Simulation-based Medical Education:

A Transformative Bridge of Complexity

Mark A. Neill

BCom, BNg (Hons), Grad Cert. TESOL

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School of Medicine

Health Professional Education

Faculty of Medicine, Nursing and Health Sciences

Flinders University

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Table of Contents

Thesis Definitions & Acronyms

Ambiguity & Uncertainty:

A time-oriented differentiation: uncertainty as related to a *future* event (Grenier, Barrette et al., 2005) and carries the known probability of a particular outcome (Ellsberg, 1961). Ambiguity is connected to circumstances of the *present* (Grenier, Barrette et al., 2005) and linked to situations containing more shades of grey which are marked by a greater urgency for resolution (Geller, 2013). The probability of an outcome surrounded by ambiguity is unknown, and so greater emphasis is placed on locating a solution (Ellsberg, 1961). For this thesis, a *future* event marks the goal of 'becoming' and 'being' a doctor, and circumstances of the *present* represent the negotiation and formation of such a professional identity.

Complexity Theory:

Complexity theory is the study of the non-linear dynamical, self-organising and emergent properties of patterns and relationships that are open and far from equilibrium. It focuses on processes and interactions of local agents that result in the emergence of new patterns as a whole (Mennin, 2010b). Such emergence of new patterns can be thought of as complex adaptive systems forming abstract sets of relationships relating to the intrinsic properties of interaction (Stacey, 2003). Complex adaptive systems and the resulting patterns have the simultaneous features of continuity, novelty, identity, and difference; these form processes of relating where such processes form the perpetual construction of the future as both continuity and potential transformation (Stacey, 2003).

Fidelity:

Describes the extent to which a simulated medical situation represents reality and the extent to which the clinical environment is accurately represented (Weller et al., 2012; McGaghie et al., 2010). Fidelity can be situated along a continuum from low, medium, and high fidelity. Fidelity relates to the engagement and immersion of learners in experiences that mimic

clinical realities (Kneebone, 2010) or 'true-to-life' clinical experiences (DeMaria, Bryson et al., 2010). Such immersion into a clinical situation makes it possible to simulate not only discrete medical tasks, but also the complexity inherent to the clinical setting, including its social and emotional dimensions (Pelletier & Kneebone, 2015a).

Identity & Identity Formation:

A psychosocial concept which includes the experience of being the same in different situations and contexts, and also the sense that others experience this sameness (Erikson, 1968). Identity matters, as people can be understood by others in certain ways, and people can act towards one another depending on such understandings (McCarthey & Birr Moje, 2002). An individual's identity is reflected on many interconnected levels: organisational, professional, social, and self (Sveningsson & Alvesson, 2003). Identity is about 'being' a person in the world (Illeris, 2014) as reflexively understood (Giddens, 1991). It encapsulates how an individual defines oneself to oneself and recognised by others in a given context (Gee, 2000; Lasky, 2005). Identity is not a fixed or static concept, it is flexible and able to evolve as an individual encounters situations throughout life (Alvesson, Ashcraft et al., 2008). Identity formation is therefore constituted by self and socially mediated (Billett & Somerville, 2004).

Legitimate Peripheral Participation (LPP):

Situated learning where learners participate in communities of practice which is an integral part of generative social practice in the lived-in world. LPP speaks about the relations between newcomers and old-timers, activities, identities, artefacts, and communities of knowledge and practice - and concerns the process by which newcomers become part of a community of practice (Lave & Wenger, 1991).

Post-Simulation Debriefing Session:

Collective reflection and discussion of an experienced SBE scenario, including the underlying premises of thought and implemented interventions and action. This includes consideration of possible alternatives in order to facilitate development of clinical reasoning and judgement

(Fanning & Gaba, 2007; Dreifuerst, 2009). Knowledge gaps can be identified which discussion and critique can resolve to reach possible consensus (Rudolph, Simon et al., 2007) of new understandings for transfer to the clinical setting.

Professional Identity:

Encompasses the beliefs, attitudes, values, world views, practices, expectations and demands of an emerging professional role (Costello, 2005). In this thesis a professional identity represents an identity as a doctor to progressively define one's self within the medical profession (Goldie, 2012; Cruess, Cruess et al., 2014).

Simulation-Based Education (SBE):

Educational technology used to created clinical situations (or simulation scenarios) for teaching and learning purposes using mannequins, part-task trainers, simulated patients or computer-generated simulations (Weller at al., 2012).

SBE Learning Activities:

BLS - Basic life support **ALS** - Advanced life support S**P** - Simulated patient

Simulation Scenario:

A medical case enacted using role players and/or a patient simulator in a simulated room that resembles the clinical setting in which a corresponding clinical situation would usually be treated. During a simulation scenario, appropriate medical equipment is used (Dieckmann, Manser et al., 2007). Simulation scenarios produce physiological responses such as a palpable pulse rate, breathing sounds, haemodynamic responses to drugs, and monitor readouts (Kneebone, 2010; Pelletier & Kneebone, 2015a) to heighten medical fidelity.

Tentative Model:

A study's tentative model represents its conceptual framework or ideas about what is out there regarding the phenomena under investigation, and what is going on with these things and why - and so provides a study's research perspective (Maxwell, 2005).

Transformative Learning Theory (TLT):

A theory to explain the process of adult learning where taken-for-granted frames of reference (meaning perspectives, habits of mind, and mind-sets) are transformed to make them more discriminating, inclusive, open, and reflective so that they may generate new beliefs and opinions which will prove more justified to guide future action (Mezirow, 2012).

Thesis Summary

Learning by simulation-based education has become a dominant medical teaching method (Bleakley, Bligh et al., 2011) and now represents a globally established central thread in the fabric of medical education (McGaghie et al., 2010). This thesis aims to cultivate knowledge and understanding of simulation-based medical education (SBME) viewed through a new exploratory lens. This lens represents the conceptual framework (or tentative model) proposed by this thesis that the SBME setting, as an experiential learning proxy, can provide learners with an educational context or place which can trigger and support transformative development of their professional identity as a doctor. This exploratory view forms an aspect of the broader canvas of SBME experiences which emerge as learners are immersed in an increasing clinical learning environment, with growing roles and graded levels of responsibility.

This thesis' tentative model is informed by Mezirow's (1991) Transformative learning theory and the theoretical constructs of professional identity and aspects of identity and its formation. This exploratory lens is focussed upon graduate-entry medical students and doctors as they journey along their temporal participation in simulation-learning activities. Temporal depicts first year medical students' often initial introduction to the doctor's role through simulated patients, which progresses to more immersed and complex demanding high-fidelity medical situations such as clinical emergences, in which later-stage students and doctors participate. This thesis' look at another aspect of learners' SBME experiences stands to capture new insights and understandings, which may further contribute to the central role simulation-

learning plays in contemporary medical education in collaboration with its primary aim of preparation for and transfer to clinical practice.

The mixed methods cross-sectional design of this thesis represents a pragmatic and flexible approach to test its tentative model and manage this study's six participant cohorts comprising medical students and doctors, the four study settings, four data gathering methods and the associated quantitative and qualitative analytical methods. This research approach provides a rich and diverse volume of findings which lead to this thesis' Simulation Identity-formation Model (SIM) as a theoretical account of an aspect of participants' SBME experiences. This model encapsulates the temporal and transformative nature of professional identity development which can be facilitated by participants' simulation-learning experiences. Three key findings are embedded in the SIM: 1) Situated and progressive identity formation, 2) Tolerance of ambiguity and reduced uncertainty, and 3) SBME - a transformative bridge of complexity.

The first key finding depicts medical simulation-learning as a situated and progressive educational context where learners can encounter legitimate opportunities to develop knowledge and skills to inform their evolving professional identities. This situated focus is informed by the sociocultural learning perspective of legitimate peripheral participation (Lave & Wenger, 1991) which exhibits learners' progression and participation in their simulation activities as a centripetal movement towards fuller participation in the medical profession. The SIM depicts this centripetal movement to involve transition between the various identity-positions that participants occupy along their identity formation journeys, from which they depart and transition towards another position of a more participatory and contributory member as a doctor. The temporary nature of these identity-positions capture the ongoing

refining nature of professional identity development, and suggest the role SBME can play to promote and facilitate such development of a place within the medical profession.

The second key finding uncovers the tolerance to ambiguity and reduction in uncertainty which can be associated with medical students' and doctors' transition between professional identity-positions. SBME is illustrated as an educational setting where learners can be prompted to develop mechanisms to manage both ambiguity and uncertainty, where ambiguity is progressively recognised and accepted as a pervasive element inherent in the complexity of the doctor's role. This is shown to facilitate learners' reduction in uncertainty about viewing themselves to occupy the doctor's role. This key finding therefore exhibits synchronous development of tolerance to ambiguity and reduction in uncertainty as participants journey towards their individual goals of being the type of doctor they wish to be in the clinical environment.

The third key finding represents the core theme of this thesis and encapsulates SBME as a transformative bridge of complexity to the clinical setting, along which learners can be prompted and supported to interactively and relationally develop their professional identity as a doctor. Such identity development is informed by complexity theory and depicted as a complex adaptive system, where emphasis is placed on the non-linear relational and multidimensional elements which constitute the doctor's role. These elements are shown to be temporally encountered throughout participants' SBME experiences which are illustrated to be negotiated and self-organised along participants' ongoing identity formation journeys to better envisage themselves as being a doctor.

This thesis' Simulation Identity-formation Model (SIM) presents another way SBME can be thought of as learners' preparation for and transfer of their skills to clinical practice. A new domain of understanding is therefore opened-up which can contribute further to the expanding empirically-based theoretical knowledge of the central role SBME plays in contemporary medical education. The SIM offers different insight into *how* and *why* SBME can facilitate students' transition towards 'becoming' a doctor, and clinical doctors refining themselves 'being' a doctor i.e. shaping their evolving individual professional identity as a doctor. This thesis' SIM also contributes to contemporary recognition of the relationship between clinical and simulation-based practice as a mutually dependent two-way process.

Declaration

I certify this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any university; and to the best of my knowledge and belief it does not contain any materials previously published or written by another person except where due reference is made in the text.

Signed: 

Dated: October 2016

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Associated Awards & Presentations

Neill, M. 2015 ANZAHPE: Australian and New Zealand Association for Health Professional Educators. **Post-Graduate Student Prize**: *Medical Simulation-based Education: Professional Identity Learning*.

Neill, M. *Medical Simulation-based Education: Professional Identity Learning*. **Poster presentation** at ANZAHPE: Australian and New Zealand Association for Health Professional Educators, Annual Conference. Newcastle, New South Wales: 30th March 2015.

Neill, M. *Medical Simulation-based Education: A Transformative Bridge of Complexity*. **Poster presentation** at Prideaux Research Centre opening, Flinders University. Presented by Professor Jennene Greenhill, Adelaide, South Australia 22nd May 2015. (*Appendix D*).

List of Tables

List of Figures

List of Graphs

1 Introduction

Simulation-Based Medical Education:

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This thesis explores simulation-based medical education (SBME) from a new perspective, and investigates medical students' and doctors' simulation-learning experiences through an exploratory lens informed by simulation-based education knowledge and research, Mezirow's (1991) Transformative learning theory (TLT) and theoretical constructs related to professional identity (Costello, 2005; Cruess, Cruess et al., 2014) and identity formation (Cohen et al., 2009; Wilson et al., 2013). This lens is formulated by a conceptual framework which forms the tentative model (Maxwell, 2005) tested throughout this study. By using such a lens, this thesis seeks to gain new understanding of the role SBME can play to trigger and support medical students' and doctors' development of their professional identity as a doctor. This lens-view is new to the simulation and medical education literature domains, and offers the potential for a different look at *how* and *why* SBME has become established as a central thread in the fabric of global medical education (McGaghie, Issenberg et al., 2010), with its overall aim to provide safe and supportive immersive environments in which clinical skills can be practiced and developed (Kneebone, 2010). This thesis also contributes to Bleakley, Bligh et al. (2011) and their recent call for research that would further anchor medical education with an understanding of professional identity formation.

This study's perspective and approach unlocks traditional ways of viewing by merging concepts and ideas from different realms (Eva, 2010). In addition to the theoretical perspectives mentioned above, this study integrates Lave & Wenger's (1991) notion of legitimate peripheral participation and complexity theory (Stacey, 2003; Bleakley, 2010; Mennin, 2010c) to further unpack the meaning of the transformative processes which may be prompted by the simulation-learning context and its association with professional identity formation.

This thesis' resultant Simulation Identity-formation Model (SIM) represents a theoretical account of an aspect of participants' simulation-learning experiences, and encapsulates another way that SBME can be viewed as much more than a discrete skills-based educational modality for preparation for practice. Three key findings emerge from the SIM: 1) Situated and progressive identity formation, 2) Tolerance of ambiguity and reduced uncertainty, and 3) SBME - a transformative bridge of complexity. The third represents the central finding of the SIM, and title of this thesis, which depicts the opening of a new chapter in simulation-based medical education in which new theoretical understanding, together with potential outcomes are uncovered. Overall, the SIM illustrates learners' temporal and transformative development of their professional identities, where aspects of themselves are changed in response to finding a better 'fit' with seeing themselves as a doctor. The SBME context is exhibited as a setting in which learners' professional identity formation represents an adaptive complex response to new and often challenging aspects of the doctor's role experienced through various simulation-learning activities. The SIM exhibits that the SBME setting can play an important role in professional identity formation, and further contributes to the global recognition of the central place simulation-based education occupies in contemporary medical education for

preparation for practice. This thesis' SIM also responds to recent calls for further understanding of the theoretical premises which underpin and can be applied to SBME (Nestel, Groom et al., 2011; Nestel & Bearman, 2015b).

The findings which make-up the SIM form aspects of the broader canvas of researched and identified SBME experiences and outcomes. This thesis' aspects of temporal and transformative professional identity formation is shown to emerge as learners are immersed in an increasing clinical simulation-learning environment with growing roles and graded levels of responsibility - on a spectrum of 1st year medical students to clinical doctors.

1.1 Background

The seeds of this thesis were planted in 2008 when I became involved in healthcare simulation education and development of its curriculum. Throughout the ensuing years these early ideas began to germinate into questions around: a) the variation in learner's perceptions of the simulation context, b) their different learning needs at each educational year level, c) the outcomes they constructed from participation in simulated clinical situations, d) their evolving and observable changes in demeanour, behaviour and communication, e) learners also appeared to make different meaning of the outcomes they gained for eventual transfer to the clinical environment, and f) why simulation-learning triggered pervasive levels of anxiety in parallel with learners' generally favourable views of having participated in simulation sessions. My publication of a simulation article and a simulation text began to answer these questions to an extent, but I continued to be

interested in whether learners had other needs and outcomes related to transfer to practice which went beyond discrete skill acquisition and development of competencies.

These ponderings brought me to begin this thesis and address my developing intuition that simulation-based education represented a unique educational context which could provide an experiential learning proxy where learners not only gained discrete skill competencies, but progressively envisaged how they would apply and enact an array of skills in the clinical setting. In others words, SBE provided an educational space in which learners participated to 'polish' how they interpreted, behaved, and managed a range of simulated clinical situations and enact their evolving clinical roles. They therefore appeared to be agentically developing their professional identities for transfer to the clinical setting. This intuition prompted the specific inquiry shaped by this thesis' tentative model, which poses that the simulation-learning setting can trigger and support development of a professional identity as a doctor for medical students and clinical doctors.

Simulation-based education is not a new phenomenon in medical education. It has been used for centuries as a way to incorporate interactive techniques for teaching and learning purposes (Owen, 2012; Weller, Nestel et al., 2012), which have been suggested as representation which 'replaces or precedes the literal' (Bleakley, Bligh et al., 2011, p. 153). Medicine is increasingly being taught in immersive simulated settings to supplement the apprenticeship model of work-based learning (Pelletier & Kneebone, 2015a), and simulation-learning is now globally established as a central thread in the fabric of medical education (McGaghie, Issenberg et al., 2010) throughout both the undergraduate and postgraduate domains (Bradley & Postlethwaite, 2003). Nevertheless, simulation as a

specialist educational practice-context is relatively new (Nestel & Bearman, 2015b). The last decade has seen a significant rise in simulation-based education integrated into global medical curricula for a number of reasons, not least, the substantial educational benefits which are translated to the clinical setting (McGaghie, Issenberg et al., 2010; Nestel, Groom et al., 2011).

The overall goal of simulation-based education is formation of a nexus between the classroom and workplace experiences, where simulated clinical situations or scenarios aim to provide immersive, safe and supportive environments in which clinical skills can be practiced and developed (Bleakley, Bligh et al., 2011; Pelletier & Kneebone, 2015a). Simulation scenarios incorporate lifelike clinical environments and diverse educational tools such as simulated patients (SPs), high-fidelity mannequins, and task trainers which contribute to the fidelity, or realism, of a presented clinical situation. Educators use these simulation tools to present contrived social situations which mimic problems, events, and conditions that often arise in complex professional medical practice (Weller, Nestel et al., 2012; McGaghie, Issenberg et al., 2014). Today, simulation-based education is widely accepted as an essential and effective learning technique which is guided primarily by the deliberate practice concept to support acquisition and retention of skills within a structured learning context (Ericsson, 2004; Rosen, 2008; Weller, Nestel et al., 2012). Deliberate practice has the overall goal of learning towards mastery levels (Kneebone, 2005; Khan, Pattison et al., 2011) through continual skill improvement and skill maintenance (McGaghie, Issenberg et al., 2011).

Whilst experience with real patients will remain fundamental for developing clinical expertise, instruction of aspects of medical practice can be enhanced and receive greater focus through simulation-learning and so expand the opportunities for skill acquisition and experience transferable to clinical settings (Ziv, Wolpe et al., 2003; Weller, 2004; McGaghie, Issenberg et al., 2014). Such expansion of opportunities has largely resulted from the rapid progression of the 'art and science' of simulation-based medical education in recent decades including its technology and educational techniques (Khan, Pattison et al., 2011). As such, the simulation setting provides a 'context' for participants' medical learning (Trede, 2012).

The benefits of simulation-based education have been empirically evidenced and cover a large domain which include: *skills acquisition and maintenance* (Barsuk et al., 2009; Cook et al., 2011; Kassab et al., 2012), *skills transfer to practice* (Bradley, 2006; Cook et al., 2011), and *teaching of procedural skills* (Kneebone, 2005; Nestel et al., 2011; Passiment et al., 2011). Other areas of identified benefits include: *participants' positive subjective perception of SBME realism* (Krahn & Bostwick, 2001; Dieckmann, Manser et al., 2007; Kassab, Kyaw Tun et al., 2012), the *positive downstream effects on health and society* (McGaghie, Issenberg et al., 2014), and *enhanced patient safety* (Gaba, 2004; Khan, Pattison et al., 2011). Despite the substantive level of simulation healthcare education research and knowledge which has emerged in the past decade, Issenberg, Ringsted et al. (2011) have suggested that overall, simulation-based education research is still at an early stage despite its continued growth and use as a medical teaching and learning method. In fact, Cook, Hatala et al. (2011) have argued that the wide-spread appeal and adoption of simulation is not often linked to or evidenced by empirical research. As such, there remain areas to be explored in order to furnish new evidence-based insights and understandings of

simulation education and its underlying theoretical premises (Issenberg, Ringsted et al., 2011; Nestel, Groom et al., 2011). Recent years have seen theories being increasingly conceptualised, adapted, and applied to simulation-based education which has signalled a shift towards more rigorous and thoughtful approaches to educational practice (Nestel & Bearman, 2015b).This thesis embraces this opportunity to contribute new conceptual and theoretical understanding of simulation-based medical education and further consolidate its central place in contemporary medical education, through the exploration of *how* and *why* it can trigger and support transformative development of a professional identity as a doctor for both students and medical officers.

Development of a professional identity is also a well established researched phenomenon in the medical education literature, and similar to SBME, the past few years have seen an increase in such research to better understand the processes of students and doctors 'becoming' and 'being' a doctor. A predominant reason for this research increase appears to be better differentiation between the constructs of professionalism and professional identity, with the former being seen as a fundamental component of medical education (Monrouxe, 2010; Wilson, Cowin et al., 2013; Cruess, Cruess et al., 2014), and the latter as an unstated aim. In this regard, professionalism has been suggested to represent a means to an end (Cruess, Cruess et al., 2014) i.e. the development of a professional identity. Research avenues have been recently suggested to explore professional identity alongside measurable professional competencies to enable a better focus on 'being' rather than exclusively on 'doing' (Jarvis-Selinger, Pratt et al., 2012) medical interventional tasks.

Formation of professional identity within medicine is not without significant challenges which are frequently experienced as crises or dilemmas during socialisation into the medical profession (Jarvis-Selinger, Pratt et al., 2012; Frost & Regehr, 2013). Such crises are often prompted by conflicts in ideas and expectations which require degrees of change and negotiation, and so becoming a doctor is necessarily challenging and transformative (Monrouxe, 2010; Frost & Regehr, 2013). Exploration of how these moments of crisis may influence students' and doctors' understanding of what it means to 'be' and 'become' a doctor have been suggested, in order to help clarify which processes support and promote this transformation of identity (Monrouxe, 2010; Jarvis-Selinger, Pratt et al., 2012). However, such references to processes and transformation are not theoretically informed and this study takes the opportunity to integrate Mezirow's (1991) Transformative learning theory to contribute to this extant literature and provide deeper insight into the nature of professional identity 'transformation', including the factors which may promote and facilitate this journey of both medical students and clinical doctors.

This thesis therefore pursues a potentially innovative avenue of exploration into simulation-based medical education, which seeks to encapsulate the transformative nature of participants' professional identity formation triggered and supported by their simulation-learning experiences. The result of this exploration - the Simulation Identity-formation Model (SIM) - is an empirical response to this thesis' originally posed tentative model. The SIM begins to open-up a new domain of knowledge and theoretical understanding which resonates with Eva (2010) and his call to merge concepts and ideas from different theories to translate into new perspectives on familiar educational terrains. Further, as suggested by Nestel and Bearman (2015b), theories do not provide a prescription for improvement, rather they prompt improvement in often unanticipated

ways. As such, it is hoped the new knowledge which arises from this study's SIM may challenge long-held assumptions regarding simulation-based medical education which could prompt refinement of practice in unanticipated ways, and so further establish its central position in medical education as dedicated to preparation for and transfer to practice in the clinical setting.

1.2 Thesis Structure

The structure of this thesis is as follows:

Chapter two: Literature Review & Conceptual Framework - presents review of the literature and a conceptual framework to contextualise this thesis within current knowledge and theory, and formulate the tentative model tested by this study. The components of this chapter include simulation-based medical education, its philosophical and theoretical educational premises, current SBME research, the constructs of professional identity and its formation in medicine, related identity theory, Transformative learning theory as conceptualised by Mezirow (1991), and my experiential simulation-based education knowledge as reflexively understood. The review of the literature identifies areas of knowledge gaps and research opportunities which are synthesised into a conceptual framework and tested by this thesis' tentative model. The components of the conceptual framework make explicit the key sensitising or orienting constructs of this study (Maxwell, 2005; MacFarlane & O'Reilly-de Brún, 2012) that provide a lens through which simulation-based medical education and the role it may play to facilitate the development of a professional identity in medicine are examined. The components of the conceptual

framework have been separately cultivated across various professional disciplines (Illeris, 2014), and are now merged to form a tentative model that:

> 'Transformative learning occurs in the simulation-based medical education context, as it can trigger and support development of a professional identity as a doctor'.

This tentative model requires a robust and pragmatic research approach by which to test it, to capture new knowledge and understanding of an aspect of learners' simulation-based medical education experiences, and contribute to the broader canvas of extant research.

Chapter three: Research Approach - presents this study's mixed methods cross-sectional research design informed by the components of the formulated conceptual framework. Mixed methods research is justified as appropriate to explore this thesis' tentative model through the synthesis of quantitative and qualitative research stages (Johnson, Onwuegbuzie, & Turner, 2007). This approach is a pragmatic and robust research design, inclusive of a number of data gathering methods and related analytical procedures in order to investigate this study's research aims and questions. Mixed methods research also provides the flexibility and adaptability necessary to accommodate this study's six independent cohorts, the four study settings, together with the anticipated large volume of data. This study has two aims which are:

1. To explore Transformative learning theory (TLT), as conceptualised by Mezirow (1991), within the SBME context, and

2. To formulate a theoretical model of participants' professional identity formation, as facilitated by their simulation-learning experiences.

The two research questions are:

1. Which aspects of TLT are experienced through SBME?
2. What are the identity related dimensions of learners' transformative simulation-learning experiences?

Chapter three presents a discussion of the epistemological and philosophical premises of this study's research approach as aligned with the above research aims and research questions. The quantitative and qualitative study stages, including participant recruitment and sampling methods, data gathering and analytical methods, and mixed-method findings integration are discussed and diagrammatically presented. The four data gathering methods of: Simulation Survey, individual interviews, observation, and electronic interviews are described in detail. Discussion of ethical considerations and the study-strength determinants of both the quantitative and qualitative aspects of this study are also presented. Overall, chapter three presents this study's mixed methods cross-sectional research approach to be a robust integration of multiple research components in order to promote their efficient and interactive functioning (Willis, 2005), to promote and facilitate the testing of this thesis' tentative model.

Chapter four: Transformative Simulation Learning - presents the Simulation Survey findings of the quantitative stage of this study to address both the first research aim and question. Descriptive and non-parametric statistical tests are used to present findings from

three discrete perspectives: 1) phases of TLT experienced by study participants, 2) the nature or types of outcomes experienced from simulation-learning activities, and 3) the association of these experienced TLT phases and outcomes. Findings from the first perspective evidence a simulation TLT framework experienced across the participant spectrum and illustrates *how* participants could experience their simulation-learning. This framework includes the following elements: disorientating dilemma, reflection, planning action, dialogue, and collective learning, which mirror the central constructs long-associated with Transformative learning theory (Mezirow, 1991; Illeris, 2014). Findings from the second perspective show participants' perception of their simulation-learning outcomes can be associated with changes in aspects of themselves, including refined ways in which they can envisage themselves as a doctor, altered expectations of the medical role, and the conscious application of these new understandings to their clinical roles, whether they are a student or doctor. These findings provide initial glimpses of the identity related dimensions of learners' transformative simulation-learning experiences which are pursued in more detail in the qualitative stage of this study. Findings from the third perspective reveal a significant association of the TLT framework and participants' experienced simulation-learning outcomes. Identified differences in how each participant cohort experience the TLT framework and the nature of their perceived outcomes exhibit meaningful patterns throughout the findings, which are associated with an *a priori* ordering of medical knowledge and clinical experience across the participant spectrum. These patterns illustrate that participant cohorts can often experience different meanings, learning needs and outcomes from their SBME experiences. Findings also indicate that simulation-learning involves more than acquisition of discrete medical skills, and extends to supporting the development of learners' evolving professional identities as a doctor. Overall, the quantitative findings presented in this chapter suggest that simulation-learning

can prompt and support transformative learning as conceptualised by Mezirow (1991), and provides initial empirical evidence to support this study's tentative model. Findings from this quantitative stage form the 'skeleton' of this thesis' Simulation Identity-formation Model (SIM), which is 'fleshed-out' in the qualitative stage to form a substantive theoretical account of an aspect of participants' simulation-based medical education learning experiences associated with their professional identity development.

Chapter five: Identity Redecoration - presents the findings of the qualitative stage of this study and addresses the second research question. The Transformative learning framework that emerged from the quantitative Simulation Survey findings is used to structure the interview and observational findings. Chapter 5 extrapolates upon *how* participants could experience their simulation-learning to unpack or uncover *why* such transformative learning was experienced and associated with development of their professional identity. This integration of quantitative and qualitative findings iteratively informs this study's SIM and its four substantive components: 1) *Identity Misalignment*, 2) *Identity Transformation*, 3) *Internally-steered*, and 2) *Externally-steered*.

The first component reveals how learners could experience identity misalignment or dilemmas when aspects of themselves do not 'fit' with newly encountered elements of the medical role. The second component illustrates participants' possible identity transformation as they resolve experienced identity misalignments and so transform their understandings of themselves, the role of a doctor, and how they could see themselves in this socially privileged position. Identity transformation is exhibited as participants provisionally occupying identity-positions reflective of their understandings, knowledge,

and experience. Transition between these identity-positions is seen to portray transformed understanding of the complexity of the skills and aspects which make-up 'becoming' a doctor, where learners can feel more like 'being'. In other words, they feel their professional identity as a doctor to develop and evolve. The final two components of the SIM suggest that participants' transformative learning, necessary for identity transformation and identity-position transition, can be triggered and supported on two levels i.e. internally through reflection and planning action, and externally through feedback and collective learning. These are seen to operate synergistically and illustrate transformative learning as related to identity aspects, both personal and professional.

