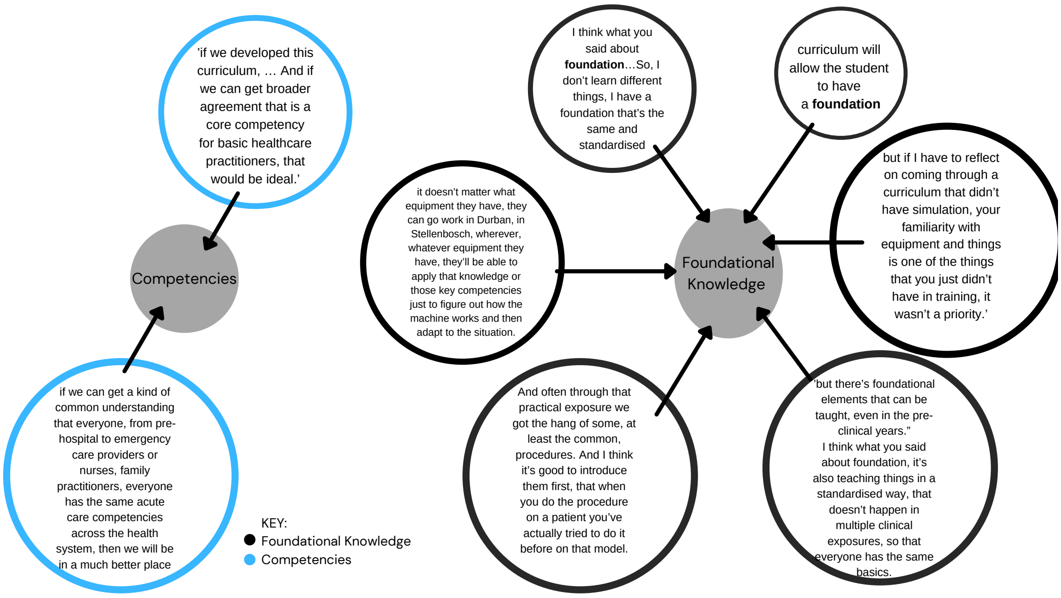
Describes control of external haemorrhage	*Demonstrate the safe and effective use of synchronised cardioversion.
Recognizes cardiac arrest rhythms (VF, pulseless VT, PEA and asystole)	*Demonstrate the safe and effective use of transcutaneous pacing.
Demonstrates safe and effective use of an automated external defibrillator	*Demonstrate the safe and effective application of vagal manoeuvres.
Demonstrates safe and effective use of a non-automated external defibrillation	Describe the principles of haemorrhage control in the acutely ill patient.
Describes alternatives to peripheral venous access	*Demonstrate the management of cardiac arrest.
Describes the indications, risks and safe administration of blood products	*Demonstrate the ability to administer fluids (including blood products) during the resuscitation of a critically ill patient.
Describes the indications for central venous catheterization	*Demonstrate the ability to commence inotropic support in the acutely ill patient.
Airway, Breathing, and oxygenation	
Describes the signs of airway obstruction	Describe the basic anatomy and variations of a patient's airway.
Demonstrates safe use of simple airway manoeuvres/adjuncts (head-tilt, chin lift, suction, Guedel, naso-pharangeal airway)	*Demonstrate the ability to effectively evaluate a patient's airway in the acute setting.
Describes the indications and rationale for safe oxygen therapy in the critically ill patient.	*Demonstrate the ability to use oxygen administration using various delivery devices.
Describes the principles of controlled oxygen therapy in the patient with chronic obstructive pulmonary disease (emphasising the importance of alleviating life-threatening hypoxia).	*Demonstrate the ability to perform basic airway manoeuvres (Jaw Thrust, head-tilt-chin-lift).
Demonstrates basic treatment for simulated choking	*Demonstrate the ability to inserting basic airway adjuncts.
Demonstrates safe and effective use of laryngeal mask airway	*Demonstrate the ability to perform adequate bag-valve-mask (BVM) ventilation.
Demonstrates safe and effective endotracheal intubation	*Demonstrate the ability to perform endotracheal intubation.
Describes the indications for and method of needle or surgical cricothyroidotomy	Describe the potential complications associated with intubation.
Demonstrates a systematic clinical assessment of breathing and oxygenation	*Demonstrate the ability to setup a mechanical ventilator for the acute ill patient.
Describes the common causes of breathlessness	*Demonstrate the ability to implement lung protective ventilation strategies in the acutely ill patient.
	*Demonstrate the ability to insert a supraglottic airway device.
Describes the clinical signs and treatment of a tension pneumothorax	*Demonstrate the ability to perform surgical Cricothyroidotomy.
Demonstrates effective bag-valve-mask ventilation	
Demonstrates effective mouth-mask-ventilation	
Demonstrates effective expired air ventilation without adjuncts	
Describes the indications for invasive mechanical ventilation	
Describes how to manage hypercapnic respiratory failure	

NB: the Asterix (*) indicates the acute care clinical competencies that lend themselves to a medical simulation modality within a South African tertiary education environment

Annexure 6: Illustrative excerpt of my deductive coding framework






'if we developed this curriculum, … And if we can get broader agreement that is a core competency for basic healthcare practitioners, that would be ideal.'
Competencies
if we can get a kind of common understanding that everyone, from pre-hospital to emergency care providers or nurses, family practitioners, everyone has the same acute care competencies across the health system, then we will be in a much better place
KEY:
Foundational Knowledge
Competencies
I think what you said about **foundation**…So, I don't learn different things, I have a foundation that's the same and standardised
curriculum will allow the student to have a **foundation**
it doesn't matter what equipment they have, they can go work in Durban, in Stellenbosch, wherever, whatever equipment they have, they'll be able to apply that knowledge or those key competencies just to figure out how the machine works and then adapt to the situation.
Foundational Knowledge
but if I have to reflect on coming through a curriculum that didn't have simulation, your familiarity with equipment and things is one of the things that you just didn't have in training, it wasn't a priority.'
And often through that practical exposure we got the hang of some, at least the common, procedures. And I think it's good to introduce them first, that when you do the procedure on a patient you've actually tried to do it before on that model.
'but there's foundational elements that can be taught, even in the pre-clinical years."
I think what you said about foundation, it's also teaching things in a standardised way, that doesn't happen in multiple clinical exposures, so that everyone has the same basics.