The Simulation Identity-formation Model is diagrammatically presented and discussed at the end of this chapter, and encapsulates the contribution simulation-based medical education can provide to learners' development of their professional identity as they transition towards 'becoming' and' being' an independent and autonomous doctor.

Chapter six: Discussion - presents the three key findings embedded in this study's SIM and integrates two additional extant theories. The three findings are: 1) Situated and progressive identity formation, 2) Tolerance of ambiguity and reduced uncertainty, and 3) SBME - a transformative bridge of complexity. Briefly, the first key finding shows simulation-learning can provide a situated and legitimate learning context in which participants develop their professional identities. Lave & Wenger's (1991) legitimate peripheral participation (LPP) is applied to provide better understanding of the nature and meaning of the identity-positions participants can provisionally occupy, and the transition between these to enable 'feeling more like' a doctor. The second key finding depicts

participants' progressive development of tolerance to the ambiguities they experience as they further unpack the meaning of a doctor's role, and how they can view themselves in such a role. Reduction in their uncertainty of 'becoming' and 'being' a doctor is portrayed as occurring concurrently, and firmly related to transition between occupied identity-positions. The third finding represents the core finding of this study. Complexity theory as conceptualised by Bleakley (2010) and Mennin (2010a) is used to provide a new way to view the relational and dynamic learning within the small-group based simulation setting, in which development of learners' professional identities can represent a responsive complex adaptive system to the continuously changing conditions encountered during simulated medical situations. This adaptive response is seen to represent the merger or self-organisation of the non-linear related elements of the doctor's role that gives meaning to learners' evolving sense of identity as a doctor. As such, this core finding depicts simulation-based medical education can be a transformative bridge of complexity along which participants co-create their professional identities for transfer to and enactment within the clinical setting. This chapter incorporates LPP and complexity theory as two additional theoretical frameworks to better inform and unpack this study's empirical response to its initially posed tentative model presented in chapter 2.

Chapter seven: Conclusion - begins with a brief summary to refresh and consolidate the study as presented in the foregoing chapters. The scholarly significance of this study's SIM is then discussed to portray the new way simulation-based medical education and its potential outcomes can be viewed. This includes the contribution the SIM makes to the *how* and *why* questions of learners' experiences of SBME , new understanding of the term 'transformation' as used in legitimate peripheral participation and complexity theory, and formation of a professional identity as a doctor. This thesis' quantitative and qualitative

study-strength determinants follow with reference to the four quality principles of: 1) *Truth value of evidence*, 2) *Applicability of evidence*, 3) *Consistency of evidence*, and 4) *Neutrality of evidence* (Janneke, Frambach et al., 2013). Study limitations are also reviewed. The practical implications of the Simulation Identity-formation Model are discussed to highlight the need for SBME curricula and practice to be developed to guide, support and challenge learners in ways that can facilitate transformative professional identity development. The chapter then discusses suggestions for further research to expand upon the new knowledge uncovered this study's SIM. The chapter concludes by saying that his study further consolidates simulation-based education as a globally established central thread in the fabric of medical education (McGaghie, Issenberg et al., 2010), and that formation of a professional identity should underpin contemporary medical education (Cooke, Irby et al., 2010; Cruess, Cruess et al., 2014). The SIM encapsulates simulation-based medical education as a transformative bridge of complexity to the clinical environment, which captures another dimension of the unique nature of simulation as a contemporary educational method.

The next chapter presents this study's conceptual framework inclusive of review of the literature.

2 Conceptual Framework & Literature Review

2.1 Introduction

This chapter presents this thesis' conceptual framework and literature review to establish the perspective and foundation of this study, by contextualising it within current knowledge and theory (Rocco & Plakhotnik, 2009). The literature review uses extant literature to build a case that shows a gap in what is known, and what this study will address (Rocco & Plakhotnik, 2009). This informs the conceptual framework of this study as a sense making model of what is happening *'out there'* and *'why'* (Maxwell, 2005) in simulation-based medical education (SBME) and its association with professional identity formation. This conceptual framework represents an abstract network of interlinked concepts which together can provide a comprehensive understanding (Jabareen, 2009; Taylor & Snyder, 2012) of how learners may experience SBME. This study's conceptual framework therefore forms the tentative model which this research tests (Maxwell, 2005), and makes explicit the key sensitising or orienting constructs from which to further explicate current theory and knowledge (MacFarlane & O'Reilly-de Brún, 2012).

A conceptual framework defines the main ideas and the network of relationships between these orienting constructs (Becker, 1998). Literature reviews and conceptual frameworks share five main functions: 1) to build a study foundation, 2) to demonstrate how a study will advance knowledge, 3) to conceptualise the overall study, 4) to assess a research approach, and 5) to provide reference points for interpretation of study findings (Merriam

& Simpson, 2000). This thesis' conceptual framework and associated literature review is guided by Maxwell (2005) and comprises the following primary components: empirical research, existing theory, and my simulation-based education experiential knowledge which shapes my position. This chapter illustrates formation of a conceptual framework is akin to being a conceptual entrepreneur (Bryant & Charmaz, 2007), which is well suited to this study's interpretive and exploratory inquiry of a different aspect of simulation-based medical education.

Five sections comprise this chapter: simulation-based medical education, including extant research and philosophical and theoretical educational premises (section 2.2), Transformative learning theory as conceptualised by Jack Mezirow (1991) (section 2.3), professional identity formation in medicine and related identity theory (section 2.4), and my experiential simulation-based education knowledge as reflexively understood (section 2.5). Section 2.6 diagrammatically presents and discusses integration of these components to formulate this study's conceptual framework, and then states the tentative model tested throughout the remaining chapters.

2.2 Simulation-Based Medical Education

This section provides an overall orientation to the phenomenon of simulation-based medical education (SBME), which is now globally established as a central thread in the fabric of medical education (McGaghie, Issenberg et al., 2010) that spans both the undergraduate and postgraduate domains (Bradley & Postlethwaite, 2003). Such integration of SBME into global curricula has seen medicine increasingly taught in

immersive simulated settings which form to supplement the more traditional apprenticeship model of work-based learning (Pelletier & Kneebone, 2015a). Immersion into a clinical situation makes it possible to simulate not only discrete medical tasks, but also the complexity inherent to the clinical setting, including its social and emotional dimensions (Pelletier & Kneebone, 2015a). Interestingly, Pelletier (2012, cited in Pelletier & Kneebone 2015a) adopts a metaphor that pedagogically, simulation can be viewed as an anteroom prior to entry into a consensual community of experts, i.e. the medical profession. Such is the firm place simulation-education now occupies in healthcare education, a recent report by the United Kingdom Health Department states simulation as a vital part of building a safer healthcare system, and forms one of the top 10 challenges for the national health service (NHS) over the next decade (Donaldson, 2009). Simulation is now widely accepted as a learning context where clinical exposure can be consolidated by simulation-education where appropriate, ensuring that learners can gain the necessary skills to promote safe and competent practice (Kneebone, Nestel et al., 2007).

The overall goal of the medical simulation education community has long been to bridge the classroom and workplace experiences through development of simulation-based learning, with the aim to provide safe, supportive, and immersive environments in which the array of medical skills can be practiced and developed (Kneebone, 2010; Bleakley, Bligh et al., 2011). SBME can therefore provide a context as a means of risk free learning for complex and rare medical situations (Gaba, 2004; Bradley, 2006). These educational aims encompass a wide spectrum of techniques (Weller, Nestel et al., 2012), and simulation facilities incorporate lifelike clinical environments and diverse education tools such as simulated patients (SPs), high-fidelity mannequins, and task trainers. Simulation mannequins can produce physiological responses such as a palpable pulse rate, breathing

sounds, haemodynamic responses to drugs, and monitor readouts (Kneebone, 2010; Pelletier & Kneebone, 2015a). SPs take part in realistic quasi-clinical scenarios and are trained to provide a consistent performance of a clinical role and to offer structured learner-centred feedback (Kneebone, Kidd et al., 2002; Kneebone, Kidd et al., 2005). SPs function as proxies for those they represent and prompt engagement of health care practitioners and trainees through the quality and realism of their performances (Smith, Gephardt et al., 2015). Simulated patients may perform in and out of role to prompt engagement of trainees by demonstrating appropriate verbal and nonverbal behaviour, and providing relevant cues to shape the interaction during simulated scenarios (Nestel, Mobley et al., 2014).

Educators use this array of simulation modalities to present contrived medical situations to mimic the problems, events, social-dynamics, and conditions that often arise in complex professional medical practice (Weller, Nestel et al., 2012; McGaghie, Issenberg et al., 2014). Simulation-education is also being increasingly used throughout other healthcare disciplines to generate a learning environment in which students and health professionals practice, develop, and refine an array of skills, together with increasing their confidence (Kneebone, 2005; Motola, Devine et al., 2013). Overall, simulation-education has the potential to effectively address many of the challenges facing modern-day medical education (Kneebone, Arora et al., 2010) and is established as a mainstay of training in both technical skills (Kneebone, Nestel et al., 2007) and other non-technical aspects of medical practice.

Simulated clinical proxies are not new to teaching medicine, and have been used for centuries (Bradley, 2006; Rosen, 2008; Owen, 2012) as interactive techniques for teaching and learning purposes (Gaba, 2004; Weller, Henderson et al., 2014). Notwithstanding this long history, as a specialist practice, simulation-based education is relatively new (Nestel & Bearman, 2015b). The last decade has particularly seen formal integration of simulation-learning into global medical education curricula rise substantially for a range of reasons: for example, development of procedural skills such as assessment, examination and communication skills (Kneebone, 2005; Nestel, Groom et al., 2011), production of substantial educational benefits (McGaghie, Issenberg et al., 2010), and favourable utility costs (Bradley, 2006; Nestel, Groom et al., 2011). As such, simulation-education is today widely accepted as an essential and effective learning technique, guided primarily by the deliberate practice concept to support acquisition and retention of skills within a structured learning context (Ericsson, 2004; Rosen, 2008; Weller, Nestel et al., 2012). The overall goal of deliberate practice is learning towards mastery levels (Kneebone, 2005; Khan, Pattison et al., 2011) through continual skill improvement and skill maintenance (McGaghie, Issenberg et al., 2011), which has been suggested to be a predictor of professional accomplishment (Ericsson, 2004). The combination of deliberate practice with feedback has been shown to lead to mastery and expertise (Ericsson, 2004). Therefore SBME can provide a learning context for clinical practice, the teaching of values, reasons and desires about how medical practice ought to be seen and felt (Pelletier & Kneebone, 2015a).

Changes to the landscape of healthcare education and clinical care (Kneebone, Nestel et al., 2007; Harder, 2009; Kneebone, 2010; Weller, Nestel et al., 2012) have also influenced adoption of simulation-based education. For example, the progression from the traditional

‘apprenticeship’ model of medical education towards clinical supervision with objective assessment of competency in the knowledge, skills, and behavioural domains, as well as the ability to work in a team (Rosen, 2008; Zigmont, Kappus et al., 2011b; Weller, Nestel et al., 2012). Simulation education in contemporary medical curricula therefore includes the development of technical skills and application of knowledge, and other aspects of the professional medical role such as interpersonal skills (McGaghie, Issenberg et al., 2014) and patient safety (Khan, Pattison et al., 2011). Also, the duration of training programmes has been significantly reduced, and work-hour restrictions have brought about fundamental organisational changes which have created the need for alternative training avenues, and simulation offers attractive solutions to many of these issues (Kneebone, 2010).

Whilst experience with real patients will remain fundamental for developing clinical expertise, there are aspects of medical practice in which instruction can receive greater focus and be enhanced by simulation-learning, and so expand the opportunities for gaining skills and experience able to be transferred to clinical settings (Ziv, Wolpe et al., 2003; Weller, 2004; McGaghie, Issenberg et al., 2014). This has largely resulted from the rapid progression of the ‘art and science’ of simulation in recent decades and the technology and the educational techniques used therein (Khan, Pattison et al., 2011).

As contemporary healthcare complexity and demands continue to rise, simulation-based medical education also offers a learning environment to supplement the dwindling educational resources necessary to meet these demands (Rosen, 2008). Recent data from Health Workforce Australia (2013) indicated a threefold increase of medical students between 2003 and 2012 and the resultant general shortage of appropriate clinical education

placements (Kneebone, 2010). For doctors, simulation-education is viewed as a way to surpass the limitations imposed by reduced training-hour opportunities (CMO, 2008), and so simulation-based medical education can then be seen to restore what is felt to have been lost (Pelletier & Kneebone, 2015a).

A move to different models of education and changing clinical-case mix within the healthcare industry (Rodger, Webb et al., 2008) have also contributed to an urgent need to maximise learning opportunities, and simulation environments can make the most of the effectiveness of educational resources through scaffolding clinical learning. SBME recognises and addresses these needs and provides a setting for learning where participants engage in authentic role-playing, refine communicative and behavioural skills, and develop procedural skills in preparation for clinical practice. As such, the simulation setting provides a 'context' for participants' medical learning (Trede, 2012).

Integration of simulation-based education into medical curricula has also been prompted by other forces such as clinical governance (Bradley & Postlethwaite, 2003) and political and societal pressures, with a focus on an ethical and safety-conscious culture. The safety of patients has been increasingly prioritised so that medical students and doctors undergoing professional training are no longer able to practice certain interventions, examinations, and invasive procedures before they have gained experience in a safe simulated clinical setting (Bleakley, Bligh et al., 2011). Simulation is also seen as ethical, such that inexperienced doctors are able to gain experience without harming patients, and without the negative emotions associated with learning through trial and error (Pelletier & Kneebone, 2015a), as can often be experienced in the clinical setting. Acceptance of

simulation-learning has therefore come from diverse avenues which have all firmly positioned it as an essential educational resource to help prepare and maintain competent and clinically proficient doctors. Simulation education will no doubt gain greater application as technology advances and new simulation modalities, educational, and theoretical approaches are developed.

Simulation-based medical education activities typically revolve around a single encounter or episode of care (Kneebone, 2010), and employ modalities such as mannequins, part-task trainers, simulated patients, and virtual-reality simulations (Weller, Nestel et al., 2012). The four major principles which underlie use of these clinical proxies are: 1) to support the development of procedural medical skills via the application of cognitive knowledge and practice of psychomotor skills in a "safe" clinical setting (Nestel, Groom et al., 2011), 2) the key consequences of diagnostic and therapeutic actions are represented as if they were real (Dieckmann, Gaba et al., 2007), 3) to promote participants to suspend disbelief and experience SBME as if they were treating a real patient e.g. patient empathy (Berg, Majdan et al., 2011), and 4) to facilitate change-in-practice and improve patient outcomes and safety (Nestel, Groom et al., 2011; Zigmont, Kappus et al., 2011b). Thus SBME provides a clinical learning context in which participants learn and refine their understanding and competency of the numerous components which make-up medical practice and together constitute the complexities of the medical role. This takes place through participation in simulated clinical scenarios.

Simulation scenarios expose learners to various levels of intensity to promote and support the above four principles. This intensity is called "fidelity" and refers to the degree to

which simulated clinical situations are a valid approximation of clinical practice (Beaubien & Baker, 2004; McGaghie, Issenberg et al., 2010) and engages, or immerses, learners in experiences that mimic clinical realities (Kneebone, 2010; McGaghie, Issenberg et al., 2011; Weller, Nestel et al., 2012) or 'true-to-life' experiences (DeMaria, Bryson et al., 2010). Fidelity signals a difference between simulation and reality, and forecloses the possibility of seeing simulation as part of reality, yet also creates it through medical clinical situations (Pelletier & Kneebone, 2015a). Other elements of fidelity used to prompt engagement by simulation participants involve the nuanced interplay of aspects which include the setting, task, technology, props, moulage, wardrobe, and the performance of roles (Dieckmann, Gaba et al., 2007).

Fidelity is also further differentiated into dimensions such as physical fidelity, equipment fidelity, environmental fidelity, and psychological fidelity (Hays & Singer, 1989; Dieckmann, Gaba et al., 2007). For example, psychological and environmental fidelity are discussed in the literature as 'immersion' into the simulation scenario, or 'being there' (Beaubien & Baker, 2004; DeMaria, Bryson et al., 2010; Fraser, Ma et al., 2012a). How well simulation activities mimic reality is frequently a core question for the array of disciplines which use simulation (Dieckmann, Gaba et al., 2007) as a teaching and learning method. To be effective, simulation-education must mirror the essential components of a clinical setting without necessarily reproducing every detail (Kneebone, 2010). However, to be an effective proxy for the array of clinical experiences, simulation should recreate the sensations and perceptions of danger while still ensuring patients are not jeopardised (Kneebone, 2010). Achieving this mixture of fidelity or the essences of real life experiences is a challenging task (Kneebone, 2010) for simulation educators and researchers.

New ways to achieve such mixtures of fidelity have led to reconceptualisation of simulation in some studies, led by Roger Kneebone and Debra Nestel (Kneebone, 2005; Kneebone, Nestel et al., 2006b; Kneebone & Baillie, 2008; Kneebone, Arora et al., 2010; Nestel & Kneebone, 2010). Succinctly, this re-thinking of simulation-based education bridges simulation and the real in hybrid practices and is an imaginative approach of paradoxical 'authentic simulation' i.e. the context is authentic but the patients are actors (Bleakley, Bligh et al., 2011). These hybrid practices focus on patient-centred simulation that offers both seamless and distributed simulation in immersive learning environments, which have addressed some of the objections raised about difficulties associated with transfer of simulation learning to clinical practice (Bleakley, Bligh et al., 2011). The overall premise of this reconceptualisation of SBME is to integrate technical skills which make-up medical practice with the human face of delivery to patients focussed on context: actors play patients, real clinical teams are available, and the context can be placed on a continuum from low to high complexity and fidelity (Bleakley, Bligh et al., 2011). Patient-focused simulation (PFS) is described as a means of offering patients' perspectives during the acquisition of clinical procedural and surgical skills (Kneebone, Nestel et al., 2007; Nestel & Kneebone, 2010). As the patient is becoming an increasing focal point of medical teaching and learning, Nestel and Kneebone (2010) argue that simulation in its widest sense can be used to support such focus. The future of learning through simulation in medicine may be framed by and rest with the power that 'hybrid' as conceptualised by Nestel and Kneebone holds (Bleakley, Bligh et al., 2011).

The fidelity construct is generally situated along a continuum of low-fidelity to high-fidelity, where high-fidelity simulation encapsulates the demands of dealing with a patient in need, and the challenges of collaboration and decision making under stressful conditions

(Roy & McMahon, 2012). High-fidelity simulation events often involve life-threatening or crisis medical situations, and may also extend to simulated operating theatres that recreate the physical conditions of a operation situation where sophisticated, computer-driven manikins respond realistically to pathophysiological changes (Kneebone, Nestel et al., 2007). Simulation activities situated along this continuum are recognised to promote and facilitate effective learning (Issenberg, McGaghie et al., 2005). The overall intent of high-fidelity medical scenarios is to typically have participants treat a mannequin as if they were treating a real patient, where the key consequences of the diagnostic and therapeutic interventions are represented as those in the clinical context, even though they are not physically real (Dieckmann, Gaba et al., 2007). As such, the scenario is then often allowed to play-out as if the simulated patient's physiology would follow naturally from the participants' actions (Dieckmann, Gaba et al., 2007). This is also valuable to help learners increase their visio-spatial perceptual skills and to sharpen their responses to critical incidents (Issenberg, McGaghie et al., 2005). Through focus upon high-fidelity approaches, the simulated environment comes to match the real (Bleakley, Bligh et al., 2011). However, debate pervades discussion and perception of fidelity within SBME scenarios, as no matter the level of sophistication of the machines used, they remain a machine, which imposes inescapable constraints on authenticity (Kneebone, 2010). Contemporary understanding and use of simulation fidelity attempts to address such debate, which allows participants to 'see the picture' of the presented medical situation, not just the 'canvas and the paint' (Kneebone, 2010).

High-fidelity simulation generally incorporates two learning phases: a simulation scenario and a post-simulation debriefing session, each with its specific learning objectives and processes. Scenarios are context specific and constitute dynamic active and relational

engagement (experience) where participants collectively assess, determine, and implement medical interventions they feel appropriate for the medical situation at hand. This provides a fast-paced learning process of intense interaction and focussed dialogue, as is often the case in clinical settings. High-fidelity simulation is therefore strongly regarded as an effective way to complement the training of medical students and doctors (Issenberg, McGaghie et al., 2005; Fraser, Ma et al., 2012a). The focus of this thesis includes the array of simulation-learning activities located along the fidelity continuum, for example basic life support (BLS) and advanced life support (ALS) situations such as acute medical emergencies representing post-surgical hypovolemic shock or diabetic ketoacidosis.

Post-simulation debriefing sessions are an important component of SBME sessions (Dieckmann, 2012), with some authors suggesting it to be of critical importance (Rudolph, Foldy et al., 2013) or the 'heart and soul' of the simulation experience (Rall, Manser et al., 2000). Debriefing, or pausing and reflecting during sessions, are designed to provide a reflective and discursive learning environment to deconstruct a simulated scenario, discuss premises underlying thought and actions performed, and engage in open discourse to conceptualise alternative actions and perhaps reach general consensus. Post-simulation debriefing collectivises experiences, and in discussing 'what happened', participants often use past tense to make their experiences perceptible through a lens of hindsight, in relation to what they eventually led to (Pelletier & Kneebone, 2015a). The debriefing facilitator plays a central role to prompt active participation of learners, and to identify knowledge and skills gaps to be addressed and perhaps closed (Raemer, Anderson et al., 2011). Ideally, debriefing encourages learners to critically reflect in a supportive and collective learning environment (Gum, Greenhill et al., 2011).

The above review has outlined the nature and educational importance of simulation-based education. Both the simulation and broader medical education literature-bases are replete with studies that have examined simulation strategies within medical education, and the next section reviews the diverse nature and outcomes of some of the aspects of such research.

2.2.1 Simulation-Based Medical Education Research

Research into SBME has evolved over recent decades on both substantive and methodological grounds (McGaghie, Issenberg et al., 2010). The past ten years in particular have seen a significant increase in evaluative research since Issenberg et al's (2005) initial comprehensive simulation education systematic review. The empirical research summarised below illustrates the diverse areas of focus: *the efficacy of debriefing methods* (Fanning & Gaba, 2007; Van Heukelom, Begaz et al., 2010; Parker & Myrick, 2010), *specific use of feedback* (Rudolph, Simon et al., 2007; Gum, Greenhill et al., 2011; Raemer, Anderson et al., 2011), *skills acquisition and maintenance* (Barsuk, McGaghie et al., 2009; Cook, Hatala et al., 2011; Kassab, Kyaw Tun et al., 2012), *concept of hybrid simulation* (Kneebone, Kidd et al., 2005; Kneebone, Nestel et al., 2006a; Kneebone, 2009b), *recruitment of fantasy and mythology in SBME* (Pelletier & Kneebone, 2015a) *SBME curriculum integration* (Issenberg, 2006; Kneebone, 2009b; Weller, Nestel et al., 2012), *underpinning educational theory* (Nestel, Groom et al., 2011; Nestel & Bearman, 2015b), *SBME as cultural practice situated in gaming* (Pelletier & Kneebone, 2015b), *closing the gap between theory and practice* (Weller, 2004), *sequential simulation and longitudinal aspects of care* (Kneebone, Kidd et al., 2005; Kneebone, 2010; Powell, Sorefan et al., 2016), *Distributed simulation-accessible and immersive training*

(Kneebone, Arora et al., 2010), *inertia or reluctance for SBME integration* (Adler, Vozenilek et al., 2009), *patient-focused simulation (PFS)* (Kneebone, Nestel et al., 2007; Nestel & Kneebone, 2010), *learner outcome measurement* (Williams, Klamen et al., 2003; Scalese & Issenberg, 2008; Cook, Hatala et al., 2011), *simulation and professional identity development* (McLean, Johnson et al., 2015), *practice, rehearsal, and performance* (Kneebone, 2009a) *teaching of procedural skills* (Kneebone, 2005; Nestel, Groom et al., 2011; Passiment, Sacks et al., 2011), *the relationship between clinical and simulation-based practice as a mutually dependent two-way process* (Kneebone, 2010), *immersion and circles of focus* (Kneebone, 2010), *simulation fidelity* (Kneebone, Kidd et al., 2005; Issenberg, 2006; Kneebone, 2009b), *ecological validity* where the validity of participant behaviours is a function of the validity of the simulated environmental cues (Dieckmann, Manser et al., 2007; Weller, Henderson et al., 2014), *participants' subjective perception of realism* (Krahn & Bostwick, 2001; Dieckmann, Manser et al., 2007; Kassab, Kyaw Tun et al., 2012), *transfer to practice* (Bradley, 2006; Cook, Hatala et al., 2011), *positive downstream effects on health and society* (McGaghie, Issenberg et al., 2014), *enhanced patient safety* (Gaba, 2004; Khan, Pattison et al., 2011), *inter-professional learning* (Gaba, 2004; Bradley, 2006), and *instructor training* (Dieckmann & Rall, 2008; Vollmer, Monk et al., 2008) and *applying the theory of Stanislavski to simulation*, (Smith, Gephardt et al., 2015).

These research foci are very diverse and have provided considerable knowledge which explicate the substantial interest in SBME as an educational method. Quantitative methodologies predominate in these studies despite the call from Bradley and Postlethwaite (2003) for SBME research to encompass an interpretive paradigm. However,

qualitative approaches have begun to emerge in recent years as a developing research emphasis (McGaghie, Issenberg et al., 2010).

This rise in simulation-based medical education research over the past ten years has firmly established a new field of medical education research, where it's place in preparation of medical students, the continued professional development of doctors, together with its overall educational efficacy are frequently presented in the array of simulation and medical education journals. The above cited literature largely acknowledges SBME as an effective and complementary clinical training modality. In addition to this now well-established literature base, there is also an evolving collection of literature which examines the more subjective experiences of learners, both favourable and unfavourable.

The effects of simulation-induced stressors and their effects on the learning experience has emerged as an area of research which has identified diverse forms of stressors and variability in individuals' responses (LeBlanc, 2009; Harvey, Nathens et al., 2010). The primary focus has been on the potential negative effects or outcomes for learners e.g. concentration, satisfaction, performance impairment, failure to improve, knowledge retention, and physiological responses such as anxiety to perceived threat and challenge, and elevated stress hormone release (cortisol). This area of research has gone beyond a focus on outcomes to also explore why and how these stressors may be generated and how they may impact on the learning experience. The research suggests potential determinants of stress responses are multidimensional in nature, with the primary stressors being: *increased cognitive load* during SBME training (Fraser et al., 2012a), *subjective assessments of the demands of a high-fidelity scenario* (Harvey, Nathens et al., 2010),

retroactive interference where newly acquired information inhibits recall of previously learned knowledge (Kromann, Jensen et al., 2010; Fraser, Ma et al., 2012b), and *socio-evaluative* i.e. being observed and assessed by educators and fear of 'losing face' in front of peers (LeBlanc, 2009). There have been contemporary calls for interventions which target stress management skills to be integrated into SBME curricula (Harvey, Nathens et al., 2010) so that the array of stressor determinants are mitigated so that learning may be improved. Research approaches have again predominantly used descriptive statistics and factor analysis to quantify stress and anxiety levels, self-perceived levels of learning and its association with less than favourable learner experiences.

In contrast to these simulation-induced stressors, a relatively small body of literature has identified positive learning experiences associated with elevated stress during simulation sessions. Indeed, some authors view stress as an advantage in its ability to recreate rare and/or challenging clinical events, such as a medical crisis (Weller, Henderson et al., 2014). Girzadas, Delis et al. (2009) have hypothesised that measurements of participants' stress and learning would be similar for all emergency residents and medical students in their simulated emergency trauma scenarios. Participants' physiological responses to stress were measured prior and during the scenario, as was their self-perceived stress and self-perceived learning. Findings suggested that self-reported learning increased with self-reported stress levels, and participants were successful in responding to factual questions about the teaching points covered in the simulation (Girzadas, Delis et al., 2009). Thus, this study found a statistically significant positive association between elevated stress levels and perceived learning.

A similar positive association was evidenced by DeMaria, Bryson et al. (2010), but they added the notion of knowledge retention to test their hypothesis: whether a high-fidelity cardiac scenario with added emotional stress could provoke anxiety and, if so, whether or not participants' learning would demonstrate better written and applied knowledge retention six months later. Findings of the predominantly statistical results were consistent with their examined hypothesis, and showed that the addition of emotional stressors did induce anxiety and was associated with improved long-term practical knowledge (DeMaria, Bryson et al., 2010). The authors concluded that emotional stressors are educationally advantageous, and that research results regarding the effects of stress on general educational outcomes are inconsistent and very limited in the medical simulation literature. Emotional stress may therefore be an important variable that affects the outcomes of simulation-based medical education (DeMaria, Bryson et al., 2010). At the date of its publication, the study provided inaugural results which linked stress and long-term knowledge retention. Overall, the literature which examines subjective experiences of SBME learning is mixed.

In a recent review of simulation-based medical education research, Issenberg, Ringsted et al. (2011) specifically suggested instructional design, outcome measurement, and translational research as central themes of a research agenda to guide future research. This call for further SBME research suggested these themes can be pictured to form a progressive whole i.e. design of simulation curricula, examination of potential learning outcomes, and the use or application of such learning in the clinical setting. Issenberg, Ringsted et al. (2011) also suggested that overall, SBME research is still at an early stage despite the continued growth in its use as a medical teaching and learning method. Additionally, Cook, Hatala et al. (2011) proposed that the wide-spread appeal and adoption

of simulation is not often linked to or evidenced by empirical research. Thus, there appears to be a mismatch between the global spread of SBME and the empirical evidence by which to validate and attach such reliance and confidence to this education modality. Also, much of the simulation research literature generally remains more descriptive than critically reflexive (Bleakley, Bligh et al., 2011).

Whilst the above research has provided a large volume of valuable knowledge, there remain areas to be explored by which to expand evidence-based simulation-based medical education. One specific area is to gain further understanding of the theoretical premises which underpin and can be applied to SBME (Nestel, Groom et al., 2011; Nestel & Bearman, 2015b). Whilst such research focus has been active for a while, for example (Bradley & Postlethwaite, 2003), (Kneebone, 2005), and (Kneebone, 2009a), recent years have seen a more dedicated pursuit of this new theoretically-based knowledge. This thesis pursues such a contemporary call, as it views the centrality of simulation-learning in contemporary medical education as a catalyst for more expansive theoretical understanding of simulation design and practice and the educational outcomes transferred to the clinical setting.

The diversity of simulation research foci reviewed above emphasises discrete areas such as procedural skills development, learning outcome measurement, transfer to practice, and exploring learners' experiences. In contrast, this study's conceptual framework synthesises simulation research to focus on *how* and *why* simulation experiences can contribute to learners' notion of development or evolution of their professional identity in medicine, and to seek to understand how SBME may support learners 'becoming' and 'being' a doctor.

After all, simulation-learning strives, through deliberate practice, to improve the ways participants interpret, handle and manage simple or complex clinical situations, and so the ways by which participants' self-perceive, and are seen to enact these array of skills and competencies must inform their sense of a professional identity as a doctor. This perspective links simulation-based education outcomes with identity theory, for example Costello (2005), who suggests that even if learners absorb all the new knowledge and skills presented throughout their education, they will not be successful as a professional unless they also develop a professional identity. Therefore, this study suggests that simulation-learning experiences can be associated with professional identity formation as students transform into clinicians, and doctors pursue career aspirations. This thesis' linkage of professional identity formation with simulation-based medical education contributes to recent similar acknowledgment within the simulation literature, for example Kneebone (2015), Bleakley, Bligh et al. (2011), and McLean, Johnson et al. (2015), and offers a new theoretical perspective of *how* and *why* simulation education can facilitate construction of a professional identity as a doctor.

The next section examines some of the philosophical and theoretical theories associated with contemporary simulation-based education.

2.2.2 Philosophical and Theoretical Foundations of SBE

Simulation-based education (SBE) can be informed by a number of theories that can question, validate, expand, or refine methods applied to simulation education practice (Nestel & Bearman, 2015b). Examples include theories within the constructivist paradigm such as andragogy and experiential learning, which clearly place it as an educational

strategy rather than purely a technological tool. More recently, social constructivist educational theories such as Mezirow's (1991) Transformative learning theory and complexity theory have emerged in the simulation education literature to explore the elements of SBE which may be transformative in nature to adult learners. Pelletier and Kneebone (2015b) provide another examination of simulation education by situating it within the gaming and simulation theoretical domain.

Notwithstanding the theoretical perspective which may be applied to SBE, simulation can only ever be as good as the educational programme into which it is integrated theoretically informed (Maran & Glavin, 2003). SBE therefore offers different ways to conceptualise learning processes, and so provides an array of opportunities for the advancement and understanding of learning (Bradley & Postlethwaite, 2003). Simulation-based education has the potential to be theory-rich in helping to understand how learning takes place and how it can be supported through the various simulation strategies (Bradley, 2006). Recent years have see theories being increasingly conceptualised, adapted, and applied to simulation-based health education, which has signalled a shift towards a more rigorous and thoughtful approach to simulation educational practice. (Nestel & Bearman, 2015b).

Nestel and Bearman (2015a) examine several theoretical perspectives of simulation education, and discuss performing arts theory and the use of sociological conversational analysis as examples that could inform SBE methodology. As further suggested by Nestel and Bearman (2015b), simulation-based education comes in different forms with various goals, and so expands the array of theoretical perspectives that can provide understanding of how people learn and how teaching can be enacted. Nestel and Bearman (2015b)

highlight a range of theories that may impact simulation-based education, which include Cognitive Load, Reflective Cycle, Informal Learning, Stanislavski's System, and Cultural Historical Activity Theory. As Nestel and Bearman (2015b) explore the role of theories in simulation-based education, these five theories come from various ontological and epistemological perspectives which include postpositivist, interpretivist, and critical theory worldviews. These theories can be regarded as frameworks of ideas which have different nuances to illuminate simulation-based educational practice, and so may prompt improvement (Nestel & Bearman, 2015b) in ways to assist learners and the array of disciplines which make use of simulation-based education in preparation of their students and professionals, guided by the construct of preparation for practice.

Currently there is no single grand theory that supports educators in making decisions about the many forms and varied goals of simulation-based education (Nestel & Bearman, 2015b). There are however a breadth of theories that can be used to inform simulation-based education to prompt improvement of educational practice (Nestel & Bearman, 2015b). This array of theoretical approaches to SBE has helped to guide researchers and educators to provide learning frameworks by which to inform a complex series of activities and processes which are important to carry out simulation-based learning activities (Issenberg, Ringsted et al., 2011). Nevertheless, gaps remain in theoretical foundations of simulation-learning that could be pursued (Nestel, Groom et al., 2011; Issenberg, Ringsted et al., 2011). This thesis embraces this opportunity to contribute further to the theoretical examination of simulation-based medical education.

Several of the theoretical perspectives within the constructivism, social constructivism, and gaming domains discussed in the literature as describing the nature of simulation learning processes, are briefly discussed below.

2.2.2.1 Constructivism

Constructivism has its origin in Piaget's notion that learners construct their understanding of the world through their interactions with it (Bradley & Postlethwaite, 2003). Constructivism suggests learners are active agents in the acquisition of knowledge to make sense of situations and create meaning (Loyens & Gijbels, 2008), and active in the knowledge acquisition process (Loyens, Rikers et al., 2007). Constructivism also stresses the importance of a safe learning environment (Watts & Bentley, 1987). Simulation-based medical education aligns with constructivism where focus is on agentic learning, building meaning schemas, activation of prior knowledge, and the scaffolding of learning. Andragogy and Experiential learning are educational theories which have been applied to simulation-based medical education.

Andragogy

Knowles (1980, p. 43) defined andragogy as 'the art and science of helping adults learn'. Although the term andragogy was coined by the German educationalist Alexander Kapp in 1833 (Howard, 1993), Malcolm Knowles extended and develop this concept to form a theory of adult learning in response to developing research focussed on educational approaches for adult learning needs (Zmeyov, 1998). Andragogy is premised on crucial assumptions about the characteristics of adult learners: 1) *self-directed and self-regulated*

(Knowles, 1985; Fanning & Gaba, 2007; Taylor & Kroth, 2009), 2) *intrinsically motivated* (Knowles, 1985; Fanning & Gaba, 2007), 3) *possess previous knowledge and experience as resources for learning* (Fanning & Gaba, 2007; Renkl & Atkinson, 2007), 4) *through experience adult learners form mental models to guide their behaviour* (Knowles, 1985), 5) *the use of analogical reasoning* (Bakken, 2002), and 6) *adults prefer learning to be problem centred and meaningful to their life situation* (Knowles, 1980).

Andragogy is frequently used to describe SBME learning (Fanning & Gaba, 2007; Zigmont, Kappus et al., 2011a) because learners are actively involved in the learning process to construct their knowledge, make sense of the learning, and to apply what they have learned (Chan, 2010). However, Clapper (2010) has argued that too often simulation educators miss opportunities to incorporate other theories to further understand simulation-based education, which may better facilitate health professionals to become more self-directed and lifelong learners.

Experiential learning

The distinguishing feature of experiential learning based on the work of Kolb (1984), is that the experiences of a learner occupy the central place in their teaching and learning (Andresen, Boud et al., 2001). Experiential learning shares epistemological tenets with andragogy but emphasises engagement and active participation for effective learning. Fanning and Gaba (2007, p. 115), have described this as: 'learning by doing, thinking about, and assimilation of lessons learned in everyday behaviours'. The experiential learning process is cyclical and encompasses four interrelated aspects (Kolb, 1984): 1) *representative experience*, 2) *reflective observation*, 3) *abstract conceptualisation*, and 4)

active participation. Kolb (1984) conceptualised that such learning is a process whereby knowledge is continuously acquired, tested, analysed and reflected upon during and after an event, and so can represent an holistic learning process (Andresen, Boud et al., 2001). This concept of reflection and analysis is the cornerstone of simulation-based education as an experiential learning context (Andresen, Boud et al., 2001; Fanning & Gaba, 2007). Experiential learning asserts adults learn in ways not possible from instruction or information delivery alone, and necessitates interaction between the learner and the environment, moving between 'opposing modes of reflection and action, feeling and thinking' (Kolb & Kolb, 2005). SBME provides an experiential learning context (Fanning & Gaba, 2007; Harris, Eccles et al., 2013), as experiences, either real or simulated, are catalysts for experiential learning (Zigmont, Kappus et al., 2011a), and experience is the foundation of, and the stimulus for adult learning (Andresen, Boud et al., 2001).

An additional experiential educational or learning model which fits with SBME and its aim to enhance learners' expertise or mastery is provided by Dreyfus and Dreyfus (1980) through their novice to expert or Five-Stage Model of Adult Skills Acquisition, which is based on learning skills, rather than a profession. Their five-stage model presents the argument that 'skill in its minimal form is produced by following abstract formal rules, but that only experience with concrete cases can account for higher levels of performance'(Dreyfus & Dreyfus, 1980, p. 5). The five phases of developing expertise were originally posited as novice, competent, proficient, expert and master, and were later refined by Dreyfus (2004) to novice, advanced beginner, competence, proficiency, and expertise. The model was constructed around the four mental functions of: component, perspective, decision and commitment and how these varied at each level of the model

Dreyfus (2004). As learners develop or mature these mental functions, they increase their level of expertise along the five-stage continuum.

Individuals progress through the five stages of expertise by drawing on their experiences of solving problems in context in order to reach higher levels of expertise using combinations of the four mental functions (Dreyfus, 2004). So context and experience are fundamental components of the Five-Stage Model of Adult Skills Acquisition. In the earlier stages, instructors reduce complex problems into small pieces which can be solved without knowledge of the entire situation, and the later stages sees learners associating the facts and rules more with context that can be relied upon for future application, and so begin to use analytical processes and rely on past experiences, including drawing on emotional reactions, to decide which elements of the situation are important (Dreyfus, 2004). At the final stage of expertise an individual, not only sees what needs to be done, but also envisages the solution without having to go through an analytical process to arrive at the solution. At this level the individual is totally immersed in understanding the situation, making decisions on how to proceed, and in the outcome of the situation.

The application of Dreyfus and Dreyfus (1980) novice to expert model to the educational/experiential aims of SBME can be clearly seen, as this setting provides an experiential medical context for expertise development where the use of mental functions is promoted as the complexity of medical scenarios is enhanced and the level of responsibilities increase. This model has been applied by several authors (Batalden, Leach et al., 2002; Carraccio, Benson et al., 2008) to examine the learning of skills and competency development in broader areas of medical education.

2.2.2.2 Social Constructivism

Social constructivism applies constructivism to the social construct and is a sociological perspective of knowledge and learning generally attributed to Vygotsky (1978), who placed emphasis on the social and collective nature of learning (Bradley & Postlethwaite, 2003; Loyens & Gijbels, 2008). Vygotsky conceptualised that the construction of knowledge resulted through the interplay between learners and others (Jones & Brader-Araje, 2002), with this inter-relational dependence central to higher order learning processes (Sanders & Sugg-Welk, 2005). Social education theories have been largely overlooked within medical education (Hodges & Kuper, 2012). In addition, despite the studies which address the use of simulation to teach social aspects (e.g. teamwork, leadership, and patient interaction), minimal studies exist which examine the social dimensions of simulation in medical education (Kneebone, Nestel et al., 2006b; Dieckmann, Gaba et al., 2007; Muller, Hansel et al., 2007). However, there are contemporary calls for application of social theories to inform future medical education (Mann, 2004; Bleakley, 2006). Mezirow's (1991) Transformative learning theory, which is informed by the social dimensions of how adults learn, has been recently applied to SBME. Habermas (1984, 1987), considered to be the most influential German social theorist, significantly shaped the development of Mezirow's adult learning theory. Complexity theory, as a socially-based framework, has also been recently applied to SBME as a way to identify new approaches for designing simulation settings, scenarios, and curriculum to expand and deepen student learning (Fenwick & Dahlgren, 2015).

Transformative learning theory

Transformative learning theory (TLT) forms the central theoretical component of this study's conceptual framework and is discussed in section 2.3. Succinctly, TLT is about significant change in premises of thought, assumptions, and expectations which leads to new ways an individual makes meaning of future experiences in order to guide action. Transformative learning theory has guided research in an array of learning contexts to initiate and support significant change in long-held premises of thought to result in changed action. Indeed, TLT has been the most researched theory of adult learning over the past three decades (Cranton & Taylor, 2012). Transformative learning theory has been recently applied to the SBME context (Parker & Myrick, 2010; Clapper, 2010; Gum, Greenhill et al., 2011). Gum, Greenhill et al. (2011) identified that post-simulation debriefing lacked a conceptual framework to guide facilitators and learners. TLT was used as a lens in their qualitative study to address this gap in knowledge and examine how the process of debriefing might be enhanced by transformative learning premises. They concluded debriefing as an ideal medium to foster transformative learning and developed the reflective conceptual framework Sim TRACT™ to enhance and guide post-simulation debriefing. Parker and Myrick (2010) critically analysed the role of clinical scenarios using human patient simulations to promote transformative learning, and concluded these scenarios, as learning events, could trigger disorientating dilemmas to represent the beginning of the transformative learning process. They also found critical reflection and social discourse as important transformative learning aspects. Clapper (2010) explored several adult learning theories and their 'fit' with simulation-based education, and similarly found simulation education interfaced well with TLT. Clapper (2010, p. e10) concluded by suggesting transformative learning is 'the goal of any simulation experience'. Medical education research applying Mezirow's (1991) Transformative

learning theory to SBME is scarce, and Gum et al. (2011) were the only authors to use TLT as a theoretical lens. This thesis aims to contribute to this emerging literature base, and uses Transformative learning theory as an informative theoretical lens to further understand and interpret learning and outcomes experienced from participation in simulation-based medical education.

Complexity Theory

Medical educators have begun to look towards complexity theory as a framework to offer an alternative that counters traditional medical education approaches (Bleakley, 2006; Mennin, 2010c; Fenwick & Dahlgren, 2015). Simulation-based education, as a socially-based learning context, has recently attracted the application of complexity theory constructs to help learners expand and deepen their learning (Fenwick & Dahlgren, 2015). Complexity theory does not distinguish between competency and capability, rather its constructs explain systemic capabilities and not individual performance (Fenwick & Dahlgren, 2015).

Complexity theory has been suggested to provide a good example of the possibilities that can be opened up by using socio-material approaches to improve design, delivery and potential outcomes of simulation-based education (Lefroy & Yardley, 2015). One specific possibility is complexity theory's concept of learning as a web of relations which form among phenomena, including social and material things (Fenwick & Dahlgren, 2015). These phenomena do not come together in a linear cause and effect trajectory, rather they combine through myriads of non-linear interactions which continually present novel possibilities (Mennin, 2010a; Fenwick & Dahlgren, 2015).

Ma (2015) has suggested that the overall premise of complexity theory may not be very different from what educators are likely to be already doing within the simulation-based setting, as simulation strategies incorporate multiple complex elements such as patient monitoring devices, diagnostic tools, and other health professionals. As such, the value of introducing complexity theory to SBE is that it makes the messiness of real world clinical practice more visible and permits experimentation (Lefroy & Yardley, 2015).

Stacey (2003) conceptualises complexity as relating to the intrinsic properties of interaction, and so offers additional theoretical insight into the potential outcomes of SBME. In this context, Stacey (2003) understands the circular processes of gesturing and responding between people who are different to be a process of self-organising patterns of relating. Stated another way, such patterns of relating constitute continuity, identity and difference which form complex processes of relating and amount to a causal framework of transformative teleology (Stacey, 2003). This framework depicts the emergence of coherent patterns of relating and forms the view that human relating to be inherently pattern forming.

For Stacey (2003), this leads to a different notion of human agency i.e. agency means doing and human agency means humans doing something. Agency concerns what causes humans to do what they do, and what they do to survive is to interact or relate with each other (Stacey, 2003). The analogy of this relational and interactive nature of SBME can be readily envisaged from this perspective, as simulation activities are inherently interactive and socially dynamic, as both learners and educators jointly decide and enact medical

interventions best suited to the often complex clinical situation at hand. Additionally, learners can be said to be driven by the agency to portray an identity, which displays a level of confidence and competence to the level of learning being both presented and experienced.

Stacey (2003) holds that such doing and acting form complex adaptive processes of relating shaped by perpetual self-organisation of the patterns which constitute such relating. These patterns involve individual mind and social interactive or relational patterns, which themselves form continual patterning processes (Stacey, 2003).

2.2.2.3 Gaming & Simulation

Pelletier and Kneebone (2015b) provide another theoretical examination of SBME, and make a case of simulation education as a cultural practice by situating it within a history of gaming and simulation. Through such a theoretical view, they see SBME as not simply teaching skills or reproduction professional practices, but how it can transform the ways medicine can be made sense of, and so describe underreported phenomena (Pelletier & Kneebone, 2015b). These authors use the concepts of play, narrative, and simulation from the field of game studies to interpret an ethnographic study of hospital-based simulation centres, as these concepts characterise the study of games and simulations as cultural practices as expressive forms (Pelletier & Kneebone, 2015b).

These concepts have been chosen for their scope in describing simulation as a genre rather than a technology (Pelletier & Kneebone, 2015b). Such an examination of SBME is seen

as demonstration of the empirical reach of aesthetic analyses of games and simulations, to better uncover the significance of imagination and fantasy in maintaining the credibility of simulation (Pelletier & Kneebone, 2015b). These authors give a different perspective of fidelity by theoretically showing that what turns a SBME manikin into a patient on the verge of death, or trauma into a need for medical intervention, 'is not fidelity to a hypothesised real, but rather fidelity to a set of values and cultural imaginaries' (Pelletier & Kneebone, 2015b, p. 21). As such, these authors apply gaming and simulation theory to SBME to see what can be done with medical simulation when it is treated as a cultural practice and not simply a medium of content and/or skill delivery.

Pelletier and Kneebone (2015b, p. 2) identify gaming and simulation research as cultural practices 'in terms of its concern with representational conventions and semiotic operations, game players/users' actions and interactions, and design/production'. The notion of 'serious games' forms a central construct of Pelletier and Kneebone's (2015) perspective, where it represents focus on the experiences of the player/user, the quality of the game design, and analysis of the games and simulations as aesthetic experiences (Charsky, 2010; Ferrara, 2013). Pelletier and Kneebone (2015b) strongly suggest that categorising SBME as a 'serious game' opens up avenues to explore how fictionalisation and other play-related activities make SBME practices possible, and perhaps more significantly, how they can determine what is learned. This could bring new realities into being and so games and play studies can make a valuable contribution to simulation-based medical education and how it can make medicine meaningful for simulation participants (Pelletier & Kneebone, 2015b). By treating SBME as a game does not mean equating it with idleness, rather it allows it to be framed as an activity implicated by symbolising the world and, consequently, in experimenting with how it can be made sense of by virtue of

the imaginative work of participants and their emotional vividness. (Pelletier & Kneebone, 2015b). This incorporates immersion into the medical situation where participants create belief, rather than suspend disbelief, and therefore intelligence is applied to reinforce rather than question the reality of the experience (Pelletier & Kneebone, 2015b).

Pelletier and Kneebone (2015b) conclude their article by suggesting their gaming and simulation view of SBME has implications for educational practices, and see value in moving away from concerns with technologies per se, and instead examining practices which enhance or disturb belief, as well as their aesthetics, ethics and politics. They suggest that one way of doing this may be to focus on the affectivity of clinical medical practice, including how 'fidelity' to its sense of purpose is sustained and the disturbances perhaps caused and thereby perhaps making original meanings possible (Pelletier & Kneebone, 2015b). The authors demonstrate the significance of imagination and fantasy in maintaining the credibility of simulation and show fidelity related to a set of values and cultural imaginaries. Pelletier and Kneebone (2015b) application to SBME broadens the analytic focus in the ''serious games'' literature beyond the measurement of intended outcomes.

The following section presents the next substantive component of this thesis' conceptual framework.

2.3 Transformative Learning Theory

Mezirow's (1991) Transformative Learning Theory (TLT) is primarily about making meaning and interpreting life experiences (Dochy, Gijbels et al., 2011). Mezirow (1991, p. 11) defined learning as a meaning-making activity - 'using a meaning that we have already made to guide the way we think, act, or feel about what we are currently experiencing'. Meaning is making sense of or giving coherence to an experience, the process of which is focused, shaped and delineated by an individual's frames of reference (Mezirow, 1991, 1994). Transformative learning is not simply any change in behaviour or the acquisition of new skills, it is learning that transforms problematic frames of reference that will prove more justified to guide future action, and so new meaning is made from a new perspective made-up of transformed ideas, expectations, and assumptions (Mezirow, 1991, 2012). Illeris (2014) has described transformative learning as changes in understandings and dealings with the essential conditions of life. Overall, transformative learning implies a change or new meaning structures altered into something that is qualitatively different (Mezirow, 1991; Illeris, 2014).

2.3.1 'Transformation' as Adopted by this Thesis

The Handbook of Transformative learning (2012) clearly shows the evolution of this body of research, and the diversity of perspectives of *what* is able to be transformed and what *transformation* can represent. A brief review of the various conceptualisations of the term 'transformation' helps to illustrate the diversity of these perspectives, but also clarifies the view adopted by this study's conceptual framework. Boyd and Myers (1988) and Dirkx

(2001) have established an extra-rational perspective of transformation in contrast to Mezirow's stance. They view transformation linked the Jungian concept of individuation, whereby individuals bring the unconscious to the conscious to differentiate self. Kegan (2000) theorises transformation as shifts in ways of knowing linked to higher orders of consciousness, and O'Sullivan (2002) has suggested a model for transformation which incorporates eco-theologian philosophical aspects, spiritual dimensions, and arts-based ways of knowing. Other authors conceptualise transformation as transposition of our hearts and moods and the nature of human consciousness (Parks, 2000), and some have integrated the degree of profundity felt with such a transformative experience (Schlitz, Vieten et al., 2007). All these views of transformation meet at certain theoretical junctures, and are neither mutually exclusive nor representative of all possible types of 'transformation' (Tisdell, 2012).

The specific perspective of ‘transformation’ adopted by this study’s conceptual framework is: a deep and subjective structural shift in foundational premises of thought, feelings, and actions (Mezirow, 1997; Kitchenham, 2008) and the process by which we change our taken-for-granted frames of reference (via challenge, deconstruction, testing, reconstruction, and re-integration) to make them more inclusive and discriminating to guide future interpretation and action (Mezirow, 1991, 2012).

2.3.2 The Essence of Transformative Learning Theory

The essence of Transformative learning theory (TLT) is change that is developmental and growth enhancing, and has three key concepts: 1) experience, 2) critical reflection, and 3) development (Dochy, et al 2011). Mezirow (1995) viewed experience as the subject matter of transformative learning, its content for critical reflection, and implemented changes as developmental. As adults, our need to understand experiences is strong and 'we *have* to understand them in order to know how to act effectively' (Mezirow, 1991, p. 10). Mezirow's emphasis on experience resonates with andragogy and experiential learning as discussed above, which elucidate how adults use their depth and breadth of past experiences as a resource to learn (Knowles, 1985). Sometimes such a reservoir of knowledge does not 'fit' with an experience, and the way to respond is not clear and so a point of disjuncture arises. Mezirow termed this as a disorientating dilemma which can serve as a trigger to ask why and begin critical reflection on that experience (Mezirow, 1991; Jarvis, 1992) and so initiate the transformative learning process.

Critical reflection involves examination of underlying beliefs and assumptions, which leads us to make meaning of an experience, assess the validity of these presuppositions, and examine their origins and consequences (Mezirow, 1991; Dochy, Gijbels et al., 2011). Despite the centrality of critical reflection in TLT, some authors have questioned whether it is a pre-requisite for transformation. For example, McDonald, Cervero et al. (1999) and (Taylor, 1994) found evidence of transformed frames of reference without awareness of change through reflection. As such, critical reflection remains a contested concept within the transformative learning literature (Kreber, 2012). Transformative learning may be focused and mindful through critical reflection, or the result of repetitive affective

interaction or unconscious assimilation such as uncritically adopting cultural or professional norms and ways of thinking (Mezirow, 2000).

Development is a multidimensional and an inherent outcome of Transformative learning theory (Dochy, et al 2011), and the ten phases shown in Table 2.1 (pg. 44) illustrate this transformative development of an adult's ways of knowing towards more inclusive and differentiated frames of reference (Mezirow, 1998). Mezirow (1991) was adamant in his view that adults naturally move towards a developed orientation in order to gain greater insight and better understand life experiences. He further stated that the process of transformative learning is 'the central process of adult development' and 'this is what development means in adulthood' (Mezirow, 1991, p. 155). Mezirow theorised meaning structures as the key 'elements' capable of such developmental transformation in order to arrive at new ways to reinterpret an old experience (or a new one) and so give new meaning (Mezirow, 1991). These structures were differentiated as meaning perspectives and meaning schemes.

2.3.3 Meaning Structures

Interpretation is central to making meaning and entails individuals drawing on past experiences through 'filters' or meaning structures in order to construe meanings to guide feeling, thought, and action (Mezirow, 1991). The primary filter is a meaning perspective through which one projects their symbolic models (or habitual set of expectations) to imaginatively construe what is presented through their senses, or serve as a belief system for interpreting and evaluating an experience:

> A meaning perspective is the structure of psychocultural assumptions within which new experience is assimilated to past experience. It is a way of seeing yourself and your relationships. More than that, it establishes the criteria that determine what you will experience – criteria for identifying what you will find interesting, for deciding which problems are of concern to you, for determining what you are prepared to learn and from whom, for determining values, for setting priorities for action, and for defining the meaning and direction of self-fulfilment and personal success.
> (Mezirow, 1978)

A second meaning structure was later added by Mezirow - a meaning scheme:

> …made-up of specific knowledge, beliefs, value judgements and feelings that constitute interpretations of experience…meaning schemes are the concrete manifestations of our habitual orientations and expectations (meaning perspectives) and translate these general expectations into specific ones that guide our actions (Mezirow, 1991, pages. 5 and 44).

Such differentiation established a hierarchical relationship where meaning perspectives subsume meaning schemes, or 'meaning perspectives generate meaning schemes' (Mezirow, 1991, pg. 62). Meaning perspectives determine the essential conditions for construing meaning, and meaning schemes are the concrete manifestations of these perspectives, and so perception is determined by specific meaning schemes e.g. various faiths or stereotypes (Mezirow, 1991). The perceived content of an experience is therefore determined by the specific meaning schemes shaped by one's meaning perspectives (Mezirow, 1991, 1995).

Mezirow (1991) conceptualised a typology of meaning perspectives which constituted an array of orienting frames of reference used to assess the meaning of an experience. In theorising this typology, Mezirow (1991) was overt in saying he wanted to avoid the

separation of the cognitive and conative dimensions of perception, and so made clearer the ways in which an adult can change the structure of their assumptions and expectations:

- *Epistemic* - 'pertains to the way we know and the uses that we make of knowledge' (pg. 43)
- *Sociolinguist* - 'premises involving specific ideologies, prescribed cultural norms and roles, cultural and language codes…and philosophies that serve to frame experience selectively' (pg. 144)
- *Psychological* - accumulated 'artefacts' of our earlier experiences - and ways we have learned to defend ourselves… (pg. 138)

Collectively, these meaning perspectives provide criteria for assessing right or wrong, good and bad, true and false, and appropriate or inappropriate, and they also define our concept of self and idealised self-image (Mezirow, 1991). Mezirow's demarcation of meaning structures was important to delineate Transformative learning theory's distinct four forms in which adult learning may occur.

2.3.4 Forms of Adult Learning

The first form of adult learning is *learning through meaning schemes* which involves further differentiation and elaboration of taken for granted meaning schemes (Mezirow, 1991), or working with what one already knows by revising present systems of knowledge (Kitchenham, 2008). The second, *learning new meaning schemes*, involves construction of new schemes which are sufficiently consistent and compatible with current meaning perspectives, although this expansion of the perspective does not fundamentally alter meaning, but may give a wider scope (Mezirow, 1991). New meaning schemes can be

assimilated consciously or sub-consciously during socialisation and identification with others (Mezirow, 1991). *Learning through transformation of meaning schemes* is the third form of adult learning, and involves reflection on assumptions when awareness of the inadequacy of such points of view or beliefs compromise interpretation of a new experience (Mezirow, 199; Kitchenham, 2008). This anomaly is not resolved through the first two forms of adult learning (Kitchenham, 2008). Mezirow (1991, p. 94) suggested that this could indicate 'a growing sense of the inadequacy of our old ways of seeing and understanding meaning', which may then lead to the next form of adult learning.

Learning through perspective transformation represents critical reflection and self-critique, to become aware of specific presuppositions upon which current meaning perspectives are based, which are then transformed through a reorganisation of that meaning (Mezirow, 1991). Mezirow regarded this as the deepest form of learning which often begins with an emotionally charged situation when expectations do not 'fit' the experience, and so meaning is not readily construed (Mezirow, 1991). Perspective transformation may be epochal or cumulative, such as a life changing experience or through socialisation (Mezirow, 1991; Kitchenham, 2008).

Mezirow further theorised that these four forms of adult learning occurred within three interacting learning domains: instrumental, communicative, and reflective learning, each with it’s own developmental logic and outcomes (Mezirow, 1991, 2003). These forms of learning were informed by Habermas (1971), Dewey (1933), Knowles (1985), and Schön (1983).

2.3.5 Domains of Adult Learning

This section briefly describes Mezirow's (1991) three interacting domains of adult learning.

2.3.5.1 Instrumental Learning

The control or manipulation of the environment and people via problem solving underlie the learning intention of this domain, and meaning is acquired by hypothetical-deductive logic and testing with an emphasis on improving prediction and performance (Mezirow, 2003; Kitchenham, 2008). Instrumental learning is focussed on assessment of truth claims, that something is as it is purported to be, such as task orientated problem solving to improve performance (Mezirow, 2003, 2012).

2.3.5.2 Communicative Learning

Communicative learning is focussed on understanding what someone means when they communicate with you (Mezirow, 2003) through discourse and general interaction to describe and explain ideas, concepts, and intensions (Habermas, 1971; Mezirow, 1991). The overall aim is discursive clarification of meaning, and the process is fundamentally different to instrumental learning (Mezirow, 1991; Kitchenham, 2008). The process of understanding involves assessing claims to rightness, sincerity, authenticity, and appropriateness via analogic-abductive inference, rather than assessing a truth claim, (Mezirow, 2003) in order to arrive at a tentative best judgement (Mezirow, 2012).

2.3.5.3 Reflective learning

Reflective learning involves assessment or reassessment of assumptions for the confirmation or transformation of ways to interpret an experience, with the type of learning derived directly linked to the level of reflection (Mezirow, 1991), as discussed below. Mezirow's reflective learning was informed by reflective practice (Schön, 1983, 1987) which emphasised support given to learners to plan and act (reflection-in-action), evaluate (reflection-on-action) and to re-conceptualise i.e. to think differently about the situation that has been reflected upon (Bradley & Postlethwaite, 2003).

As reviewed above, Mezirow's conceptualisation of transformative learning can be viewed as a broad description of what is essential for adults to learn in order to change fundamental and well-established premises that shape understanding, and which in turn govern how adults think and behave (Illeris, 2014). The core process which structures such transformative learning is discussed below.

2.3.6 Process of Transformative Learning

Mezirow (1997, pg. 60) fundamentally conceptualised transformative learning as a three part process of: 'critical reflection on one's assumptions, discourse to validate new critically reflective insights, and action'. This denoted integration of transformed meaning structures into one's assumptions and expectations to determine future action. Table 2.1 presents the ten Transformative learning theory phases Mezirow (1991) typified as the process of transformative learning.

Table 2.1

Transformative Learning Theory Phases

1.	A disorientating dilemma
2.	A self-examination with feelings of guilt or shame
3.	A critical assessment of epistemic, socio-cultural, or psychic assumptions
4.	Recognise that one's discontent and the process of transformation are shared and others have negotiated a similar change
5.	Exploration of options for new roles, relationships, and actions
6.	Planning a course of action
7.	Acquisition of knowledge and skills for implementing one's plans
8.	Provisionally trying out new roles
9.	Building competence and self-confidence in new roles and relationships
10.	A reintegration into one's life on the basis of conditions dictated by one's new perspectives

2.3.6.1 Critical reflection

Critical reflection is a central construct of transformative learning, which Mezirow (1991) suggested could occur in response to major challenges to one's meaning structures, such that long-held assumptions are called into question and so threaten deeply held personal values and very sense of self. Disorientating dilemmas are depicted as initiating such discomfort, where an individual feels uncomfortable and unable to interpret meaning through use of existing meaning structures by which to decide action (Mezirow, 1991, 2000). Disorientating dilemmas are deemed to represent the commencement of a possible transformative learning event. Reflection can occur on three levels: *content*, *process*, or *premise* as an adult attempts to interpret and give meaning to a new or past experience (Mezirow, 1991; Kitchenham, 2008). Content reflection involves thinking back over what was done (*learning with present meaning schemes*), process reflection considers the aetiology of actions with possible need for expansion (*learning new meaning schemes*), and premise reflection critically asks why an interpretation was made (*learning through transformation*) (Kitchenham, 2008). Thus premise reflection is akin to critical self-reflection (Kitchenham, 2008; Mezirow, 1995). Mezirow (1991, 1994, 2012) long-argued

the centrality of reflection in his theory of transformative adult learning, which may occur either through group interaction or on an individual level (Mezirow, 2003). This centrality remains firmly based on Mezirow's (1991) assertion of critical reflection as inherently a rational process of thought and action. However, over the past several decades of the evolution of Transformative learning theory, may scholars have challenged Mezirow's emphasis on rationality as separation of the rational and the intuitive, which does not account for emotions or alternative forms of knowing (Johnson-Bailey, 2012).

2.3.6.2 Discourse

Another crucial dimension to Transformative learning theory involves the justification or validation of communicated ideas via dialogue which involves the assessment of beliefs, feelings, and values (Mezirow, 1991, 2003). Discourse is an intrapersonal process and involves topics referred to from the perspective of individual's frames of reference, which have been decisively shaped by cultural and social norms (Mezirow, 1991). Group dialogue provides a unique container in which individuals engage in transformative dialogic moments, facilitated by critical reflection and feedback, in response to moments of dissonance (dilemmas) with an experience (Schapiro, Wasserman et al., 2012) and adapt meaning from another's perspective (Mezirow, 2003). In relation to the developmental outcome of such collective group work, transformation can occur within three domains: 1) personal growth and awareness, 2) relational empathy across differences, and 3) critical systemic consciousness (Schapiro, Wasserman et al., 2012). The first relates to self-discovery in the context of relationship to others, the second relates to empathy and engagement with the identity narratives of others in the group, and the third focusses on understanding and changing shared aspects of group members' contexts through

continuing processes of action, reflection, and dialogue (Schapiro, Wasserman et al., 2012). Group dialogue can play a central role in transformative learning, and forms an important construct in this study's conceptual framework.

2.3.6.3 Action

Transformative learning involves an individual taking action to implement new perspectives gained from critical reflection, which have been internalised and integrated with existing meaning structures (Mezirow, 1991; Dochy, Gijbels et al., 2011). Action in Transformative learning theory means making a decision, and not necessarily an immediate behavioural change (Mezirow, 1994). The decision to act is based on new insight, and the type of action taken 'depends upon the nature of the disorienting dilemma' (Mezirow, 1997, p. 60) e.g. epistemological or physiological. This action concept has received long-critique as being too ego-centric, as opposed to the more socially or collectively orientated transformative-prompted actions (Taylor, 1997). However, Mezirow (2000, 1991) recounted with the opposite point by stating that individual transformation can lead to social action. Therefore, transformative learning can lead to action in both directions (Dochy, et al 2011).

The potential of an individual's transformative learning experiences leading to change in a range of deeply-felt and long-held assumptions, including aspects of themselves, has been reviewed in this section. It is not unreasonable to understand that such changes occur as medical students learn to 'become' doctors, and doctors expand 'being' a doctor and develop their capabilities as they pursue a fully-fledged autonomous independent doctor

role. Stated another way, medical students and doctors all pursue a professional identity in medicine as a competent, functional, and contributory doctor. Transformation associated with development of such a professional identity resonates with the changes both students and doctors are often confronted with as they encounter new and unexpected complex medical situations (Monrouxe, 2010) where meaning structures are threatened, and which resulting dissonance needs to be resolved. This study's conceptual framework exhibits the simulation context as an experiential learning setting for such transformative learning. The next major component of this study's conceptual framework are the constructs of a professional identity in medicine, its formation, and related aspects of identity theory. These are theoretical perspectives only beginning to emerge in the simulation-based medical education literature, and so the place simulation-learning may play in medical students' and doctors' formation of their professional identity is a contemporary knowledge gap requiring further exploration.

2.4 Professional Identity in Medicine

Development of a professional identity in medicine plays a crucial role in transition from being a medical student to becoming a doctor (Wong & Trollope-Kumar, 2014) and remains equally important once in the clinical setting. Becoming a doctor is to take on an identity associated with multiple roles, and a time arrives when certain clinical procedures once carried out under supervision are now unsupervised: at this point an identity is assumed (Bleakley, Bligh et al., 2011). A professional identity is vital for a sense of 'feeling' like a doctor, and this 'becoming' is increasingly being recognised as an important goal of medical education. When a medical student states 'I want to be a doctor'

or a doctor says ‘I want to specialise as a paediatrician’ this is a reference to a professional identity (Bleakley, Bligh et al., 2011). Such identities are closely associated with roles which have been clearly defined, socially engineered and legitimated activities, where the journey towards a desired identity involves a self-altering processes of construction and reconstruction (Bleakley, Bligh et al., 2011). A common theme throughout the diverse literature of professional identity is that it is accumulated and constructed through experience, its diverse elements, and the potential various educational components.

The construct of professional identity within medicine has been extensively researched within medical education literature, where focus has been on professionalism as a fundamental curriculum component (Cohen, Kay et al., 2009; Monrouxe, 2010; Cruess, Cruess et al., 2014). This had the objective of ensuring students understood the nature of professionalism, its obligations and the need to internalise the medical profession’s value system (Stern & Papadakis, 2009; Cruess, Cruess et al., 2014). Therefore, the unstated aim was the development of doctors who possessed a professional identity, and so professionalism represented a means to that end (Cruess et al., 2014). The medical education literature over the last five years has been re-examining educational strategies which support professional identify formation. (Cohen, Kay et al., 2009; Monrouxe, 2010; Wilson, Cowin et al., 2013). Professional identity formation necessitates students’ socialisation into the culture of the medical profession as they transition from being a student to becoming a doctor (Draper & Louw, 2007; Burford, 2012) and so eventually define themselves within the medical profession.

Whilst professionalism and professional identity are interrelated and often used interchangeably, they are not synonymous (Wilson, Cowin et al., 2013; Cruess, Cruess et al., 2014). The former relates to the demonstration of expected doctor aspects - a set of values, behaviours and relationships, i.e. 'doing' (Lesser, Lucey et al., 2010; Cruess, Cruess et al., 2014). A recent definition of professional identity (or 'being') has been posited by (Cruess, Cruess et al., 2014, p. 2):

> A physician's identity is a representation of self, achieved in stages over time during which the characteristics, values, and norms of the medical profession are internalised, resulting in an individual thinking, acting, and feeling like a physician.

Several authors have suggested formation of such a professional identity should be the backbone or principal goal of contemporary medical training (Cooke, Irby et al., 2010; Cruess, Cruess et al., 2014), and Frost and Regehr (2013) adopt a powerful metaphor to suggest medical educators are gateways to the medical profession to educate the 'right' kind of doctors.

To practice medicine, students and doctors need to form a professional identity i.e. ways of being and relating in professional contexts and to classify their place as both an individual and a member of a collective, or the medical profession (Goldie, 2012). Such a view of professional identity has prompted studies to begin to explore the factors and processes of such identity formation i.e. 'becoming' and maintaining 'being' a doctor. Hence the conceptual framework of this study adopts the term 'becoming' to depict medical students' temporal transition towards the doctor-role, and 'being' to illustrate clinical doctors'

refinement and maintenance of 'being' a doctor as they pursue career aspirations. Thus both students and doctors collectively pursue a professional identity within medicine.

2.4.1 Identity & Professional Identity Formation

Identity, as defined by Erikson (1968) is a psychosocial concept which includes the experience of being the same in different situations and contexts, and also the sense that others experience this sameness. Bauman (2004), from a sociology perspective, proposes identity has two broad components: aspects of identity shared by a community brought together by 'life and fate' (pg. 11) without the element of choice, and aspects of identity held together by a community such as values, ideas, and general principles. Identity matters, because it influences who we are and who we are seen to be (Monrouxe, 2010), and so identity comprises how one experiences one's self, one's qualities and properties, and how one is experienced by others (Illeris, 2014). Identity is important, as people are understood by others in certain ways, and people can act toward one another depending on such understandings (McCarthey & Birr Moje, 2002). An individual's identity is reflected on many interconnected levels: organisational, professional, social, and self (Sveningsson & Alvesson, 2003). It is widely accepted that an identity is about 'being' a person in the world (Illeris, 2014), and encapsulates how an individual defines oneself to oneself and recognised by and relates to others in a given context (Gee, 2000; Lasky, 2005). Identity is also understood as the self as it is reflexively understood by an individual (Giddens, 1991), and the self is reflexive in that it can take itself as an object in order to classify or name itself in particular ways, as shaped by cultural symbols that are used to designate these classifications (Stets & Burke, 2000).

Identity is not a fixed or static concept, rather it is flexible, multidimensional and able to evolve as an individual encounters situations throughout life (Sveningsson & Alvesson, 2003; Costello, 2005; Monrouxe, 2010). Identity evolution is therefore something that is constituted by the self and socially mediated (Billett & Somerville, 2004).

As commented by Costello (2005), an individual's identity is much like an iceberg, as the majority of it lies invisible and beneath the surface of consciousness, and only a small part of the identity is perceptible to the conscious mind. The term habitus was imported into the sociological research domain to describe this nonconscious identity concept as systems of durable and transposable dispositions predisposed to function as structuring principles which generate and organize practices without a conscious aiming towards an end (Bourdieu, 1977, 1990). Habitus can therefore be viewed as a mixture of the embodied, the instinctual and the unthought (Reay, 2004), and Bourdieu (1990) located these notions in an individual's past and present everyday relationships which they carried their habitus into different fields of relations (McCarthey & Birr Moje, 2002).

Costello (2005) provides a clear descriptions of these elements of habitus: the first element is made up of an individual's unconscious assumptions about the way the world works, with behaviour shaped by such nonconscious assessment. The second element of habitus is taste, which can constitute a large component of identity which is predominantly the determined cultural constructs of an identity (Costello, 2005). The other elements of unconscious identity or habitus are embodied identity and emotional identity or emotional orientations (Costello, 2005). We are generally unaware of these elements which largely resist conscious manipulation which can create a problem for people working to alter their

identities, for example students at professional schools (Costello, 2005). Bourdieu (1990, p. 86) sees these elements 'refer to something historical and linked to individual history' and so habitus can be viewed as a complex internalised core from which everyday experiences emanate (Reay, 2004).

The view of professional identity adopted by this study's conceptual framework also draws on social identity theory, which deals with intergroup relations and an individual coming to see him or herself as a member of a group. Possessing a certain social identity means being at one with that group and being like the others in that same group (Stets & Burke, 2000). The formation of a professional identity is central to 'becoming' and 'being' a successful doctor (Monrouxe, 2009) and so sense a belonging to the group represented as the medical community. Social theories view identity formation as a product of participation and activity, which is dependent upon the quality and quantity of relational associations within the system of activity (Bleakley, Bligh et al., 2011).

Professional identity formation begins when newcomers join a collective with the view to attain full membership (Jarvis-Selinger, et al., 2012), and it is created, developed, and changed through learning which must be open to further development (Illeris, 2014). Throughout their education, medical students develop skills, abilities, and knowledge, together with the behaviour and general demeanour society expects of a doctor, and do so through encounters with medical teachers, patients and other health professionals who collectively influence students' professional identity formation (Weaver, Peters et al., 2011; Goldie, 2012; Cruess, Cruess et al., 2014). Professional identity development is therefore an adaptive, complex and socially constructed trajectory with constant interaction

with others in the professional context involving developmental tasks or stages (Gaensbauer & Mizner, 1980; Draper & Louw, 2007; Monrouxe, 2010).

In the context of medicine, identity formation is an iterative, adaptive, and dynamic process (Cruess et al., 2014; Goldie, 2012; Monrouxe, 2010) which relates to how individuals conceive themselves as a doctor (Frost & Regehr, 2013). The way these formation processes are experienced has implications for future well-being and clinical integration (Monrouxe, 2009). The medical education literature shows that identity formation is influenced by various theoretical perspectives, but references to cognitive, conative (agency), sociological and psychological models remain dominant to depict the ways individuals make sense of and become internally comfortable with the privileged role of 'being' a doctor (Rhodes & Smith, 2006; Monrouxe, 2010; Wilson, Cowin et al., 2013).

Formation of a professional identity as a doctor is further hypothesised as a developmental process which occurs simultaneously on two levels: 1) *the individual* - which involves the psychological development of the person and, 2) *the collective* - which involves socialisation into appropriate roles and forms of participation in the community's work (Jarvis-Selinger, et al., 2012). This is consistent with understandings of the personal and social dimensions of identity which are espoused in the broader literature, for example (Jenkins, 1996).

At the individual level, professional identity formation is a complex and often confronting process where newly encountered realities do not 'fit' with personal aspects, and so trigger dissonance or crises (Erikson, 1980; Costello, 2005) which prompt self-reflection on habits

of thinking, feelings, and ways of behaving (Wear & Castellani, 2000; Rabow, Remen et al., 2010). The parallels with Mezirow (1991) and his conceptualisation of disorientating dilemmas within Transformative learning theory are evident in this respect. For medical students, professional identity construction involves integration of personal identity aspects with elements of the doctor's role as they expand understanding of what being a doctor entails, and the way they see themselves within this role and so begin to make it their own (Cohen et al., 2009). It is making a future role as a doctor their own that constitutes individual professional identity formation (Cohen et al., 2009; Wilson et al., 2013).

Identity theorists Kegan (1982) and Erikson (1980) have suggested this involves a movement through a series of conceptually distinct developmental stages, which are delineated by qualitatively different ways to understand one's environment and one's place within that setting. Applied to medical students and doctors, each year level and professional level thinks differently about the medical role and their place within the wider profession, and Jarvis-Selinger, Pratt et al. (2012) postulate that these levels require its own internal identity formation process i.e. to internalise that level and begin to 'feel like' that level - e.g. a 2nd year medical student compared to a junior doctor. Thus, the developmental nature of a professional identity can be further suggested as stages precipitated by challenges which must be negotiated as part of the developmental process. Such challenges are often triggered by a broad range of medical encounters (Jarvis-Selinger et al., 2012). Therefore, there are opportunities for medical education to examine these moments of challenge, not from a competency perspective, but rather how crisis events influence both students' and doctors' understanding of what it means to 'become' and 'be' a doctor (Jarvis-Selinger et al., 2012). These crisis events resonate with

Mezirow's (1991) notion of disorientating dilemmas and the process of Transformative learning theory, as meanings are unpacked for further understanding to guide future behaviour.

At the collective level, social interaction is shown as a fundamental component of professional identity formation (Vygotsky, 1978; Jenkins, 2008; Monrouxe, 2010; Goldie, 2012) and shaped by cultural and discursive elements (Hall, 1977; Gee, 2000; Sveningsson & Alvesson, 2003). With a collective professional identity, people behave in concert within the group with which they identify, and find uniformity of perception and action among the group's individuals as they take on a group-based identity (Stets & Burke, 2000). The connection to medicine is not surprising, as the Hippocratic tradition reinforces the importance of group identity, group loyalty and affiliation with the medical profession as a 'second family' (Cohen et al., 2009).

These social and relational concepts have been researched extensively within the broader sociological and psychological literature and demonstrate the significant influence of context and socialising agents have on professional identity formation (Gee, 2000; Feldman, 2003; Jenkins, 2008). Within medical education, doctors and educators are essential socialising agents for students and junior doctors to observe and listen to how the medical role is enacted. Peers are also important socialising agents, and peer groups are contexts in which students and young professionals may regulate identity formation. In addition, individuals and groups outside of the medical profession such as other healthcare professionals and patients can also function as indirect agents, helping students and junior doctors shape their professional identities (Jarvis-Selinger et al., 2012). The idea that

observed interactions can form external messages and become internalised scripts for professional identity formation (Jarvis-Selinger et al., 2012) resonates with the experiential learning nature of simulation-based medical education through the use of various modalities.

Discourse and action also play important roles in professional identity formation, and occur at the conscious level of awareness and subconscious level of regulative and normative ways of being (Jarvis-Selinger, Pratt et al., 2012), also known as hidden curriculum (Hall, 1977; Goldie, 2012). Through these external forces, professional identities in medicine are shaped in accordance to cultural expectations and are enacted in relation to who else is present in the room (Lingard, Garwood et al., 2003). During medical education these enacted professional identities and roles vary from year-to-year, and continue to change with transition towards the junior doctor role and beyond, where these forces continue to be imposed (Jarvis-Selinger et al., 2012). Roles are the external characterisations of behaviours or the visible actions others see, whereas identity is the internal consolidation of experience as individuals try to answer 'Who am I at this moment?' (Beijaard, Meijer et al., 2004).

Thus, collective or social construction of a professional identity is dynamic, i.e. it is open to refinement and remodelling as new knowledge and encounters are experienced (Ibarra, 1991). This interactional nature formed in the context of interactions with others is a powerful force (Payne, 2006; Cohen, Kay et al., 2009; Monrouxe, 2010), and as students transition from one year to the next, they consolidate their professional identity by accumulating even more skills, cultural norms and values of medicine (Mann, 2011). Some

medical education authors suggest such consolidation as a process where students move from 'the edge towards the centre' of a professional community by offering more 'contributions' via a heightened sense of professional identity (Swanwick, 2005; Mann, 2011; Frost & Regehr, 2013).

In summary, professional identity formation is a two-way process comprising cognitive and social processes through which we make meaning of and organise our world, thereby creating a complex multidimensional classification of our place in that world as an individual and as a member of a collective (Hall, 1977; Monrouxe, 2010; Jarvis-Selinger et al., 2012). Several contemporary medical education authors describe these cognitive and social meaning making processes as transformative in nature (Monrouxe, 2010; Jarvis-Selinger et al., 2012; Cruess et al., 2014), although they do not use 'transformation' with reference to Mezirow's Transformative learning theory. Nevertheless, it seems there is a link between professional identity formation and meaning perspective transformation. Mezirow's (1991) Transformative learning theory is used by this thesis to explore the nature and process of professional identity formation, as prompted and facilitated by SBME, and introduces a new conceptualisation of identity 'transformation' to the medical and simulation literature. This conceptual framework adopts transformation as a verb, rather than an adjective to describe development of a professional identity as a doctor.

The following components of this thesis' conceptual framework have been reviewed and discussed above: Simulation-based medical education, Mezirow's Transformative learning theory, professional identity and its formation within medicine, and aspects of identity theory. Gaps in knowledge and theoretical understanding have been identified.

The final component of this thesis' conceptual framework outlines my simulation-based education experiences as reflexively understood, which Maxwell (2005) argues as an important aspect of a study's explorative conceptual perspective.

2.5 My Simulation-Based Education Experience

This section affirms the changed views about how important a researcher's own experiences are to a study, which need to be articulated and viewed as a potential valuable and reflexive component (Maxwell, 2005). Strauss (1987) and Charmaz (2008) regard such experiential knowledge as 'experiential data' which can be reflexively mined. This section outlines my simulation-based education background as reflexively understood to be a component which informs this study's conceptual framework.

I was involved in healthcare simulation education for five years before undertaking this study. In this context, I was repeatedly prompted to reflect upon why students appeared to have such diverse experiences of learning and meaning-making whilst collectively engaged in similar simulation activities. For example, some learners commonly experienced heightened anxiety despite assurance from simulation educators that they adopted a non-judgemental position. In direct contrast, some learners did not display such discomfort and appeared to 'merge' with the roles scripted for the simulation activities with greater ease. Also, it was clear that as learners progressed through their courses, their demeanour and interaction during simulation sessions changed, and they began to adopt more of the professional characteristics observed in clinical health settings. I began to think simulation-based education represented much more than discrete skills acquisition

and appeared to have other outcomes of a temporal nature without an objective or pre-determined end-point i.e. progressive or ongoing changes.

I also began to reflect on how learners interpreted and experienced simulation-learning differently as shaped by individual goals, motivations, and understandings. I repeatedly wondered what meaning learners applied to their simulation-learning experiences, what they left with, and how they integrated outcomes or new insights into how they saw themselves in future and current clinical roles. So my evolving epistemological (*how*) and philosophical (*why*) reflections about learners' experiences also shaped the position and approach I took within this thesis. These also shaped the choice of Transformative learning theory as the primary theoretical component of this study's conceptual framework. The major reason was repeatedly witnessing significant changes in students' ideas, assumptions and the resultant changes in their behaviour and actions, which were often planned for enactment or transfer to the clinical setting.

In my five years of experience teaching and designing simulation-based education, I realised that learners participated in simulation activities with the initial intention of "polishing their skills" and over time, as simulation scenarios became more challenging, it assisted them to shape their professional identity. Witnessing the transformation of students to clinicians inspired me to seek a deeper understanding of *how* and *why* this might occur and formed the foundation of this thesis. This lead to Mezirow (1991) and his transformative view of adult learning discussed above forming a substantive component of this thesis' conceptual framework.

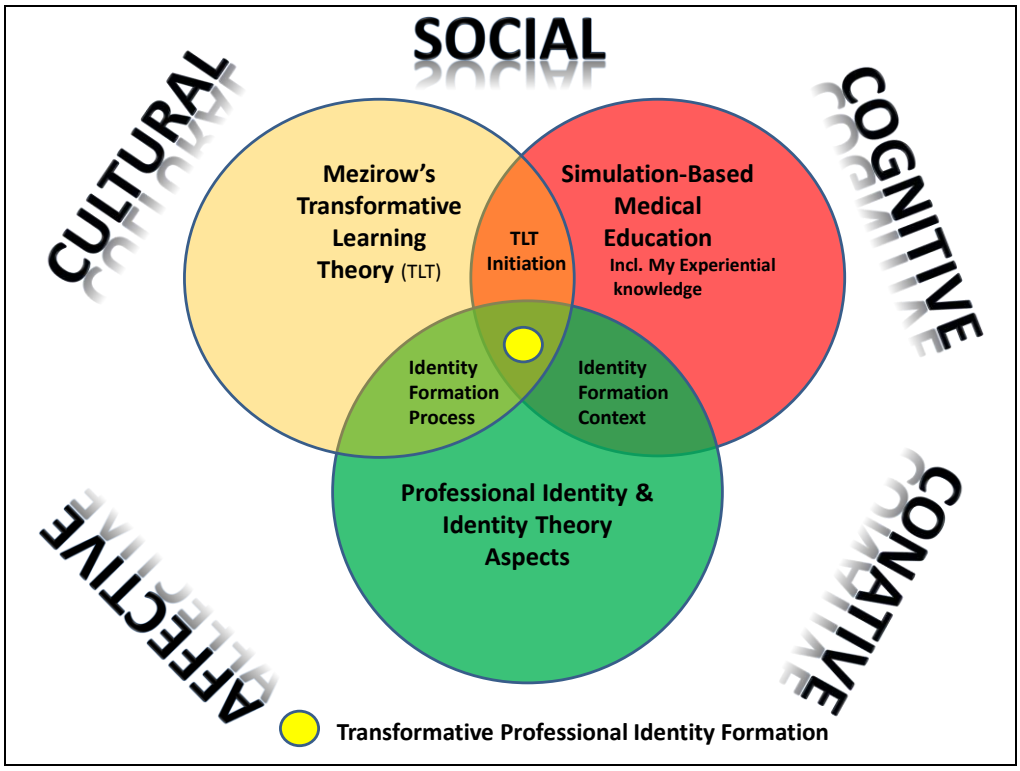
Section 2.6 integrates the above discussed and reviewed elements of this thesis' conceptual framework. This forms the tentative model which is tested to address the identified knowledge gaps to open-up new understandings of the professional identity aspects of learners' transformative experiences of SBME.

2.6 Conceptual Framework

As pointed out in this chapter's introduction, a conceptual framework is primarily a model of the phenomena under study i.e. what is happening *'out there'* and *'why'* (Maxwell, 2005) through an abstract network of interlinked concepts (Jabareen, 2009; Taylor & Snyder, 2012) which together form a tentative model under investigation. Figure 2.1 presents the conceptual framework for this thesis and shows how its components reviewed and discussed throughout this chapter are integrated. The five words surrounding this framework emerged throughout development of this framework as important overarching themes associated with each component: *social* depicts the relational and dynamic collective practices where interaction follows certain rules which are based on shared assumptions, values, and functions (Dieckmann, Manser et al., 2007), *cognitive* relates to the processes of knowing, *conative* is behaviour directed toward action or change, *affective* depicts evoked feelings or emotions, and *cultural* represents the complexities and influence of medical norms or hidden curriculum. When read as whole, these five constructs show that an individual's professional identity formation, as facilitated by the SBME setting, passes beyond discrete skill acquisition and is informed by external social cultural elements, together with incentive or agentic motivation to negotiate an often challenging learning trajectory. As such, it is suggested that changes in these constructs are

in some way important to the individual's mental whole, and therefore only changes that have such importance can be understood and accepted as transformations (Illeris, 2014).

Figure 2.1 Conceptual Framework



This conceptual framework poses the tentative model that:

> 'Transformative learning occurs in the simulation-based medical education context, as it can trigger and support development of a professional identity as a doctor'.

A new perspective of professional identity development as an outcome of SBME is thus introduced by this tentative model. Also, the potential for new implications for SBME

curriculum design and practice, which may offer new ways to enhance learning opportunities and outcomes, is also raised. The yellow centre of the conceptual framework presented in Figure 2.1 depicts transformative professional identity development as prompted and supported by simulation-based medical education experiences.

This chapter's review of the literature and formation of this thesis' conceptual framework has given substance and form to my reflexively understood intuition that simulation-learning can extend beyond discrete skills acquisition. The pragmatic theoretical integration of the various components of this conceptual framework forms a new exploratory perspective and provides an informative way to see *how* and *why* formation of a professional identity as a doctor can be facilitated by simulation-learning experiences. This responds to contemporary calls to use multiple theoretical perspectives to examine aspiring doctors' understanding of what it means to 'become' a doctor (Jarvis-Selinger, Pratt et al., 2012), and to use new theoretical perspectives from which to view SBME (Nestel & Bearman, 2015b).

The next chapter presents the research approach adopted by this study.

3 Research Approach

A good design is one in which the components work harmoniously together, promotes efficient successful functioning and involves interconnection and interaction among the design components *(Willis, 2005)*

3.1 Introduction

This thesis' exploratory perspective of the role simulation-based medical education (SBME) may play to support transformative development of a professional identity in medicine was constructed in the previous chapter. The pragmatic research approach used to pursue this avenue of research is discussed in this chapter. Section 3.2 presents the study aims, research questions and objectives. Section 3.3 discusses this study's mixed methods research approach and constructivist grounded theory methodology. Sections 3.4 to 3.7 detail this study's cross-sectional research design, its research context, and study methods. Merging and integration of findings from the quantitative and qualitative study stages is described in section 3.8. The study-strength determinants or quality principles are discussed in section 3.9, and ethical considerations are presented in section 3.10.

3.2 Research Aims

This study had two aims: the primary aim was to explore Transformative learning theory (TLT), as conceptualised by Mezirow (1991) within the simulation-based medical

education context. The secondary aim was to formulate a theoretical model of participants' professional identity formation, as facilitated by their transformative simulation-learning experiences. These two aims were constructed to show the synergy of this study's quantitative and qualitative stages. The research questions were:

1. Which aspects of TLT are experienced through SBME?
2. What are the identity related dimensions of learners' transformative simulation-learning experiences?

The research objectives were:

1. To construct a Transformative learning framework evidenced by participants' SBME experiences,
2. To understand the nature of participants' transformative learning as triggered and supported by their SBME experiences,
3. To understand how SBME supports professional identity development,
4. To build upon SBME knowledge and theoretical premises, and identify future research avenues, and
5. To contribute to SBME practice.

The overall goal throughout this chapter is to present the thought put into the construction of this thesis' pragmatic and systematic research approach to effectively address its research aims, questions, and objectives to facilitate productive and informative testing of its formulated tentative model presented in chapter 2.

3.3 Research Methodology

Exploration of participants' simulation-learning experiences firmly situated this study in the interpretive and explorative qualitative paradigm. However, to determine which aspects of TLT informed these experiences, a quantitative dimension was introduced. A mixed methods approach was chosen as appropriate, as both the quantitative and qualitative components of this study shared the same phenomenon of inquiry (Leech & Onwuegbuzie, 2009). Also, mixed methods research requires a deliberate and careful strategy to address complex research questions by targeting specific components with particular methods that are best suited to these components. As such, the quantitative stage of this thesis was envisaged to distil issues, or areas of focus, for further exploration and understanding in the qualitative study stage. The first research question and research objectives one and two were quantitatively examined, and the second research question and further examination of research objective two together with the remaining objectives were pursued through qualitative inquiry. This approach enabled both research paradigms to be deliberately addressed and examined, and to then be used in a complementary way.

Mixed methods research incorporates the goals of generalisability of findings and in-depth understanding of the targeted phenomenon (Kemper, Stringfield et al., 2003; Onwuegbuzie & Leech, 2007) and provides a means of combining data gathering methods and analytical strategies from contrasting perspectives to construct knowledge. This integration of contrasting paradigms has long been debated to possess an inherent philosophical incompatibility between the quantitative and qualitative paradigms. However, contemporary literature now discounts such debate and moves towards a more flexible and integrative merging of these philosophical perspectives (Johnson & Onwuegbuzie, 2004;

Mertens, 2010a; Sharp, Mobley et al., 2012). This paradigmatic-merging suited the two research questions and testing of this study's tentative model, and so the quantitative stage of this study was envisaged to distil issues for further exploration and understanding in the subsequent qualitative stage. As such, the quantitative stage was focussed on the 'how many or how much' questions, which were complemented by qualitative exploration of how and why these results related to the processes investigated (Blessing & Forister, 2013). The mixed methods research approach adopted also responded to contemporary calls for more mixed approaches to Transformative learning theory research (Merriam & Kim, 2012), and the increasing presence of mixed methods research in the simulation-education literature.

3.3.1 Philosophical Stance of Mixed Methods Research

Mixed methods research is known as the third major research paradigm which often challenges assumptions about the world and nature of knowledge. It combines elements from both the qualitative and quantitative paradigms to produce converging findings in the context of complex research questions (Lingard, Albert et al., 2008), and study methods are integrated from a question-driven philosophy (Heyvaert, Maes et al., 2013b). This particularly suited this study's aims and tentative model, as both Mezirow's Transformative learning theory and professional identity formation are complex phenomena. Mixed methods research is an intellectual and practical synthesis of contrasting paradigms and respects both viewpoints in order to find or construct a workable 'middle solution' (Johnson, Onwuegbuzie et al., 2007). This suited another intention of this study to pragmatically derive useful knowledge from both the quantitative and qualitative research perspectives. Put another way, qualitative findings of this study

were used to inform and further explain and extend understanding of the initially obtained quantitative results (Blessing & Forister, 2013).

Pragmatism is the primary philosophical stance of mixed-methods research in order to productively consider multiple viewpoints, perspectives, and standpoints for knowledge construction (Johnson, Onwuegbuzie et al., 2007; Sharp, Mobley et al., 2012; Heyvaert, Hannes et al., 2013a). Pragmatism is also viewed as a bridge to connect conflicting paradigms (Johnson, Onwuegbuzie et al., 2007; De Lisle, 2011). As this study adopted a conceptual framework not previously applied to SBME research, the pragmatic underpinnings of mixed-methods research provided a philosophical stance to facilitate a flexible research design and practical implementation throughout the research process.

The pragmatic tenets of mixed-methods research allow a flexible and reflective research approach where knowledge can be viewed around the relationship between action and consequences, not just about the world "out there" (Creswell & Plano Clark, 2007; Biesta, 2010). This relationship is also a central tenet of Transformative learning theory (Mezirow, 1991). These flexible and reflective elements also interfaced well with this study's simulation-learning context, as reflection, action, and consequences form important processes throughout SBME sessions. Simulation scenarios are action-based with immediate consequences demonstrated, and post-simulation debriefing sessions encompass reflection to review the medical actions and clinical reasoning implemented. The pragmatic assumptions of mixed-methods research therefore provided the utility and philosophical flexibility to pursue this study aims, objectives, and to test its tentative model.

Another important tenet of mixed-methods research is triangulation, which had its origins in attempts to validate research findings through generation and comparison of different sorts of data from the same phenomenon under investigation (Torrance, 2012). In fact, suggestions have been made that the core justificatory principle underpinning mixed methods research is triangulation, as no single study method is likely to provide a comprehensive account of phenomena under inquiry, and so different perspectives can give a fuller and more informative picture of what is going on (Torrance, 2012). This can result in the increase of interpretive density (Johnson, Onwuegbuzie et al., 2007; Teddlie & Tashakkori, 2009) or convergent validation for enhanced richness (Fielding, 2012). As such, triangulation involves a multiple-strategy approach that combines different methods to progressively uncover additional 'pieces of the puzzle' or varied dimensions of the phenomena being examined (Blessing & Forister, 2013).

Triangulation therefore formed an important element of this study's mixed-methods research approach, as use of its four data gathering methods: a Simulation Survey, individual interviews, observation, and electronic interviews produced a large amount of data which necessitated a mechanism for corroboration and convergence of findings. This study's combination of statistical analysis of the quantitative survey data and a constructivist grounded theory approach to qualitative analysis further facilitated triangulation, which proved particularly valuable to both identify and confirm areas of finding diversity (Mertens & Hesse-Biber, 2012) between the six cohort groups of this study. Triangulation therefore promoted a fuller understanding of another aspect of the role SBME could play in participants' learning experiences.

Another form of triangulation not discussed extensively in the literature is that of participant validation, where participants of a study respond to forms of initial data, for example, interview transcripts to check for accuracy or first drafts of interpretive claims (Torrance, 2012). Each participant in this study received a copy of their transcript for review, and validation of emerging themes was also achieved through electronic interviews (theoretical sampling) in the latter stage of data analysis as part of the grounded theory methods used.

Mixed-methods approaches are generally used to examine 'what is happening' and 'how or why it is happening' in order to reach deeper understanding and make new connections (Ortiz, Sosulski et al., 2012). This thesis' tentative model mirrored this 'how' and 'why' focus, and so the choice of mixed-methods research provided a robust approach by which to pursue this study's new exploratory perspective. This study was also inherently naturalistic, and its mixed-methods research approach was helpful to understand the purpose and processes of this human inquiry (Schwandt, 2006).

3.3.2 Constructivist Grounded Theory

Grounded theory methodology formed the overarching framework for this study, as it is acknowledged as an approach to research phenomena about which little is known (Glaser & Strauss, 1967), which suited this thesis' tentative model. Charmaz (2006) and her constructivist grounded theory approach was seen as a better epistemological 'fit' with this thesis' aims and orienting perspective and so chosen as a systematic and inductive

approach for collection and analysis of data in order to construct a middle-range theoretical model, or account of participants' simulation-learning experiences. The analytical methods (or coding stages) used are discussed below in section 3.7.2.

The constructivist grounded theory methods used in this study focussed on immersion or grounding into the data provided by participants (Charmaz, 2006, 2008). Constructivist grounded theory offers the capacity to interpret complex phenomena (Charmaz, 2003, 2008), provides suitability for understanding socially constructed experiences (Charmaz, 2008), and places emphasis upon emergence (Charmaz, 2006, 2008). These suited the nature of this study's overall aim of theory development, together with the research context described below. It was this study's emphasis on theory development which echoed grounded theory's major difference between other approaches to research (Charmaz, 2006; Corbin & Strauss, 2008).

The choice to use constructivist grounded theory was based upon its underlying premise to further refine and challenge extant theories and concepts, or 'sensitising concepts' which provide a perspective to view, organise, and understand experiences (Charmaz, 2006, 2008). Sensitising or orienting concepts 'are embedded in our disciplinary emphases and perspective proclivities.....and we may use sensitising concepts *only* as points of departure from which to study the data' (Charmaz, 2006, pg. 515). After all, generation of a new theory or a different understanding of established concepts is the goal of qualitative research (Blessing & Forister, 2013). Charmaz (2008) actively embraces extant theory as tools by which to facilitate the conceptual direction of a study.

The previous chapter presented this study's conceptual framework, which detailed the orienting concepts of simulation-based medical education and its extant research, professional identity and related aspects of identity theory, Mezirow's (1991) Transformative learning theory, and my simulation-based education experiential knowledge. These were integrated and conceptually linked to form a tentative model to be further explored throughout this study, and so drew heavily on the pragmatic notion of emergence for systematic expansion of current knowledge (Charmaz, 2006, 2008). The constructivist grounded theory approach therefore allowed elaboration or refinement of these orienting concepts, or points of departure, (Charmaz, 2006) to specify more carefully the conceptually dense circumstances in which they may offer potential for further explanation (Vaughan, 1992) or a context of new discovery (Miller & Fredericks, 1999).

The constructivist grounded theory approach of this study also firmly aligned with the main epistemological and philosophical premises which underlie mixed-methods research, and the use of a combination of quantitative and qualitative techniques.

3.4 Research Design

A cross-sectional analytic study design (Schneider, Whitehead et al., 2007) shaped this thesis to test the tentative model developed in the previous chapter. Cross-sectional studies are usually carried out at one-point in time, or over a short period, to estimate the prevalence of the studied outcome of interest for a given population (Levin, 2006). Researchers aim to obtain a representative sample by taking a cross-section of the population under examination (Sedgwick, 2014). The medical students and doctors

partaking in this thesis represented discrete subsets or cohorts of the population who undertook simulation-based medical education as a component of their medical training or continuing professional development through Flinders University. These cohorts reflected that each shared certain characteristics, such as medically-focussed training and the goal of becoming a competent doctor, yet differed in the stage of such learning each occupied, and so represented a continuum which allowed differences to be examined (Sedgwick, 2014).Therefore, each cohort depicted a 'snap-shot' of this thesis' participants at one-point in time (Blessing & Forister, 2013) along their journeys from beginning medical training to practicing and refining being a clinical doctor. This cross-sectional design suited the aim of this thesis to explore transformative development of a professional identity as doctor, as facilitated by participation in SBME from the level of first year medical students to clinical doctors.

Cross-sectional analytic studies can employ inferential statistics to infer causal relationships between the variables or factors of interest (Schneider, Whitehead et al., 2007), and so tell us whether an alternative hypothesis is likely to be true which can then assist with the rejection or confirmation of study predictions (Field, 2009). Cross-sectional analytic designs often use a survey to investigate associations between such factors (Levin, 2006), and Chapter 4 presents the statistical models used to examine this study's Simulation Survey data and the resulting inferences made to explain these findings.

Advantages of using a cross-section design in this thesis included the minimisation of loss of follow-up (Levin, 2006; Sedgwick, 2014) as the data gathering period was relatively short. A cross-sectional design was also considered appropriate as it did not look for

absolute causation, rather associations and inferences between the examined factors and examined outcomes (Levin, 2006; Sedgwick, 2014). This was considered important, as formation of a professional identity as a doctor is a very complex process influenced by a matrix of elements which can make-up a unique experience of an individual. So SBME was viewed as one of these contributing elements which could play a role with such professional identity formation. Cohort-specific findings therefore reflected what was 'going-on' with each at a point in time of professional identity development. A cross-sectional design was therefore used to capture a point-in-time of each of the six participant groupings in an effort to gain a progressive or temporal feel of their experiences and development of a professional identity as a doctor, as prompted by SBME.

3.4.1 Research Context

This section sets-out the research context, and discusses this study's simulation settings, the types of research participants or cohorts, and the nature of SBME activities situated within each of these cohorts.

3.4.1.1 Study Simulation Settings

This study had four simulation settings, with the primary setting being the Flinders University Clinical Skills Simulation Unit (CSSU) located in the Flinders Medical Centre (FMC), Adelaide Australia. The other settings included Flinders University campuses located in Darwin in the Northern Territory, and Renmark and Mt Gambier in South Australia and their respective simulation-education facilities. The decision to include these four study settings was made to access a larger population of simulation participants, and

so extend the depth and range of potential study findings which may have been limited by a single setting. Also, it was anticipated that any unique elements of each of the four setting could be captured to also broaden potential findings.

All sites typified the general layout and functionality of SBME facilities, inclusive of teaching modalities along the low to high-fidelity spectrum, (e.g. patient mannequins such as SimMan™ by Laerdal), other general medical instruments used in clinical skills or task training, and dedicated rooms for simulated patient (SP) interviews and post-simulation debriefing sessions. All settings included simulation educators, clinical specialists (e.g. intensivists or clinical consultants), and registered nurses. The general technological set-up included medical read-out screens, responsive patient mannequins, audio-visual abilities for scenario review, and separate rooms from which educators controlled the simulation setting and medical situation at hand (e.g. patient response to enacted medical interventions). All simulation facilities shared the Flinders University simulation curriculum for medical students and had similar continual professional educational programs for clinical doctors.

3.4.1.2 Study Participants

The overall aim when selecting participants was to form cohorts of medical students and clinical doctors to capture the diversity their simulation-learning experiences. Cohorts representing each of the four years of the Flinders University Medical Doctorate (MD) programme were designed, and for doctors, a cohort for interns (junior doctors) and post-graduate year (PGY) 1 & 2 doctors were created. PGY 1 & 2 doctors were chosen as these

were the predominant level of doctors to partake in simulation-education across the four study settings. These student and doctor participants formed this study's six discrete cohorts which all participated in SBME as either a mandatory component of their medical education curricula or continuing professional development programs. This design represented an *a priori* ordering of study participants medical knowledge and experience, which facilitated this study's cross-sectional look at their simulation-learning experiences i.e. from 1st year medical students to clinical doctors.

Study participants were spread across several locations: medical students were located at Flinders University campuses in Adelaide, Darwin, Renmark and Mt Gambier. Interns were placed at the FMC, and Mt Gambier Hospital, and PGY doctors were working at the FMC and Repatriation General Hospital, Adelaide in a diverse range of medical and surgical specialities. All medical students were graduate-entry level entrants with a range of previous tertiary study, as presented in Table 4.2 of the next chapter. Thus, they came from an eclectic range of backgrounds when they commenced medical education, which in some instances represented a complete change in life-direction. Doctor participants included those who had completed their medical education at Flinders University, and others who had completed their education as an undergraduate student elsewhere.

3.4.1.3 Simulation Activities

1st year medical students usually began their SBME with basic life support (BLS) sessions and simulated patient (SP) interviews, which were held several times each week. BLS sessions commenced with instruction on low-fidelity models, and would progress to a more contextually situated scenario where actors played predetermined roles and the DRS

ABCD response BLS methodology was enacted by students, followed by brief *in situ* debriefing. 2nd year medical students began progression towards weekly high-fidelity and more complex medical scenarios which involved clinical doctors and a registered nurse. 3rd and 4th year medical students partook in high-fidelity acute life support (ALS) scenarios, with clinical specialists such as an intensivist or clinical consultant. A registered nurse and an actor also formed part of the simulation-education team. Examples of these high-fidelity medical situations were acute post-operative haemorrhage and deep vein thrombosis which progressed to pulmonary embolism and eventual death. The length of these scenarios were approximately 20 to 30 minutes. Following all ALS scenarios a post-simulation debriefing session was held in a dedicated room equipped with suitable audio-visual equipment to enable review and discussion of simulation scenario performance. Debriefing sessions were attended by all students and simulation educators who took-part in the scenario, with the average length of each session being approximately 40 minutes.

Doctor SBME sessions we all ALS medical situations, which included scenarios such as acute diabetic ketoacidosis and acute hypoglycaemic shock situations. The simulation education team included clinical specialists and a registered nurse. These sessions were approximately 20 minutes in-length followed by a 45 minute debriefing session. Interns generally took-part in SBME monthly, and PGY 1 & 2 doctors took-part a little less frequently.

3.4.2 Study Stage Sequencing

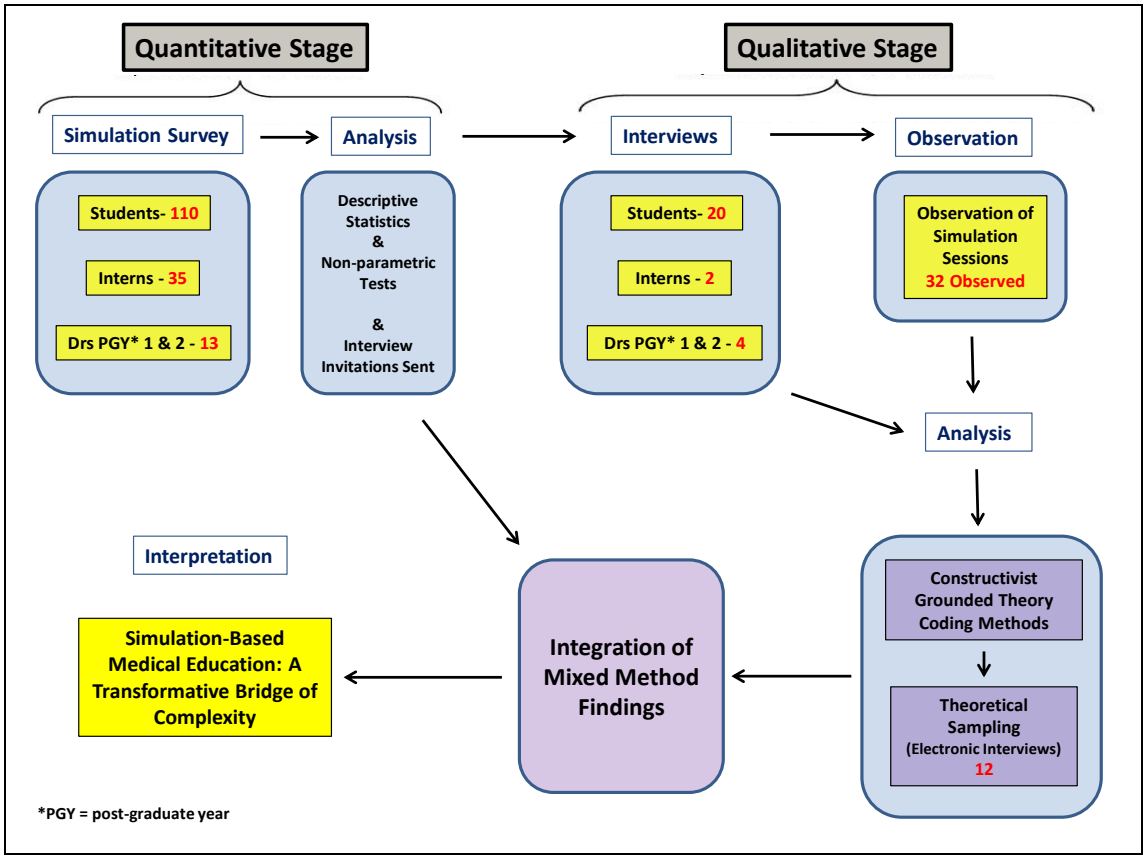
The sequence and integration of this study's quantitative and qualitative research stages required considered thought. Leech and Onwuegbuzie (2009) provided a model to inform

the design adopted: *Fully mixed sequential equal status design*. Informed by this design, the quantitative and qualitative stages occurred sequentially within each discrete participant cohort and throughout the research process (i.e. fully mixed), and both stages were given equal weighting (Leech & Onwuegbuzie, 2009). This study's six cohorts and the varying times of their scheduled SBME sessions suited the utility of this sequencing design. The quantitative study stage was designed as the first stage to suite this thesis' first research question and related objective. It was therefore anticipated to provide the 'skeleton' of this study's eventual findings, to be later 'fleshed out' in the following qualitative study stage where the second research question and other objectives were addressed. Stated another way, this study's quantitative stage was envisaged to broadly gauge the extent and type of transformative learning experienced through SBME, and the subsequent qualitative investigation was seen as deeper examination to unpack and provide more meaning to these transformative learning experiences.

Within each participant cohort, quantitative Simulation Survey data was gathered first followed by one-on-one interviews, observation, and electronic interview qualitative data. This sequencing of stages needed to be applied discretely to each cohort as SBME occurred throughout the curricula of each of the year levels of medical students (i.e. 1st year to 4th year) at very different times across the four study settings, and my access to the CSSU at the FMC was limited and so required flexibility. This approach proved well-suited for this study to capture the range of data reflective of the diversity of the SBME experiences within each cohort, and so provided a cross-sectional view for subsequent analysis and interpretation.

Figure 3.1 diagrammatically presents this study's sequencing design, which illustrates the process used to create a strategy which informatively addressed its aims, research questions, and test its tentative model presented in the previous chapter.

Figure 3.1 *Study Stage Sequencing*



3.5 Participant Recruitment & Sampling Methods

This section discusses how study participants were recruited and sampled from the targeted population of those partaking in simulation-based medical education at the four study settings.

3.5.1 Participant Recruitment

The emphasis on participant recruitment when planning this study was to identify information-rich individuals who possessed both the knowledge and SBME experiences relevant to the phenomenon under investigation (Patton, 1990). The main method of recruitment involved an email invitation as an efficacious way to contact a large amount of potential participants. All Flinders University medical students, interns (junior doctors) and doctors PGY 1 & 2 working at the FMC, RGH, and Mt Gambier hospitals, and who partook in SBME through Flinders University, received an email invitation inclusive of detailed research information.

Before the start of each observed simulation session I was able to attend at the Clinical Skills Simulation Unit at the FMC, I also introduced this study and made myself available to provided additional information if requested. I also presented a brief overview of this study at an intern orientation program at the FMC in January 2014 and responded to several questions raised. Potential participants were also given my email address to seek further information to assist with their decision to participate. The four study settings and the range of potential study participants to form this study's six cohorts required a sampling plan.

3.5.2 Sampling Methods

All the medical students, interns, and doctors PGY 1 & 2 located at the four study settings who participated in SBME represented the targeted population of this study. Table 3.1

presents the population of participants involved in simulation-education through Flinders University during the data gathering period.

Table 3.1 *Population of SBME Participants*

Participant Groups	n =
1st Year*	168
2nd Year*	163
3rd Year*	141
4th Year*	122
Interns	74
PGY (Yr1 & Yr2)+	66

*Medical Students - +Post Graduate Year Doctors

This population was purposefully approached for participants to take part in this study. The overall aim of sampling was to gain participants who resembled this overall population of simulation participants and their respective experiences to yield the anticipated large and diverse range of informative data (Song, Sandelowski et al., 2010). The mixed-methods research design of this study required consideration of sampling methods for the quantitative and qualitative stages (Onwuegbuzie & Collins, 2007), as decisions would likely impact upon the quality of meta-inferences made in the interpretation stage when mixing the findings (Collins, 2010).

Sampling for the quantitative stage of the study initially commenced with 4th year students, interns, and doctors, followed by 3rd year, 2nd year, and finally 1st year medical students. This was in response to the general order in which SBME sessions were scheduled. This involved a stratified sampling approach, where each of the four year levels of medical students, interns and PGY doctors formed groups of the targeted population called strata or

six individual stratum (Roberts & Taylor, 2002). At the end of each simulation session, potential participants were provided with a Simulation Survey and were free to decide whether or not to complete it. However, as discussed below in section 3.6.1.1 different strategies needed to be developed as the study progressed to provide participants with the flexibility to complete surveys and therefore participate in the study. The decision for potential participants to take part in the quantitative stage of this study through completion of the Simulation Survey was self-determined.

Purposive sampling for the qualitative stage of this study followed survey completion, where respondents had indicated in the survey an interest to partake in either a one-on-one interview and/or an electronic interview. Participants who had indicated an interest were then approached via email to arrange an interview time. In total, n=49 Simulation Survey respondents indicated such a willingness and all were contacted, however n=38 followed-through with an interview and/or electronic interview. Observation of simulation and debriefing sessions was also purposive where each participant cohort was specifically observed. Additional sessions were also purposively chosen to pursue specific data leads which had emerged during the data analysis stages, as part of grounded theory theoretical sampling. These sampling methods supported triangulation of quantitative and qualitative findings (Collins, 2010).

Theoretical sampling represents a defining property of grounded theory methodology, where specific avenues of inquiry which have emerged are pursued for consolidation and theoretical integration (Glaser & Strauss, 1967). The aim is to refine abstractions already developed to make them definitive and more useful (Charmaz, 2006). Purposive sampling

was also used to return to interviewees and ask for clarification and expansion of themes which had emerged through analysis of their transcripts. The electronic interview formed the data gathering method for this task.

3.6 Data Gathering Methods

The four data gathering methods used in the quantitative and qualitative study stages of this study are discussed below.

3.6.1 Quantitative Stage

This section discusses the Simulation Survey and the pilot testing of this study's single quantitative method.

3.6.1.1 Simulation Survey

The aim of the Simulation Survey was to explore Mezirow's (1991) Transformative learning theory as experienced through SBME sessions. This Simulation Survey (*Appendix A & B*) formed the quantitative data acquisition method used, which was informed by the Learning Activities Survey (LAS) originally developed by King (1998). Jack Mezirow and Edward Taylor (recognised TLT scholars) provided input for the LAS development, although it has not been fully validated (Taylor & Snyder, 2012). Early on in this study's Simulation Survey development it became apparent various contextual adjustments were required to better align with the SBME environment. Two final Simulation Surveys were

developed with minor linguistic changes for medical students and doctors. These surveys were consistent with addressing the first research question and first research objective, and also provided initial insight into the second research question and other study objectives to be more deeply pursued in the qualitative study stage. Appendices *A* & *B* present the two Simulation Surveys used.

Survey question 1 contained statements which mirrored Mezirow's (1991) ten Transformative learning theory phases and asked respondents to select those which applied to them. Questions 2 and 3 prompted respondents to provide a brief narrative to describe a simulation-learning experience, and question 4 presented eight options from which participants could choose the types of changes or outcomes experienced from their participation in simulation sessions. Question 5 asked respondents to rate the overall influence of simulation on their learning. A number of demographic questions were also included. The final question asked respondents to indicate whether they were willing to have a one-on-one interview and/or electronic interview at a later stage. Before application of the Simulation Survey, pilot-testing was necessary.

Pilot-testing of the survey, via an interview, was undertaken to confirm the questions were appropriate and sound for addressing this study's aims, questions, objectives, and therefore its tentative model. Pilot testing is well established within the literature (Fowler, 1998) as a strategy to ensure survey questions are understandable and the survey items can obtain the information desired, without the need for a large group of participants (Blessing & Forister, 2013). Succinctly, survey pilot testing asks participants to evaluate the survey,

give feedback on their feelings, interpretations, and provide feedback for improvements (Blessing & Forister, 2013).

Willis' (2005) *Cognitive Interviewing Model* was chosen as a systematic method of testing, as its techniques attended to the manner in which interviewees comprehended, mentally processed, and responded to presented survey material. Canvasing of participants to take part in a pilot-testing interview occurred via an email invitation sent to all medical students and Interns. Table 3.2 displays the acceptances for a one-hour pilot-testing interview, and *Appendix C* presents the Pre-Test cognitive interview protocol used.

Table 3.2 *Simulation Survey Pilot-Testing Interviews*

Interviewee	No.
1st Year*	6
2nd Year*	4
3rd Year*	4
Interns	1
Total	**15**

* Medical Students

Two cognitive interviewing methods based on Willis' (2005) model were used: the *think-aloud* technique asked respondents to verbalise their thinking and responses when reading through the presented draft of the Simulation Survey, and *verbal probing* used questions to better understand interviewee's interpretation and responses to survey questions and instructions. Both these methods helped to identify areas in which academic and technical lexicon had to be replaced with 'lay' terms to increase participants' comprehension. Other areas of refinement included survey layout and reduction of question density. Fifteen hours

of pilot-testing enabled changes to be made in a staged manner so that drafts of the survey could be tested by subsequent interviewees. This reflected the iterative nature of the cognitive interviewing procedure (Willis, 2005). Pilot-testing provided ample evidence of the intention, clarity, and representativeness of the two final Simulation Surveys to generate the anticipated data from which to begin testing this study's tentative model. It also clearly demonstrated a primary principle of good survey design - simplicity is a virtue (Willis, 2005). Therefore, final survey presentation was framed by the need for survey items to be short, clear, exact, understandable, and answerable (Blessing & Forister, 2013).

Flexible methods were needed for Simulation Survey delivery to potential participants for completion. Initial plans to hand SBME participants a hardcopy of the survey following each simulation session proved inadequate, as students and doctors had limited time to remain in simulation facilities. An electronic version of the survey was then developed and circulated via email to prompt completion and easier return. However, response rates remained below expectations, so an on-line survey was created with LimeSurvey™ software which allowed participants to access the Simulation Survey with a personal code to preserve anonymity. Another email invitation was sent to prompt this on-line survey completion method. This online method took advantage of contemporary research participation through electronic means, and response rates significantly increased.

3.6.2 Qualitative Stage

Semi-structured one-on-one interviews, observation, and electronic interviews formed the three qualitative data collection methods.

3.6.2.1 Semi-Structured Interviews

The overall aim of the one-on-one interviews was to establish an interactive conversational relationship with participants about their experiential meanings (van Manen, 1997) of their simulation-learning experiences, and so formed the primary tool in this study's qualitative stage. The purpose was to explore participants' Simulation Survey results further and provide them with an opportunity to present a narrative of their related simulation-learning experiences. Merriam (1998) described semi-structured interviews as seeking specific information where the interviewer was guided by a list of questions or issues, however, the precise wording and order of these questions was not predetermined. As such each interviewee's Simulation Survey responses were used to guide the questions asked.

Although interviews were initially semi-structured, a decision was made after several to move towards a less structured approach, based on early analysis which tended to depict restricted responses and less provision of wider narratives to describe SBME experiences. This prompted participants to 'speak more freely' which allowed their stories to better unfold. Initial interviews appeared to be constrained by direct or more categorised questioning and did not flow, as participants were more eager to present their narratives informed by their individual meanings attached to their simulation-learning experiences. This enabled more detailed focus on the linguistic emphasis inherent in participants' stories, and facilitated deeper inquiry into their complex and multidimensional experiences of SBME, which were better understood without *a priori* categorisation (Fontana & Frey, 2005) via more structured questioning. This conversational method led to deeper immersion into participants' experiences which supported the constructivist grounded theory analytical methods used. Analysis of the initial interviews also indicated that

responses were somewhat constrained, as the first step in analytical coding was not as expansive and immersed into participants stories as anticipated. The focus to expand upon participants' simulation survey responses was maintained through a more interwoven and reactive questioning response to their stories, which was experienced as a productive way to prompt participants to more freely expand upon their SBME experiences and let the 'nuances' of their stories unfold.

3.6.2.2 Observation

Observation has been long-characterised as the fundamental basis of social and behavioural research (Glaser & Strauss, 1967; Adler & Adler, 1994). As SBME is a socially dynamic learning context, the observation of simulation scenarios and post-simulation debriefing sessions was considered critical in enabling me to view behavioural aspects during simulation-learning activities. It also allowed me to observe the interactive and relational aspects of participants learning. Observation was from the non-participatory or non-obtrusive position (Angrosino, 2005), where participants were aware of my presence, yet I did not partake in the simulation scenarios or debriefing sessions in any way. I did not wish for my presence to impact upon participants' actions during observations, and so I positioned myself as discretely as possibly and also was mindful of my body language to mitigate any unintended or non-verbal influence.

Observations were conducted in the CSSU simulation-education facility at the Flinders Medical Centre, Adelaide. First year medical students' basic life support (BLS) sessions were observed, and the types of scenarios included simple cardio-pulmonary resuscitation

(CPR) with a standard mannequin, and other scripted 'situations' in which learners had to negotiate other factors in conjunction with CPR. These other factors included environmental elements and additional actors such as an intrusive patient relative. Observed simulation scenarios for 3rd and 4th year students, Interns and Doctors included high-fidelity medical emergency situations such as post-surgical haemorrhagic shock and severe hyperglycaemic diabetic ketoacidosis. A range of simulated medical situations was therefore observed. The observed post-simulation debriefing sessions following high-fidelity scenarios included those learners who had participated in the simulated medical scenario, together with a debriefing facilitator in a dedicated room with suitable audio-visual equipment to review the scenario. Observation of 2nd year medical students' simulation sessions did not occur due to the timetabling of these sessions and my availabilities.

3.6.2.3 Electronic Interviews

Electronic interviews formed the method for grounded theory theoretical sampling, which took advantage of computer mediated communication (CMC) as an important electronic communication medium of contemporary research (Kralik, Koch et al., 2000; Kralik, Price et al., 2006). As theoretical sampling was used to return to previous interviewees for clarification, expansion, and validation of themes which had emerged from analysis of their transcripts and observation, the electronic method was seen to be less invasive on medical students' and doctors' limited availabilities. This method of data collection also provided participants with the opportunity to think and formulate considered responses in their own time within a private environment (Mann & Stewart, 2000) leading to rich

narrative data. Harris (2002) has argued that electronic correspondence can be instrumental in facilitating participants to express themselves more freely.

3.7 Data Analysis Methods

The different methods of analysis applied to the four data types supported the pragmatic assumptions of mixed-methods research. Simulation Survey results were collated and analysed using statistical packages SPSS 22 and StataCorp (2014). QSR Nvivo 10 was used in analysis of interview transcripts and observational data. The analytical methods described below formed the pragmatic strategy to test this study's tentative model. As analysis unfolded, findings from all sources were continually compared and integrated to advance development of this thesis' evolving theoretical model (Glaser & Strauss, 1967; Charmaz, 2006).

3.7.1 Quantitative Data Analysis

The overall aim of quantitative Simulation Survey analysis was to determine which aspects of Mezirow's (1991) Transformative learning theory participants' experienced through their SBME sessions. The analysis framework involved: 1) quantification of the number of each transformative learning phase selected by participants, 2) examination of the number and types of perceived simulation-learning outcomes chosen by respondents, and 3) the association of the transformative learning phases and simulation-learning outcomes to measure correlation of these learning components. Descriptive statistics formed the basis of analysis, and informed the use of the non-parametric statistical tests: Independent-

samples Jonckheere-Terpstra test, Mantel-Haenzsel test, Pearson chi-square ($\chi 2$) estimation of association, Phi and Cramer's V correlation coefficients, and the Tetrachoric rho correlation coefficient. These tests provided extensive and detailed statistical analysis of data patterns or trends within each participant cohort and across the participant spectrum, which gave insight into the differences or variations of transformative learning experiences and simulation-learning outcomes. The strength and effect size of determined correlations were also quantified. Statistical analysis provided the 'bones' which formed the 'skeleton' of this study's iteratively evolving theoretical model which were 'fleshed-out' by qualitative findings.

3.7.2 Qualitative Data Analysis

The aim of qualitative analysis was to extend and build upon the Simulation Survey findings to gain further insight into the reasons and nature of participants' transformative SBME learning experiences. This analysis addressed the second research question and second research objective. As discussed in section 3.3.2 grounded theory methodology formed the overarching approach, and constructivist grounded theory methods (Charmaz, 2006) were used.

3.7.2.1 Constructivist Grounded Theory Coding

The constructivist grounded theory methods (coding) used in this study for all qualitative data comprised three iterative and inductive phases – initial-coding (or open-coding),

focussed-coding, and theoretical-coding (Charmaz, 2006). Initial-coding represented the first level of analysis applied to each interview transcript, observation memo, and electronic interview. This involved defragmenting data through line-by-line analysis to uncover themes or concepts, and so represented initial immersion into participants' stories (Charmaz, 2006) and observational data. As this level of coding generated the basics of this study's intended theoretical model, this immersion into the data took a considerable amount of time and resulted in a very large number of concepts. Therefore at this early stage of qualitative data analysis, deeper insight and meaning of participants' stories began to emerge. Once open-coding was deemed to reveal no new concepts (data saturation), the next phase of focussed-coding was commenced.

Focussed coding represented a higher analytical level and was applied to the defragmented concepts previously identified through initial-coding to give more direction and insight to further shape the emerging theoretical schema (Charmaz, 2008). This involved merging open-codes with collective meanings into larger categories, which gave further substance and form to participants' stories. Focussed coding also facilitated further questions about the data to gain further meaning and make analytical interpretations or abstractions (Walker & Myrick, 2006; Charmaz, 2008). This cyclical nature of grounded theory coding was very complex and involved, and was facilitated by the combination of this study's data gathering methods and the different times data were collected from each participant cohort across the four study settings.

Theoretical-coding was the final stage of data analysis, and represented an advanced level of integration of the developed conceptual categories and their theoretical links or

relationships (Charmaz, 2008; Glaser, 2013). Therefore, this was a pivotal stage in this study, where its emerging theoretical schema was developed to have explanatory power across its substantive areas (Charmaz, 2000), or to show what this study was all about (Strauss & Corbin, 1998). Therefore theoretical-coding was focussed on specifically identified issues which represented gaps in the emerging theoretical schema which had to be filled, in order to gain substantive understanding of participants' simulation-learning experiences associated with development of their professional identities. It was important to stay open to theoretical-coding to allow for unexpected themes and thinking 'outside the square' rather than forcing preconceived views (Glaser, 2013). Grounded theory methods enabled analysis to move away from description, and towards theory construction, which was fundamental in achieving one of this thesis' aims of a theoretical model to depict medical students' and doctors' development of their professional identities, as informed by their simulation-learning experiences.

Merger of mixed-methods findings was the final analytical stage in order to arrive at this study's response to its tentative model: the Simulation Identity-formation model (SIM) as presented and discussed in chapter five.

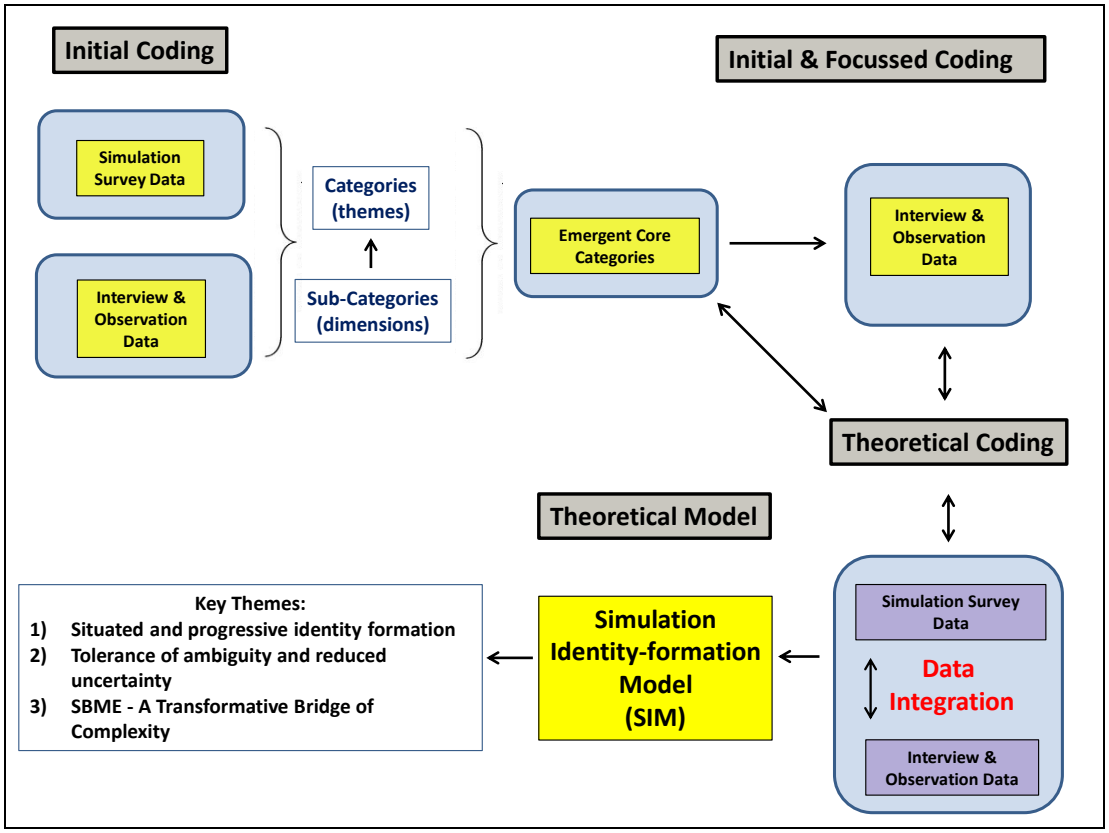
3.8 Merging Quantitative and Qualitative Findings

Integration of this study's quantitative and qualitative findings was an exciting juncture in this study. Figure 3.2 shows the overall structure of this integration. Triangulation was a central process of this mixed-methods integration as it converged findings from both study

stages through corroboration (Nastasi, Hitchcock et al., 2010; Nilsen & Brannen, 2010). Thus triangulation represented the simultaneous display of multiple and refracted realities (Denzin & Lincoln, 2005) to result in a dense and rich (Fielding, 2012) understanding of participants' professional identity development as triggered and supported by their SBME experiences.

This merger of Simulation Survey findings with qualitative results arrived at this study's Simulation Identity-formation Model. The three key findings embedded in the SIM are discussed in chapter six.

Figure 3.2 Mixed-Methods Integration



3.9 Mixed Methods Research - Quality Principles

Mixed-methods research attracts the study-strength determinants of both quantitative and qualitative research approaches. Janneke, Frambach et al. (2013) provide the following quality principles as a framework to assess the quality of quantitative and qualitative research in medical education: 1) *Truth value of evidence*, 2) *Applicability of evidence*, 3) *Consistency of evidence*, and 4) *Neutrality of evidence*. These are discussed below to illustrate how this thesis exhibited these study-strength determinants. Overall, this study's attention to mixed-methods triangulation within and across its quantitative and qualitative stages supported these four quality principles. Also, these quality principles were achieved through its diverse six participant cohorts, four study settings engaged in simulation-based medical education, the four data gathering methods, and its statistical and constructivist grounded theory analytical methods.

Truth value of evidence

Internal validity can be used to assess the truth value of quantitative research evidence, to the extent to which identified effects can be attributed to the analysed independent variables (Janneke, Frambach et al., 2013). The Simulation Survey attracted n=153 complete responses which were regarded as a good number to support internal validity of the findings statistically derived (Field, 2009). Therefore, the effects of SBME learning experienced can be attributed to the Transformative learning theory phases i.e. the independent variables. The other factors which support internal validity suggested by (Janneke, Frambach et al., 2013) are: 1) standardised conditions, 2) detailed description of the educational context and interventions, and 3) avoid the loss of participants and provide

information regarding nonresponses. All participants participated in simulation-learning medical curricula informed by the Flinders University School of Medicine, so the provision of simulation activities and scenarios, together with post-simulation debriefing sessions were viewed as suitably standardised conditions. Similarly, the details of the SBME context and the provision of simulation-learning activities were fully described. No participant withdrew from this study and any missing data was acknowledge and/or removed from analysis, the criteria for which are discussed in chapter four.

Credibility formed the truth value of evidence construct for the qualitative stage of this study, and depicted the extent to which study findings can be viewed as trustworthy and believable to others (Janneke, Frambach et al., 2013). Credibility relies on the research process, findings, and interpretations being reasonable and representative of some type of truth to the reader (Hansen, 2006). The techniques used by this study to enhance credibility included: the use of six independent participant cohorts and four settings as data sources (data triangulation), four data acquisition methods (method triangulation), and use of Transformative learning theory, aspects of identity theory, legitimate peripheral participation, and complexity theory (theory triangulation) (Janneke, Frambach et al., 2013). Other methods also included data collection for an extended period of twelve months (prolonged engagement), and return of interview transcripts to participants for feedback and review and/or verification of emerging themes through theoretical sampling (member checking) (Janneke, Frambach et al., 2013).

Applicability of evidence

External validity communicates the extent to which the results of a quantitative study can be generalised from the research sample to other similar study-contextual situations, and therefore provide a level of replication (Murphy & Davidshofer, 1994; Janneke, Frambach et al., 2013). The use of five statistical tests to verify the relationships between the large number of survey variables, and the examination of data trends and statistically significant variations across the six participant cohorts supported the external validity of this study's quantitative findings. These are detailed in chapter four.

Applicability of evidence of this study's qualitative findings is informed by the notion of *transferability*, or the extent to which the findings can be transferred or applied in different settings (Janneke, Frambach et al., 2013). Transferability was enhanced by collecting data from the six participant cohorts regarding their SBME experiences, the different simulation-learning contexts and describing those contexts in detail (thick description). The sampling strategies described in this chapter showed how selections were made across the participant spectrum (Janneke, Frambach et al., 2013). Discussion of the findings which constitutes this study's formulated SIM (Chapters 5 & 6) is presented with reference to existing literature from different settings (Janneke, Frambach et al., 2013), so transferability of this study's qualitative findings to other SBME settings is further supported.

Consistency of evidence

Janneke, Frambach et al. (2013) view the consistency of evidence in quantitative research as *reliability* i.e. the extent to which a study's results are consistent if that study was

replicated. This quality principle was supported in this study via its four settings from which data was obtained, and the same Simulation Survey being used across these settings. The six independent participant cohorts also contributed to reliability, as any commonalities spread across this continuum were viewed as consistency of evidence to depict the nature of transformative learning experienced together with perceived SBME outcomes. Internal consistency of quantitative data was also achieved through repeated measures (classical test theory) (Janneke, Frambach et al., 2013) via the statistical tests use to determine significance, association, and linear-by-linear correlation as described in chapter four. The Sidak correction statistic was also applied to quantitative analysis in order to mitigate the probability of a Type 1 error whilst maintaining the level of analytical power (Field, 2009). This further enhanced reliability through estimation of a potential source of variance affecting the measurement of statistical outcomes (generalizability theory) (Janneke, Frambach et al., 2013).

Dependability is the concept used to depict the consistency of evidence of the qualitative findings of this study, and represents the extent to which findings were consistent in relation to the contexts in which they were generated (Janneke, Frambach et al., 2013). The techniques that Janneke, Frambach et al. (2013) view to contribute to dependability are: collection of data until no new themes emerge (saturation), continual analysis of data to inform additional data collection (iterative data collection), continuous re-examination of the data using insights which have emerged during analysis (iterative data analysis), and being flexible and open towards the process and topic under investigation (flexible/emergent research design). These techniques were supported by the constructivist grounded theory methods used throughout analysis of individual interviews, observation data, and electronic interviews. Also, the mixed methods research approach of this study

enabled the flexibility to necessarily respond to emerging data collection requirements as already discussed in this chapter. Dependability also requires a researcher to report in detail the methodological processes used in a study (Hansen, 2006). This chapter has presented such detailed information.

Neutrality of evidence

The final quality principle of the framework provided by (Janneke, Frambach et al., 2013) is their conception of neutrality of evidence, which they describe as *objectivity* in quantitative research i.e. the extent to which personal biases are removed (or bracketed) to facilitate acquisition of unbiased or value-free information, and *confirmability* in qualitative research i.e. the extent to which findings are based on the study's participants and settings, rather than a researchers' biases. This study displayed both objectivity and confirmability through emphasis on a reflexive understanding of my experiences and knowledge of simulation-based education, and being mindful that this experiential data did not bias analysis or interpretation as much as was possible. In other words, this study focused on letting the facts speak for themselves (Janneke, Frambach et al., 2013) to understand what the data was saying (Charmaz, 2006) and to uncover what this study was all about (Strauss & Corbin, 1998). This was achieved via the constructivist grounded theory methods used. Objectivity was also supported by the use of codes to maintain the anonymity of participants' identities (Janneke, Frambach et al., 2013). Confirmability was also further enhanced by a repeated search of the data for possible evidence which may have disconfirmed emergent findings. Discussion of this study's research process and findings with my supervisors (peer debriefing), and documentation of the steps and decisions taken in this thesis and their underpinning premises (audit trail) (Janneke,

Frambach et al., 2013) and grounded theory memo writing, further contributed to the neutrality of evidence of qualitative findings.

Another important research strength-determinant is the concept of construct validity (Dellinger & Leech, 2007). It is interwoven throughout Janneke et al's (2013) quality principles discussed above, but is highlight more specifically here. Construct validity requires that researchers demonstrate the instruments used to measure the constructs that they were designed to measure (Dellinger & Leech, 2007), and to show that these constructs related to other variables with which they should, theoretically, be associated (Cronbach & Meehl, 1955). Construct validity encompasses all types of measurement-related validity of identified evidence which include other validity evidence, such as design-related validity evidence and statistical inference validity evidence (Dellinger & Leech, 2007) of a construct which may not be directly observable (Westen, 2003). Further, construct validity in mixed-methods research sees the merging of realist and constructivist study approaches used in the validation of data meaning (Markus, 1998; Messick, 1998).

As will be shown in the following chapters, the concept of construct validity is established by this thesis through the merger of quantitative and qualitative evidence of the concept of transformative development of a professional identity as a doctor. Both paradigmatic perspectives lead to a grounded understanding of the role SBME can play in professional identity formation. The Simulation Survey findings in the next chapter demonstrate that this instrument provided statistically significant data to infer that aspects of Mezirow's (1991) Transformative learning theory indicated the transformative nature of participants'

unfolding development of their professional identity as a doctor. The qualitative findings presented in chapter 5 demonstrate that the one-on-one interviews, observation, and electronic interviews were appropriate for extrapolating upon the Simulation survey evidence to unpack the transformative nature of participants' professional identity development as facilitated by their simulation-learning experiences.

The pragmatic integration of mixed-methods findings in this thesis, as shown in the following chapters, represents this study's desire to produce meaningful data and inferences through negotiation of the phenomena of professional identity formation triggered and supported in the SBME context. The result of this integration is shown by this thesis' Simulation Identity-formation Model (SIM) which encapsulates the convergence and association of the variables identified through analysis - construct validity is therefore observable.

3.10 Ethical Considerations

Ethics approval was gained from the Flinders University Social and Behavioural Research Ethics Committee (No. 5768), and additional approval was received from the Flinders University School of Medicine Expert Assessment and Evaluation Advisory group for permission to approach and accept medical students as participants in this study. This group assessed whether participation would adversely impact upon students' workloads. Ethics approval was also obtained from the Medical Directors of the Flinders Medical

Centre, Repatriation General Hospital, and Mt Gambier Hospital for interns and doctors to also participate. All approvals were gained without objections raised.

All participants received full information upon which to base their informed consent. Participants were also clearly advised in this information that they were free to partake in any of the study stages and data gathering methods, and able to withdraw from the study at any time without prejudice. Participants were also informed they were able to request to have their data discarded at anytime, and no reason was expected to be provided. The preservation of the safety and confidentiality of all data provided by participants' data was also clearly stated in the research information. No participant withdrew from the study, requested to have their data discarded, or reported concerns or difficulty about participation in this study at any stage.

Confidentiality and anonymity were maintained throughout this study, where alphanumerical codes were used to represent participants when taking simulation observational data. Pseudonyms were used for all interviewees throughout the study process and when quoted in the qualitative findings presented in chapter five. My email account was a formal and safe Flinders University account and password protected, so electronic interviews and other participant correspondence was confidential and preserved. Observational data and grounded theory memo notes used throughout the study were always locked in a filing cabinet. These confidentiality and anonymity methods were in accordance with the National Health and Medical Research Council (NHMRC) guidelines. All participants were assured in the research information documentation, and again verbally if interviewed, that confidentiality and anonymity would be maintained in any

future publications resulting from this thesis. Finally, all were assured participation in this research would not impact upon their medical education progression or workplace in any way.

3.11 Chapter Conclusion

The overall approach discussed throughout this chapter forms the research platform of this thesis. The strength of this platform was shown through the epistemological and pragmatic compatibility of this study's research aims and questions with the philosophical underpinnings of mixed-methods research, and the statistical and constructivist grounded theory analytical methods used. The four data gathering methods, the six independent sample cohorts, and this study's four settings were also discussed as contributing research strength through triangulation and constant comparison of findings. As such, the quality principles, as discussed above, were exhibited by this thesis' approach in its quest to gain deeper insight and understanding of participants' SBME experiences from its new exploratory perspective. The overall research approach described in this chapter showed a pragmatic and appropriate design through which this thesis' tentative model was tested.

The next chapter forms the quantitative stage of this study, where Simulation Survey findings are presented in response to the first research question.

4 Transformative Simulation Learning

What's changed for me over the past four years is I now realise it [SBME] can be transformative to almost anyone…I think knowledge is definitely an area where it can be transformative but I think that's the least important part of transformation in simulation…I think where simulation has the most transformative prospects is in communication, practical, putting things into practice, taking on leadership, ceding leadership, the so-called soft skills.

Martin, 4th year Medical student.

4.1 Introduction

This chapter presents the quantitative phase of this study, where Simulation Survey findings infer that participants' simulation-learning experiences can be informed by Mezirow's (1991) Transformative learning theory. Martin's above quote captures this overall transformative nature. This study's first research question and first research objective are addressed in this chapter:

***Research Question 1*:** Which aspects of Transformative learning theory (TLT) are experienced through SBME?

***Research Objective 1*:** To construct a Transformative learning framework evidenced by participants' SBME experiences, and

Simulation Survey findings also begin to address research objective 2 to inform deeper examination in the next qualitative findings chapter:

***Research Objective 2*:** To understand the nature of participants' transformative learning as triggered and supported by their SBME experiences.

Participant demographics are first presented in section 4.2 followed by descriptive and nonparametric statistical findings in section 4.3. SPSS version 22 and StataCorp (2014) statistical software packages were used for all analysis. Simulation Surveys for medical students and doctors are presented in *Appendix A* and *Appendix B* respectively.

To aide reading, Mezirow's (1991) ten Transformative learning theory phases are mapped onto corresponding statements represented in Simulation Survey question 1(Q1):

Figure 4.1 ***TLT Phases and Corresponding Survey Q1 Statements***

	TLT Phases	**Question 1 Statements**
1.	A disorientating dilemma	(a)
2.	Self-reflection	(b & c)*
3.	Critical self-reflection	(e)
4.	Recognise that others are negotiating similar changes	(d)
5.	Exploration of options for new roles, relationships, and actions	(f)
6.	Planning a course of action	(g)
7.	Acquiring knowledge and skills for implementing one's plans	(h)
8.	Provisionally trying out new roles	(i)
9.	Building competence and self-confidence	(j)
10.	Integration of new perspectives	(k)

*Statements b & c were merged within SPSS to a single variable to better align with the 10 stages of TLT

In total, n=161 Simulation Surveys were received. Eight (n=8) had substantive missing data and were excluded from analysis. The remaining n=153 provided the data for the quantitative analysis and findings presented throughout this chapter. Criteria for exclusion were the absence of answers to the survey questions 1 and 4 combined, as these were the data points for all quantitative analysis. If surveys had an absence of data for question 1 or question 4 these were not excluded, as some participants may not have experienced some of the learning experiences or some of the learning outcomes presented as options. Some surveys were received with data missing from the demographic and educational background sections, but these were not excluded from analysis. This decision was taken as it was assumed some participants may have felt comfortable with provision of their Simulation Survey responses, yet preferred to not divulge demographic details. As analysis in this chapter focusses on questions 1 and 4, missing demographic data was not envisaged to bias these results.

4.2 Demographic Data

Table 4.1 displays participant cohorts by cultural background, gender, and age-range. There was some missing demographic data, so complete data in 144 (94% of 153) surveys are presented. This data shows there were 59 male (38.6%) and 90 female (58.8%) participants in this study. Four participants did not provide this information (2.6%). The age range of participants was 20 to 48 with the standard deviation (SD) of 5.538 reflective of this wide range. The Kolmogorov-Smirnov (K-S) model was used to test the normality of the spread of ages, and its statistics showed these ages were not normally distributed: $D(144) = 0.185$, $p < 0.05$, with the median of 27 years. This age distribution also had a skewness (lack of symmetry) of 1.480, which indicated ages clustered towards the lower-

end (Field, 2009) i.e. 50% of participants' ages were between 25 to 29 years. The diverse cultural background responses were allocated to three overall representative groups:

Table 4.1 *Participant Cohort Demographics*

	Caucasian			Asian			Aboriginal		
	Gender		Age Range	Gender		Age Range	Gender		Age Range
	Male	**Female**		**Male**	**Female**		**Male**	**Female**	
1st year	7	6	20-39	3	2	20-27	0	0	n/a
2nd year*	14	18	21-43	1	0	24	1	1	37-47
3rd year+	11	23	22-40	2	3	22-48	0	1	30
4th year*	1	3	27-37	3	0	27-29	1	0	37
Intern^{0}	15	3	25-42	4	5	24-30	0	0	n/a
PGY 1 & 2*	0	7	25-37	0	3	27-28	0	0	n/a

*3 missing cases, $^{+}$2 missing cases, ^{0} 4 missing cases

Table 4.2 displays participants' reported education.

Table 4.2 *Participants' Education*

	Bachelor*	**Honours**	**Masters**	**Doctorate**	**Other**
1st Year students	17$^{\#}$	5	1	0	2
2nd Year students	37^{+}	14	3	3	0
3rd Year students	40$^{\wedge}$	14	2	0	3
4th Year students	11	4	2	0	1
Interns	27^{o}	8	3	1	0
PGY 1 & 2 Doctors	13	2	0	1	0

* Missing cases: $^{\#}$1, $^{+}$2, ^2, ^{o}4 Other denotes TAFE certificates

As the medical doctorate (MD) course at Flinders University is graduate-entry, all students possessed a Bachelors degree upon admission. Sixty two (43% of 144) respondents reported further education: honours (n=47), post-graduate higher education (n=16), and

technical and further education (TAFE) certificates (n=6). Nine respondents did not provide educational details.

4.3 Simulation-Survey Findings

Simulation Survey analysis and findings are presented from three perspectives to more substantively analyse the data: 1) the TLT phases experienced (section 4.3.1), 2) types of selected SBME outcomes (section 4.3.2), and 3) the association between these findings (section 4.3.3). Findings are presented to illustrate the extent (as evidenced by survey responses) of Transformative learning theory phases experienced through participation in simulation-learning activities, perceived senses of change or outcomes, and the statistical association or likelihood that the TLT findings led to participants' perceived outcomes. Descriptive and non-parametric statistical tests are used to present findings at both the universal level (all n=153 surveys) and for each of the six independent respondent cohorts (i.e. 1st year medical students to doctors PGY 1&2). Table 4.3 indicates the number of completed surveys returned by each cohort and associated response rates:

Table 4.3 *Returned Simulation Surveys*

Respondent Groups	Surveys n =	Denominators	Response Rates
1st Year*	18	168	11%
2nd Year*	38	163	23%
3rd Year*	42	141	30%
4th Year*	11	122	9%
Interns	31	74	42%
PGY (Yr1 & Yr2)+	13	66	20%
Total	**153**		

*Medical Students +PGY – post graduate year doctors

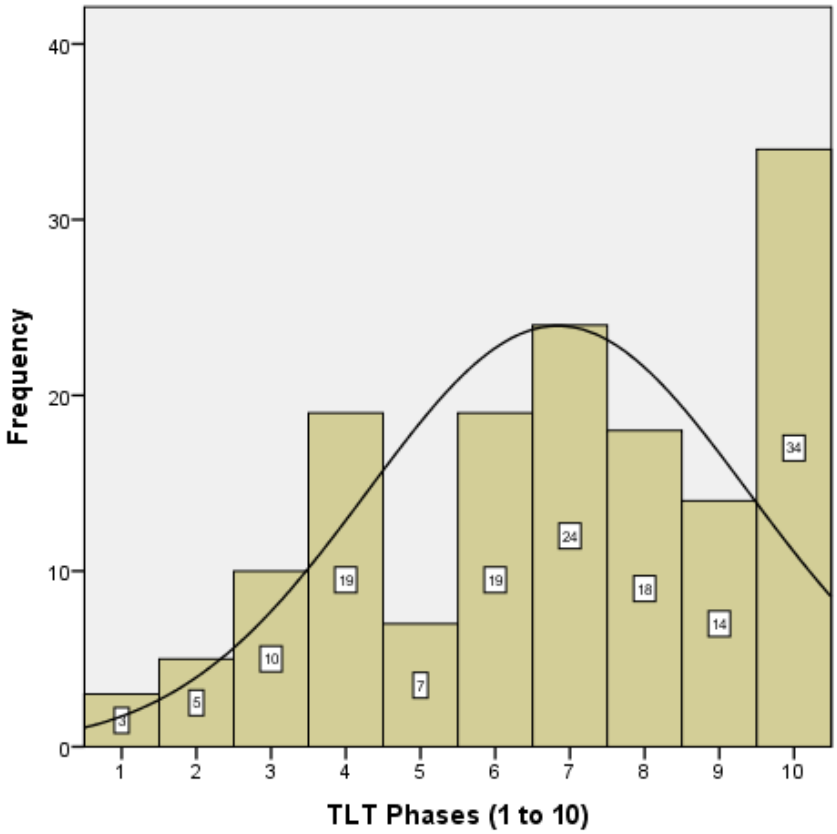
Denominators for each respondent group represent both the number of medical students and doctors (population) who partook in SBME through the curriculum provided by Flinders University.

4.3.1 TLT Phases Experienced Through SBME Activities

This section examines which TLT phases, as documented in survey Q1 responses, were selected by respondents to describe their simulation-learning experiences. Analysis of the large amount of discrete responses (n=1025) began with determination of its distribution to visually gauge the spread or general 'lay' of the data, which also guided the nonparametric statistical tests employed below.

This spread of data provided an initial understanding of the total number of TLT phases selected by participants, and so gave an idea of the extent TLT was experienced during SBME. Graph 4.1 plots this frequency distribution (histogram) of the total number of selected TLT phases. The X-axis represents how many phases were selected (1 to 10), and the Y-axis indicates the number of participants (frequency) who selected these total number of phases. This numerical frequency is also displayed within each vertical-bar. The sum of all these frequencies equates to the number of surveys n=153 used for analysis.

Graph 4.1: *Frequency Distribution: Selected TLT Phases*



Immediately noticeable is the highest frequency (n=34 or 22% of 153) of respondents who identified with all 10 phases, and no survey was returned without any phase selected. With this initial look at data distribution it appears transformative learning, as conceptualised by Mezirow (1991), was experienced across the participant spectrum. As such, it could be suggested the extent of TLT experienced was spread across this study's six cohorts, and so it could be inferred that the SBME setting can provide a transformative learning context. To better interpret this data spread, Table 4.4 presents the distribution normality test and Table 4.5 shows the distribution statistics of this data spread:

Table 4.4 *TLT Phases: Test of Normality*

Test of Normality			
	Kolmogorov-Smirnova		
	Statistic	df	Sig.
Sum of TLT Stages	.116	153	.000

Degrees of freedom (df) = sample size

Table 4.5 *TLT Phases: Distribution Statistics*

Valid	153	
Missing	0	
Median		7
Std. Deviation		2.548
Skewness		-0.39
Kurtosis		-0.877

Table 4.4 shows data frequencies as not normally distributed: $D(153) = 0.116$, $p < 0.001$, which is the basis for the nonparametric statistical tests used later in this section. Table 4.5 reveals the relatively large standard deviation (SD) of 2.548 which depicts the range of the frequencies for each of the TLT phases selected. The negative skewness of -0.39 is indicative of frequencies clustered towards the selection of larger numbers of phases, which corresponds to the median of 7. The negative Kurtosis of -0.877 shows the relative clustering of frequencies at the ends of the distribution which suggests respondents generally experienced either a low or high number of Transformative learning theory phases. These initial statistics and general 'lay' of Q1 findings suggest respondents' simulation-learning experiences can align with Mezirow's TLT i.e. 109 (71% of 153) respondents identified with 6 or more phases to describe aspects of their SBME learning experiences.

Also, these early findings may indicate that the main constructs of TLT – disorientating dilemma (DD), reflection, dialogue, and action could make-up elements of participants' simulation-learning. Table 4.6 shows the Q1 distribution statistics of each cohort to more deeply examine this extent of TLT experienced across the participant spectrum.

Table 4.6 *Participant Cohort Question 1 Distribution Statistics*

Statistics							
		1st Yrs	2nd Yrs	3rd Yrs	4th Yrs	Intern	PGY
N	Valid	18	38	42	11	31	13
	Missing	0	0	0	0	0	0
Median		6	7	6.5	8	8	8
Std. Deviation		2.744	2.351	2.943	1.968	2.166	2.178
Skewness		-0.049	-0.185	-0.078	-1.045	-0.983	-1.145
Kurtosis		-1.43	-0.738	-1.249	2.068	0.386	1.342
Minimum		2	1	1	3	2	2
Maximum		10	10	10	10	10	10

SD statistics tended to approximate the overall SD of 2.548 (Table 4.5) and negative skewness scores again indicated selection of a larger number of TLT phases across cohorts. An important difference was seen with 4th year students, interns and doctors with skewness scores approximating -1.0 which suggested that participants, with more medical knowledge and clinical experience, were more likely to identify more strongly with TLT phases. The positive kurtosis scores for these three groups also supported this finding, which raised the notion that these participants may have had more specific learning needs actioned or focussed upon during their SBME sessions.

The median statistic rise from 6 to 8 further supported this inference, and the non-parametric Jonckheere-Terpstra (J-T) model suggested this as a significant ascending data

trend: $j = 5302.5$, $z = 2.11$, $p < 0.05$. The J-T model tested for a meaningful ordered pattern in the medians of respondent groups (Field, 2009). This result suggested that as learners transition from being 1st year medical students to PGY doctors, their learning needs changed, and so more TLT phases may have been experienced in response to such changes. This was perhaps suggestive of learners needing to expand and develop their understanding of the diverse aspects of the doctor's role inline with their more extensive clinical experiences, which resonated strongly with one of TLT's key concepts: developmental.

Kurtosis statistical differences i.e. negative and positive indicated that 1st, 2nd, and 3rd year students had a greater distribution of frequencies at the extremes i.e. either identifying with few or many TLT phases, whereas 4th years, interns and doctors appeared to have a more concentrated range i.e. most of the TLT phases. These findings again supported the notion of changing learning needs associated with more developed medical knowledge and clinical experience. Therefore a natural *a priori* ordering of participant cohorts, reflective of their knowledge and experience, could be inferred to better understand the transformative nature of each cohorts' simulation-learning experiences.

Table 4.7 shows the numerical frequency of each Transformative learning theory phase selected within each cohort to better infer the influence of each, and the phases which appear to be more representative for each group of learners. This further explores the nature of the above *a priori* differences. The overall top five phases are highlighted to reflect the apparent importance participants applied to them when selecting the TLT phases to describe their SBME learning experiences.

Table 4.7 *Numerical Frequencies of Selected TLT Phases*

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8	Phase 9	Phase 10
1st Year students	15	17	11	10	11	12	9	8	16	11
2nd Year students	27	33	20	21	23	28	14	18	32	25
3rd Year students	36	40	23	26	22	32	18	20	28	20
4th Year students	11	10	7	9	9	10	8	4	9	6
Interns	29	31	25	26	24	27	23	14	26	20
PGY Doctors	10	13	7	10	6	11	10	8	7	10
	128	**144**	**93**	**102**	**95**	**120**	**82**	**72**	**118**	**92**

Five phases (50% of 10) had total frequencies greater than 100 (phases: 1, 2, 4, 6, and 9) which suggested the majority of respondents (> 67%, or at least 102 of 153) identified with these TLT phases to depict aspects of their simulation-learning experiences. These top five findings included the four central constructs (in bold below) long-associated with TLT (Mezirow, 1991; Illeris, 2014):

- **Phase 1** – **Disorientating dilemma (DD)**
  - Survey statement (a) – '*I have sometimes felt out of my comfort zone*'

- **Phase 2** – **Reflection**
  - Survey statements (b & c) – '*I have sometimes questioned the way I would normally act'* and '*I have sometimes questioned aspects of my knowledge, beliefs, or ideas*'

- **Phase 6** – **Planning a course of action**
  - Survey statement (g) – '*I thought about how to adopt these new ways of acting in future clinical situations or roles*'

- **Phase 9** – **Development of confidence and competence via Discourse**
  - Survey statement (j) – '*I have taken note of feedback and reactions from my new practices and ways of acting*'

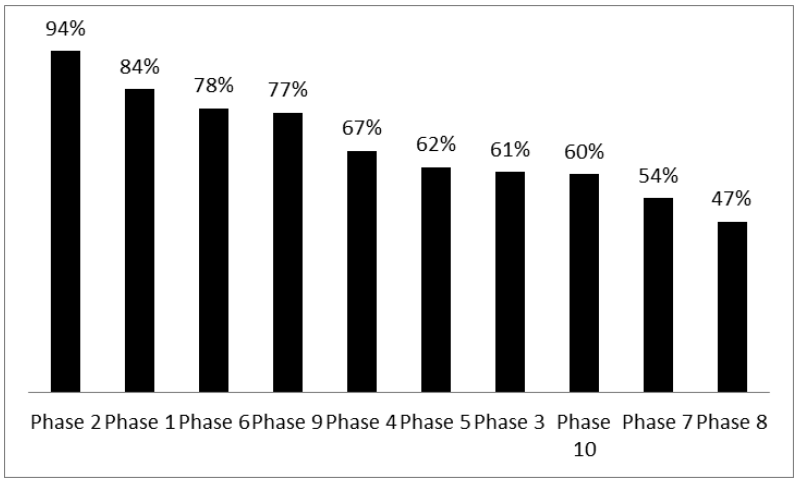
- Phase 4 – Collective learning
    - Survey statement (d) – '*I have realised other people also question aspects of their knowledge, beliefs, or ideas*

The amalgamation of these phases can be suggested to have evidenced a general simulation transformative learning framework experienced by participants: beginning with experiencing discomfort with aspects of simulated medical situations, then engaging in reflection to seek clarification of such discomfort, then planning new ways to manage similar future situations, and developing confidence and competence through others' feedback. The percentage rankings of each of the above TLT phases is presented in figure 4.2 below to better visualise the overall placement of each stage allowing an inference on influence or importance to be gauged.

These findings may then indicate that upon experiencing a disorienting dilemma, participants sought to reflect on and clarify their understandings and meanings of various aspects of the doctor's role. The inclusion of phase 4 – collective learning – within the top five suggested participants can recognise that others may also experience discontent, and that simulation-learning sessions could generate an effective collective or relational learning atmosphere. These findings can be viewed as typifying Mezirow's TLT and suggest learning took place in the instrumental (phase 6), communicative (phase 9), and reflective (phase 2) learning domains as discussed in chapter 2. These findings additionally aligned with Mezirow's (1991) three part transformative learning process of: critical reflection on one's assumptions, discourse to validate new critically reflective insights, and action.

Figure 4.2 displays the overall relative frequencies of each TLT phase in descending order to more infer the relative importance placed upon each. As cohort sizes differed largely (Ref: Table 4.3) this mitigated interpretation-bias based only on numerical frequencies (Field, 2009) presented above in Table 4.7. This relative ordering provides reasonable strength to more confidently picture how participants' SBME learning was shaped by Mezirow's TL theory of how adults can learn.

Figure 4.2: *Overall Relative Frequencies of Selected TLT Phases*



Phase 2 – reflection - was selected by 94% (n=144 of 153) of respondents which suggested this as a central TLT learning component triggered and supported by simulation-learning. Phase 1 – disorientating dilemma had a similar influence (84% or n=128) and the close alignment of these top two can be suggested to infer that learners reflected on feeling 'out of my comfort zone' – hallmark beginnings of transformative learning, as Mezirow (1994, p. 223) stated: 'we are confronted with a disorientating dilemma, which serves as a trigger for reflection'.

Nine TLT phases (9 out of 10) had a percentage considerably higher than 50% which further inferred that the SBME context could trigger and support Mezirow's Transformative learning. In addition, the displayed sequence of findings in Figure 4.1 was clearly not linear, and this correlated with the often non-linear trajectory of Transformative adult learning (Mezirow, 1991, 2000). Table 4.8 further depicts which aspects of TLT were experienced within each cohort to explore for any specific differences or variations, so that more precise meaning of each cohorts transformative simulation-learning experiences can be understood.

Table 4.8 *Cohort Relative Frequencies of TLT Phases*

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8	Phase 9	Phase 10
1st Year students	83%	94%	61%	56%	61%	67%	50%	44%	89%	61%
2nd Year students	71%	87%	53%	55%	61%	74%	37%	47%	84%	66%
3rd Year students	86%	95%	55%	62%	52%	76%	43%	48%	67%	48%
4th Year students	100%	91%	64%	82%	82%	91%	73%	36%	82%	55%
Interns	94%	100%	81%	84%	77%	87%	74%	45%	84%	65%
PGY Doctors	77%	100%	54%	77%	46%	85%	77%	62%	54%	77%

These findings displayed cohort variations in selected TLT phases, which again suggested groups situated at different points along their learning trajectories could experience SBME differently inline with their evolving needs. For example, the value placed upon discourse (feedback) – phase 9 for early-year medical students differed significantly from PGY doctors, and the importance placed upon collective learning – (phase 4) - appeared to correlate with increasing knowledge and clinical experience of 3rd year students and above.

The top five Transformative learning theory phases are displayed in Table 4.9 to infer *how* TLT phases were experienced by each cohort during their simulation-learning. The overall findings of the n=153 surveys are also included. Initial insight into the reasons (*why)* are presented by findings in section 4.3.3, and expanded by the qualitative findings presented in chapter five and discussed in chapter six.

Table 4.9 ***Top Five TLT Phases of Each Cohort***

	1	***2***	***3***	***4***	***5***
Overall	2	1	6	9	4
1st Year students	2	9	1	6	3,5,10*
2nd Year students	2	9	6	1	10
3rd Year students	2	1	6	9	4
4th Year students	1	2	6	4,5,9*	7
Interns	2	1	6	4,9*	3,7*
PGY Doctors	2	6	1,4,7,10*	8	3,9*

(* same relative frequency)

The findings presented in Table 4.9 show that the four main constructs (i.e. phases 1,2,6, and 9) of Mezirow's TLT were commonly experienced across the cohort spectrum. The variation in the order of phases again suggests these could be related to the *a priori* level of medical knowledge and experience, and so may have had different meaning for each cohort's learning needs. Different meaning could have been related to each cohorts location or position along their learning trajectories. For example, 1st year and 2nd year students rated TLT phase 10 - *integration of new perspectives into one's actions* - lower than doctors, which may have suggested that the integration of new understandings was rated as being more important for doctors' direct transfer to their current clinical roles.

Additionally, doctors were the only group to select phase 8 – *provisionally trying out new roles* - which inferred this had particular meaning for them as they enacted their already developed medical capabilities within the simulation context. Doctors were also the only grouping to have nine of the ten phases ranked within their top five. This finding was perhaps not surprising, as they were more engaged in and committed to their medical work because it was part of who they took themselves to be, and so a greater level of learning with the aim of general competency development would likely take place as a result of participating in simulated medical situations (Billett & Somerville, 2004).

These cohort variation findings in experienced TLT phases may therefore be related to participants' transition between these cohorts i.e. from 1st year student to doctor and the emerging learning needs thereof. So a temporal nature to participants' simulation-learning experiences can be suggested to have emerged from these findings. If so, each cohort's 'position' or location along their learning trajectories appeared provisional until expansion and integration of further understanding enabled transition to another. This pointed towards the notion of developing tolerance to ambiguity or uncertainty whereby the pervasive experience of DDs (phase 1) across cohorts was seen not so much as a threat, but as a resource or motivator for further learning (Bleakley, 2010; Luther & Crandall, 2011), which the SBME context appeared to provided an appropriate learning context.

These variation findings required deeper analysis to promote clearer understanding of cohort differences or specificities, and to test whether these were statistically significant and if meaningful order or trends were apparent (Field, 2009). SPSS provided the nonparametric statistical test - independent-samples Jonckheere-Terpstra (J-T) test for

ordered alternatives - to examine independent samples which have a natural *a priori* ordering. This test was appropriate here as it specifically looked for meaningful order (Field, 2009) in the differences of importance each cohort placed upon each TLT phase. In this study, each cohort was independent with an increasing level of medical knowledge and clinical experience i.e. there was a natural *a priori* ordering of groups.

Through the Jonckheere-Terpstra test, the null hypothesis (H_0): 'The distribution of Sum of TLT phases is the same across categories of Participants' was tested by the ranked sums of phases (Field, 2009) selected in each of the n=153 surveys.

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Sum of ... is the same across categories of Participant.	Independent-Samples Jonckheere-Terpstra Test for Ordered Alternatives	.035	Reject the null hypothesis.

Test statistics of: $j = 5302.5$, $z = 2.113$, $p < 0.05$ inferred the variations in the order of TLT phases as shown in Table 4.9 were statistically significant, and that an ascending trend (as j is positive) in the number of TLT phases identified with was present. The likelihood of this occurring by chance was close to zero as $p < 0.05$. Thus these statistics inferred that each cohort could be understood as having different learning needs which were focussed upon during simulation-learning activities. This meant the H_0 was rejected.

Stated another way, acceptance of the alternative hypothesis (H_1) implied that participants who were further along in their training had a greater level of medical knowledge and

clinical experience, which led them to have a tendency to select more TLT phases. Therefore, the J-T analysis findings suggested there was a meaningful order to survey Q1 results which therefore implied an association of knowledge and clinical experience with learning needs, and perhaps the meaning applied to participation in simulation-learning activities. This finding corroborated the ascending median trend (6 to 8) identified above. Deeper inquiry into the meaning of this statistically significant order was necessary to specifically explore each TLT phase. Therefore the findings displayed in Table 4.9 were examined for any associated trends specific to each cohort i.e. linear-by-linear association.

The non-parametric Mantel-Haenzsel test was used to examine linear-by-linear association, as it made sense to order the importance placed upon each TLT phase within each cohort (i.e. independent variables), to perhaps better highlight the contrasts between cohort findings more clearly (Field, 2009). This association test used crosstabulation (2 x 2) of each cohort and specific phases, and was based on the assumptions that data were not normally distributed and comprised binary and/or nominal or ordinal data (Field, 2009; Pallant, 2010). The survey Q1 data depicted these assumptions.

The chi-square (χ^2) metric formed the estimate of association for the Mantel-Haenzsel test, with its resultant significance (*p*) value an indicator of whether these variables were independent or in some way related, via exact significance one-tailed directional testing (Field, 2009). This analysis looked for increased selection of TLT phases (from lowest to highest) across the cohort spectrum and tested the H_0 that the crosstabulated variables were independent i.e. not associated (Field, 2009). This test provided findings which inferred

better understanding of the meaning participants' applied to their selected TLT phases to depict their simulation-learning experiences, and so nature of their learning.

Table 4.9 above showed reflection as the highest ranked TLT phase for all cohorts except 4th year medical students, where it was ranked second. The Mantel-Haenzsel statistic findings: χ^2 (1) = 3.452, $p < 0.05$ indicated reflection as a statistically significant data trend which inferred SBME increasingly prompted participants to reflect upon aspects of their simulation-learning as they transitioned from a 1st year medical student to doctor. As reflection is a central component of Mezirow's (1991) theory, this association may have suggested reflection to be a significant learning domain arising from participation in simulation activities. This increasing reliance on reflection appeared to be related to the pervasive experience of disorientating dilemmas. Whilst *disorientating dilemmas* (phase 1) was not identified as a statistically significant trend, it was nonetheless shown in Table 4.9 as a finding that was commonly experience across all cohorts. Therefore, participants appeared to experience something during SBME that prompted reflection in response to encountering a disorientating dilemma. Insight into the nature of these dilemmas is given by the findings in sections 4.3.2 and 4.3.3 below, and specifically addressed by the qualitative findings presented in the next chapter.

A finding of interest in Table 4.9 was the change in weighting applied to TLT phase 9 – *building of self-confidence and competence through dialogue or feedback*, and phase 4 – *communal or collective learning*. First year and 2nd year students appeared to place higher importance on individual feedback, whereas 3rd year students through to doctors appeared to value collective learning. The Mantel-Haenzsel test indicated phase 4 as a statistically

significant trend: χ^2 (1) = 7.715, $p < 0.05$ which could have suggested that as medical experience and knowledge increased, so did emphasis placed on collective learning. When observing simulation scenarios and debriefing sessions this transition to a collective learning orientation was clearly seen in the evolving group dynamics. This suggested the value of the relational dimension of learning (Bleakley, 2010), and highlighted the importance of the communicative TLT learning domain within SBME. This resonated with the increasing complexity of simulated clinical scenarios requiring integrated teamwork and collective thinking to manage the scenario at hand, and then collectively discuss in post-simulation debriefing sessions. Phase 9 was not determined to be a significant data trend, but was also inferred in Table 4.9 as a pervasive and influential element of participants' simulation-learning.

Phase 6 – *planning action* – was another statistically significant trend finding indicated in Table 4.9: χ^2 (1) = 3.847, $p < 0.05$. These statistics appeared to suggest as clinical experience increased, so did the general emphasis situated within the SBME context on planning future action to then be transferred to the clinical setting. This again aligned with the increasing complexity of simulation activities, and also inferred an increasing level of tolerance to ambiguity and the response to plan action to navigate such uncertainty. This data trend typified the importance Transformative learning theory places on action, as discussed in chapter 2.

TLT phase 7 - *acquisition of knowledge and skills for implementing one's plans* - was a highly statistically significant trend finding within the top five phases as shown above in Table 4.9 for 4th year students, interns, and doctors: χ^2 (1) = 11.338, $p < 0.001$. This

aligned with the trend finding for phase 6 discussed above, and further inferred these participants' appeared to have more focussed learning needs. As these participants had a firm foundation of knowledge and clinical exposure, this phase could have had more meaning when they participated in simulated medical scenarios. Given their current association with clinical roles, transfer of such focussed learning to the clinical setting could be reasonably inferred. This finding resonated with the developmental focus of Mezirow's (1991) TLT.

The findings discussed in this section evidenced that participants' simulation-learning experiences may trigger and support key elements of Mezirow's (1991) Transformative learning theory. Findings identified a framework inclusive of the four central constructs long-associated with Mezirow's (1991) theory. Variation findings between cohorts indicated that simulation-learning sessions may take-on more specific meaning (or temporal development) for participants as they developed their clinical knowledge, skills and expertise, and provided a focussed and collective context for such learning. Findings also may have indicated that in the face of pervasive ambiguity i.e. disorientating dilemmas, participants engaged in key transformative learning phases (reflection, planning action, discourse, and collective learning) to seek further understanding and meaning, which could be suggested as guiding future action for transfer to the clinical setting. The natural *a prior* ordering of participant cohorts was inferred to mediate Transformative learning experiences. Overall, this sections findings provide reasonable strength to state that there are differences in cohort experienced TLT phases, together with apparent progression from 1st year medical students to practicing doctors.

The next section presents findings from the opposite perspective to the above, i.e. possible outcomes from participation in SBME rather than the TLT phases experienced.

4.3.2 Outcomes Associated with SBME

Findings from question 4 (Q4) of the Simulation Survey reported participants' senses of change or types of outcomes they associated with participation in simulation-learning activities. Results show these outcomes to include: changed views of themselves, refined ideas of how they pictured themselves as a doctor, new understanding of the medical role, and application of new ideas to the clinical setting. Figure 4.3 displays the alphabetical codes used throughout this section to represent the eight Simulation Survey Q4 options from which respondents selected their perceived simulation-learning outcomes. There were n=547 discrete responses to Q4 from n=153 surveys.

Figure 4.3 *Q4 - SBME Outcomes*

Code		Q4 options – Simulation-Based Medical Education Outcomes
A	-	I have left some simulation sessions seeing 'things' differently
B	-	Simulation has helped me recognise personal attributes I did not know I had
C	-	I have begun to reshape the way I see myself as a doctor in the future
D	-	My beliefs and expectations of the doctor's role (my medical role)* have been reshaped
E	-	Some of my long-held views and ideas have been challenged
F	-	My beliefs and opinions of the social complexities of healthcare have been restructured
G	-	Simulation sessions have given me new understandings which I now consciously use (in my clinical role)*
H	-	Simulation sessions have led me to explore new ways of learning

***change in wording for Intern and Doctor Surveys*

Graph 4.2 displays the histogram of the above selected Q4 options. The X- axis shows the range of the total number of Q4 options selected, and the Y- axis indicates the number of respondents (frequency) who selected these totals. For example, 15 respondents selected 7 types of change to depict outcomes experienced through their simulation-learning. The K-S statistics shown in Table 4.10 indicate deviation from normal distribution as statistically significant: $D(153) = 0.112$, $p < 0.001$, which is visualised by the overlaid normal distribution curve.

Graph 4.2 *Frequency Distribution: Selected SBME Outcomes*

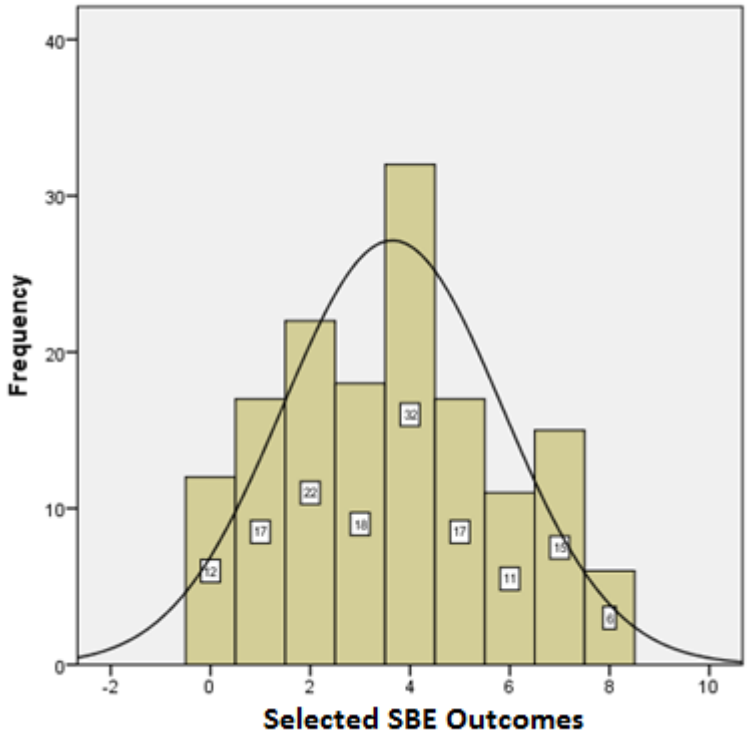


Table 4.10 *SBME Outcomes: Test of Normality*

	Kolmogorov-Smirnova		
	Statistic	df	Sig.
Outcomes	.112	153	.000

Degrees of freedom (df) = sample size

A clear finding was 32 (21% of 153) participants selected four options to describe their simulation-learning outcomes. Six (4% of 153) identified with all types of outcomes, and 12 participants (8% of 153) did not select any to depict a sense of change. This range in the total amount of outcomes from SBME selected can be suggested to resonate with the *a priori* ordering of participant cohorts, and their different learning needs as inferred in the

previous section. The clustering of fewer than 4 selections was evident and was supported by the distribution statistic findings displayed in Table 4.11.

Table 4.11 *SBME Outcomes: Distribution Statistics*

Distribution Statistics		
N	Valid	153
	Missing	0
Median		4.00
Std. Deviation		2.241
Skewness		.157
Kurtosis		-.849

The positive skewness statistic of 0.157 confirmed the clustering of fewer selections despite the relatively large SD of 2.241. The negative kurtosis statistic of -0.849 supported the median score of 4 and the reduced frequency of scores at the extremities. The majority (n=89 or 59%) of participants selected between 2 and 5 types of outcomes. These findings suggested that the eight Q4 options could be inferred as representative of the types of outcomes or senses of change participants experienced from participation in simulation-learning activities. Therefore, these findings may have reflected the types of outcomes experienced across the cohort spectrum, and mirrored the *a priori* ordering of medical knowledge and clinical experiences respective of each cohort.

Table 4.12 displays the metric results (both numeric and relative) of each Q4 outcome to gain a better idea of the nature of selected changes and the weightings applied to each across the cohorts. This shed more light on the differences associated with the different learning needs of each cohort as initially raised in section 4.3.1. These findings also provided more nuanced insight into the meaning of their learning. For example, the top

outcome for 1st year students was **D**, associated with changes in their beliefs and expectations of the medical role. Whereas for 2nd and 3rd year students, the highest rated outcome was **B** to describe realisation of personal attributes of which they were previously unaware. This was perhaps unsurprising as 1st year students began SBME with basic life support and simulated patient interviews may have challenged and changed their initial ideas about the doctor's role. Second and third year students were however more immersed into the medical culture, which may have led to new personal attributes beginning to emerge as they better found their 'way' through their education and the matrix of medical cultural norms and how they were to 'fit' with such new understanding.

Table 4.12 *SBME Outcomes: Numerical and Relative Frequencies*

	Overall		1st Year		2nd Year		3rd Year+		4th Year*		Interns		PGY Drs	
A	**100**	65%	**11**	61%	**24**	63%	**22**	54%	**9**	100%	**22**	71%	**12**	92%
B	**82**	54%	**7**	39%	**25**	66%	**22**	54%	**3**	33%	**18**	58%	**7**	54%
C	**65**	43%	**9**	50%	**15**	39%	**13**	32%	**7**	78%	**15**	48%	**6**	46%
D	**62**	41%	**12**	67%	**10**	26%	**12**	29%	**3**	33%	**18**	58%	**7**	54%
E	**44**	29%	**6**	33%	**8**	21%	**9**	22%	**4**	44%	**12**	39%	**5**	38%
F	**36**	24%	**7**	39%	**9**	24%	**8**	20%	**3**	33%	**7**	23%	**2**	15%
G	**92**	60%	**10**	56%	**24**	63%	**20**	49%	**8**	89%	**20**	65%	**10**	77%
H	**66**	43%	**8**	44%	**18**	47%	**15**	37%	**6**	67%	**10**	32%	**9**	69%

The most frequent overall finding of **A** (n=100 or 65% of respondents) suggested that most, in response to some aspects of simulation-learning, may have begun to interpret and understand a range of 'things' differently. This finding provided a gauge to infer that a large number of respondents experienced changes in their assumptions, expectations, and

ideas as a result of some aspects of their simulation-learning experiences i.e. transformative learning events. This finding was consistent with section 4.3.1 which inferred participants' simulation-learning experiences were informed by the four central constructs of Mezirow's (1991) Transformative learning theory.

The next highest finding (n=92 or 60% of respondents) – outcome **G**, suggested that most participants reported conscious action or application of their new ways of understanding. The close alignment of this finding with outcome **A**, again inferred the hallmarks of TLT i.e. new perspectives were decisively integrated into existing meaning structures to arrive at new meaning to guide future action (Mezirow, 1991). This aligned with development and action as key aspects of Transformative learning theory as discussed in Chapter 2.

The third highest response of (n=82 or 54% of participants) outcome **B**, inferred that over half of participants may have experienced changes in personal aspects through recognition of new attributes. This coincided with Mezirow's (1991) concept of critical self-reflection where premises underlying assumptions about self are critiqued, and also resonated with his psychological-type meaning perspectives capable of such significant change.

The 4th commonly experienced outcome of - **C** (n=65 or 43%) built upon outcome **B** but also introduced changes in expectations of the medical role per se, thereby attesting to revision in ways participants may have pictured themselves in a future medical role. This aligned with Mezirow's (1991) sociocultural type of meaning perspectives. The inherently interactive and socially dynamic style of SBME appeared to have also prompted many participants to explore new ways of learning - outcome **H** (n=66 or 43% of participants),

which exemplified Mezirow's (1991) transformation in epistemic meaning perspectives. These findings of the types of experienced SBME outcomes resonated with Mezirow's (1991) typology of meaning perspectives, and inferred how the complexity of simulation-learning shaped the way participants' viewed themselves and how they saw themselves in a doctor's role.

Table 4.13 displays the mixture of SBME outcomes specifically for each cohort, and so provides a clearer sense of the nature of changes experienced across the participant spectrum. The aim was to begin to shed further light on the evolving learning needs of each cohort as previously suggested to be associated with their *a priori* ordering of medical knowledge and clinical experience above in section 4.3.1.

Table 4.13 *Cohort Specific SBME Outcomes*

	1	2	3	4	5	6	7	8
Overall	A	G	B	H	C	D	E	F
1st Year Students	D	A	G	C	H	B	F	E
2nd Year Students	B	A	G	H	C	D	F	E
3rd Year Students	B	A	G	H	C	D	E	F
4th Year Students	A	G	C	H	E	B	D	F
Interns	A	G	B	D	C	E	H	F
PGY Doctors	A	G	H	B	D	C	E	F

There appeared to be (highlighted in blue) close association between outcomes **A** – *I have left some simulation sessions seeing 'things' differently* and **G** - *Simulation sessions have*

given me new understandings which I now consciously use across the participant spectrum. This further appeared to suggest that participants had recognised changes in their ideas and applied such to their actions - again hallmarks of Mezirow's Transformative learning theory. This finding also inferred active negotiation of experienced disorientating dilemmas (TLT phase 1) in order to see 'things' differently, as found in section 4.3.1, and applied resultant new understandings.

This finding further supported the previously raised notion that participants may have been developing an increasing level of tolerance for ambiguity (i.e. disorientating dilemmas) in order to progress their learning. This finding resonated with Mezirow's (1991) description of the end-point of Transformative learning theory, i.e. reinterpretation of a past experience (or a new one) through a new set of ideas and expectations, thus giving new meaning and understanding to guide action. This appears to be a reasonable assumption to make, as the SBME setting is an experiential proxy dedicated to eventual transfer to the clinical environment.

The increased association between outcomes **A** and **G** for 4th year students and above mirrored the linear trends which evidenced increased meaning attached to TLT phases, as inferred in section 4.3.1. This further supported the previous findings which suggested the simulation setting provided a context in which more specific focus was applied to SBME participation. Observation of simulation scenarios and debriefing sessions mirrored this focus, through more synchronous interaction, focussed relational communication, specific medical vernacular, and the general presentation of a medical demeanour. These findings therefore further inferred that the simulation setting constituted a space where learning

went beyond discrete skills acquisition, and moved towards how participants collectively enacted the complexity of the elements which made-up a professional identity as a doctor. This is further explored below in section 4.3.3 and in subsequent chapters.

Another finding presented in Table 4.13 showed outcome **B** - *Simulation has helped me recognise personal attributes I did not know I had* was ranked first by 2nd and 3rd year students and third for interns. This finding suggested that students in the early to middle years of their courses could have began to recognise new aspects of themselves, and that interns may have had a similar experience associated with their new junior doctor positions. These findings again supported the above suggestion that the simulation setting provided learning beyond discrete skills acquisition. These findings may have further indicated that simulation-learning triggered and supported learners to change ideas about themselves as they negotiated a better 'fit' with the doctor's role, and how they saw themselves to occupy this socially privileged position.

The overall nature of the SBME outcome findings presented in Table 4.13 suggested a meaningful pattern of transformative learning across the cohort spectrum. First year students appeared to experience changes of their initial ideas about the doctor's role, 2nd and 3rd year students appeared to experience changes in aspects of themselves, and 4th year students, interns and PGY doctors appeared to experience an array of outcomes related to their current clinical roles. These findings again inferred differences were representative of the *a priori* ordering of their knowledge and experience, as statistically evidenced in section 4.3.1.

The Jonckheere-Terpstra (J-T) test was again used here to shed further light on these SBME outcome differences to look for possible meaningful order, and to examine whether these were statistically significant. This analysis tested the H_0 that the distribution of perceived changes/outcomes was the same across the participant spectrum.

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Perceived Changes is the same across categories of Participant.	Independent-Samples Jonckheere-Terpstra Test for Ordered Alternatives	.390	Retain the null hypothesis.

Test statistics of: $j = 4715.5$, $z = 0.860$, $p > 0.05$ indicated retention of the null hypothesis, which suggested the overall distribution of changes/outcomes across sample groups was not statistically different, despite variations illustrated above. This provided the evidence to infer that all respondents (n=153) may have experienced a similar array or matrix of simulation-learning outcomes, which reflected the complexity of learning across the participant spectrum within the SBME setting. This complexity was now inferred as relating to, not only the development of discreet skill competencies, but also to the development of new understandings about aspects of self, the medical profession, and how participants' envisaged themselves as a doctor. In other words, these findings suggested participants may have attached meaning to their SBME experiences to find a better 'fit' with the doctor's role, and so develop or progress their evolving professional identity as a doctor.

In the above two sub-sections, Simulation Survey findings were presented from two discrete perspectives: 1) experienced Transformative learning theory phases, and 2) perceived simulation education outcomes. These findings suggested that learning within the SBME context could depict Mezirow's (1991) Transformative learning theory, and inferred that changes in assumptions and ideas occurred in various areas, including aspects of self and the doctor's role. Together, these findings show reasonable evidence to state that learning differences and outcomes can be experienced across the participant spectrum, with apparent progression from the 1st year medical student level to clinical doctor, which look to align with the natural *a priori* ordering of each cohort reflective of their medical knowledge and clinical experiences.

In the next sub-section I examine the association between the above identified TLT phases and SBME outcomes to further explore the extent and nature of transformative learning which has thus far been evidenced that could be triggered and supported by the simulation-learning context. This analysis provides a finer focus on both the first research question and objectives 1 & 2, and gives initial insight into the second research question and research objectives qualitatively followed-up in the next chapter.

4.3.3 Association of TLT Phases and SBME Outcomes

This sub-section further explores the extent of Mezirow's TLT within the simulation-based medical education context, and examines the association between the TLT phase findings in 4.3.1 and the SBME outcome findings in 4.3.2. Stated another way, analysis examines whether the inference can be made that transformative learning phases led to or had a correlation to participants' selected simulation-learning outcomes. Crosstabulation and

nonparametric statistical tests are used to determine and quantify possible association. This analysis looks for further evidence to more confidently infer participants' SBME experiences can be transformative in nature, and so align with Mezirow's (1991) theory of the process transformative adult learning.

The Pearson chi-square (χ^2) test was again used to examine association, with its resultant significance value (*p*) an indicator of whether TLT phases and SBME outcomes were independent or in some way related. This test was appropriate here as it did not rely on the assumption of normally distributed data (Field, 2009). The strength of associations was measured by the *Phi* and *Cramer's V* correlation coefficient statistics, and the odds ratio was used to quantify the effect size (Field, 2009). In this instance, association between TLT phases and SBME outcomes was measured as a directional one-tailed test (Field, 2009) i.e. phases resulted in particular outcomes. The chi-square χ^2 tested the H_0 of variable independence or no association.

Analysis used the transformative learning framework evidenced in sub-section 4.3.1 - reflection (**phase 2**), disorientating dilemma (**phase 1**), planning action (**phase 6**), dialogue/feedback (**phase 9**), and collective learning (**phase 4**). The SBME outcomes used were: **B**, **C**, **D**, **G, E, and H** from section 4.3.2 as they were thought to capture the overall transformative nature of SBME outcomes. Association findings are displayed in Table 4.14. This analysis was extensive, as reflected by the density of findings displayed. Full descriptive text for each outcome is again presented in the narrative to facilitate reading.

These association findings presented in Table 4.14 further expand previous suggestions of *how* study participants may have experienced their transformative learning SBME sessions, and provide additional insight into the nature of these experiences or inference as to *why* participants selected these SBME outcomes when completing their Simulation Surveys.

Table 4.14 *Associations of TLT phases & SBME Outcomes*

		Chi-square X^2 (1)	Phi & Cramer's V	Sig. (one-tailed)	Odds Ratio
Outcome **B**					
	Reflection (2)	4.408	0.171	$p < .05$	4.59
	Dialogue (9)	4.796	0.179	$p < .05$	2.37
	Action (6)	4.837	0.185	$p < .05$	2.43
Outcome **C**	Reflection (2)	15.222	0.319	$p < .001$	6.64
	Dialogue (9)	3.475	0.152	$p < .05$	2.16
	Action (6)	12.718	0.346	$p < .001$	5.58
	Dilemma (1)	4.567	0.174	$p < .05$	2.83
	Collective (4)	7.181	0.219	$p < .05$	3.15
Outcome **D**	Reflection (2)	8.104	0.232	$p < .05$	2.74
	Dialogue (9)	7.803	0.228	$p < .05$	3.47
	Action (6)	11.087	0.272	$p < .001$	5.05
	Collective (4)	3.973	0.163	$p < .05$	3.25
Outcome **G**	Reflection (2)	6.084	0.201	$p < .05$	2.33
	Dialogue (9)	7.532	0.224	$p < .05$	2.93
	Action (6)	22.643	0.389	$p < .001$	7.41
	Collective (4)	7.435	0.223	$p < .05$	5.78
Outcome **E**					
	Dilemma (1)	6.587	0.215	$p < .05$	5.82
	Collective (4)	4.647	0.176	$p < .05$	4.76
Outcome **H**					
	Action (6)	4.161	0.167	$p < .05$	2.39

Numbers in brackets denote respective TLT phase.

This mapping of association between TLT phases and SBME outcomes provided further support to this chapter's previous findings which evidenced the transformative nature of

learning possible within the SBME setting. Chi-square (3.475 to 22.643) findings indicated directional association of TLT phases leading to certain SBME outcomes. The statistical significance *p* values (all at least $p < 0.05$) inferred these directional associations were unlikely to have happened by chance (Field, 2009). Therefore the H_0 of independence was rejected. The *Phi* and *Cramer's V* findings inferred association with strength measurements ranging from high-low - 0.152 to high-medium - 0.389 (Pallant, 2010). Odds ratio (2.16 to 7.41 times higher) findings generally suggested that SBME outcomes were more likely to have occurred if the associated TLT phases were experienced (Field, 2009). This detailed analysis of association provided the findings to more confidently infer that SBME represented a Transformative learning context, as contextualise be Mezirow (1991).

For example, the outcome **C** - *I have begun to reshape the way I see myself as a doctor (my medical role) in the future* was crosstabulated with reflection: χ^2 (1) = 15.222, *Phi* and *Cramer's V* = .310, $p < .001$, and odds ratio = 6.64. These statistics inferred a medium association (Pallant, 2010), with the odds of respondents having reshaped their views of themselves as a doctor were 6.64 times higher if they had engaged in reflection. This finding supported the importance of reflection (TLT phase 2) as indicated in Table 4.9 in sub-section 4.3.1.

Outcome **G** - *Simulation sessions have given me new understandings which I now consciously use* crosstabulated with planning action: χ^2 (1) = 22.643, *Phi* and *Cramer's V* = .389, $p < .001$, and odds ratio = 7.41. These statistics inferred a high-medium association (Pallant, 2010), with the odds of participants' conscious application of new understandings

7.41 times higher if they had engage in planning action (TLT phase 6). This corroborated the ascending linear-by-linear trend of TLT phase 6 identified in 4.3.1.

Another association finding again suggested the hallmarks of Transformative learning: **E** - *Some of my long-held views and ideas have been challenged* crosstabulated with D. Dilemma: - χ^2 (1) = 6.587, *Phi* and *Cramer's V* = .215, $p < .05$, and odds ratio = 5.82. These statistics measured a medium association (Pallant, 2010), with the odds of participants having had their long-term views and ideas challenged were 5.82 times higher if they had experienced a disorientating dilemma (TLT phase 1) or feeling 'out of my comfort zone'. When **E** was also crosstabulated with collective learning (TLT phase 4): χ^2 (1) = 4.647, *Phi* and *Cramer's V* = .176, $p < .05$, and odds ratio = 4.76, statistics inferred changes to ideas about learning, together with the emerging influence of collective learning. This supported the inference of increasing importance participants placed on the collective nature of SBME, as found in the trend analysis findings of sub-section 4.3.1.

The extensive nature of the measurement of association findings presented in Table 4.14 evidenced the H_1 of a directional association between TLT phases and SBME outcomes. Stated another way and assuming the H_0 of no association, the *p* values suggested the probability of obtaining these measures of association in a sample of 153 participants was very close to zero (Field, 2009). Therefore, these findings further infer that the simulation-based medical education setting can be viewed as an educational context which triggers and supports Mezirow's (1991) Transformative adult learning theory.

In order to gain further insight into the meaning participants may have attached to their selected SBME outcomes, association between the outcomes displayed in Table 4.14 was also measured. This examined for possible correlation between each outcome (2x2) which may have been jointly selected. The nonparametric tetrachoric correlation coefficient (rho) was chosen as appropriate to measure such association. Briefly, rho quantifies bivariate relationships and tests the H_0 of independence (Field, 2009). As the Simulation Survey Q4 SBME outcome variables were binary, rho was an appropriate and readily interpretable measurement of association (Uebersax, 2006).

Analysis of all eight SBME outcome variables produced a large number of multivariate findings (i.e. multiple pairwise analysis) which increased the likelihood of a Type 1 error i.e. rejecting the H_0 when it was true (Field, 2009). As such, the Sidak correction statistic was applied to mitigate (via adjustment to calculated *p* levels) such error probability whilst maintaining the level of analytical power (Field, 2009). Associations were examined non-directionally i.e. two-tailed test with no dependent variable, and the statistically significant findings of $p < 0.05$ (n=10) are highlighted in Table 4.15. The StataCorp (2014) statistical software package was used for this analysis. The informative value evidenced by these findings is discussed below.

Table 4.15 *Tetrachoric Associations of SBME Outcomes*

		A						
		***Tetrachoric correlation coefficient**						
B	T. Coefficient*	0.15	**B**					
	Sig. (*p*)	0.999	.					
C	T. Coefficient*	0.4	0.59	**C**				
	Sig. (*p*)	0.078	0.000	.				
D	T. Coefficient*	0.31	0.42	0.61	**D**			
	Sig. (*p*)	0.471	0.024	0.000	.			
E	T. Coefficient*	0.42	0.33	0.47	0.73	**E**		
	Sig. (*p*)	0.107	0.409	0.014	0.000	.		
F	T. Coefficient*	0.44	0.29	0.53	0.61	0.52	**F**	
	Sig. (*p*)	0.116	0.791	0.002	0.000	0.01	.	
G	T. Coefficient*	0.44	0.53	0.27	0.35	0.31	0.34	**G**
	Sig. (*p*)	0.02	0.000	0.711	0.178	0.557	0.572	.
H	T. Coefficient*	0.23	0.33	0.19	0.11	0.08	0.12	0.37
	Sig. (*p*)	0.968	0.305	0.996	1.0	1.0	1.0	0.115

The ten highlighted rho coefficient findings were all positive which inferred association between these SBME outcomes. The significance values (n=5 $p < 0.001$ and n=5 $p < 0.05$) further suggested a lack of independence, with the likelihood of chance association being very close to zero (Field, 2009). Thus the H_1 of association was accepted and the H_0 of mutual independence was rejected. The strength of these association findings ranged from 0.42 to 0.73 which quantified associations as medium to very large respectively (Pallant, 2010; Field, 2009). These findings provided further informative insight into the meaning participants' may have attached to their senses of change or outcomes arising from participation in simulation-learning activities.

For example, association between **E** - *Some of my long-held views and ideas have been challenged* & **D**- *My beliefs and expectations of the doctor's role have been reshaped from*

my original ideas: the rho coefficient of 0.73 suggested a very large and highly significant (p<0.001) correlation. This finding inferred that participants may have had, at some stage during their SBME experiences, made significant changes to their long-held expectations and views of the doctor's role.

Another firm (0.47) and significant (p<0.05) association was found between outcomes **E** and **C** - *I have begun to reshape the way I see myself as a doctor (my medical role) in the future*. This finding suggested participants may have been prompted by their simulation-learning experiences to reshape their long-held assumptions of how they saw themselves as a doctor. This finding resonated with the professional identity theme raised earlier.

The association finding between **G** - *Simulation sessions have given me new understandings which I now consciously use* and **B** - *Simulation has helped me recognise personal attributes I did not know I had*, revealed another large (0.53) and highly significant (p<0.001) correlation. This finding suggested participants may have made changes to how they viewed themselves which they had integrated with their medical experiences. Other firm and significant association findings between **B** and the SBME outcomes of **C** (0.59, p<0.001) & **D** (0.42, p<0.05) also evidenced participants' renegotiation of aspects of themselves and how they may have envisaged themselves in a doctor's role. This cluster of association findings more firmly inferred development or evolution of participants' sense of a professional identity as a doctor, which perhaps involved a complexity of negotiated changes or transformations.

Analysis of the SBME outcomes **F** - *My beliefs and opinions of the social complexities of healthcare have been restructured*, and **C** (0.53, $p<0.001$), **D** (0.61, $p<0.001$), & **E** (0.52, $p<0.05$) also revealed large and significant associations. These findings collectively suggested that simulation-learning experiences may have gone beyond discrete skill acquisition, and extended to the relational elements of medical practice e.g. social interaction between peers, clinical educators, and patients. These findings again inferred participants' expansion in their understanding of what 'becoming' and 'being' a doctor involved, or the evolution of a professional identity in medicine.

Finally, the close approximation of **A** - *I have left some simulation sessions seeing 'things' differently* and **G** - *Simulation sessions have given me new understandings which I now consciously use* (as previously found), resulted in a medium strength (0.44) and significant ($p < 0.05$) association finding. This supported previous results which suggested that the simulation setting prompted and supported the overall Transformative learning cycle as posited by Mezirow (1991). This finding also supported the previous notion raised of SBME being a bridge to the clinical setting, over which new understandings were transferred to clinical roles.

Overall, these tetrachoric correlation coefficient findings suggested that participants may have attached significant meaning to their simulation-learning experiences as opportunities to understand and develop (i.e. transform) their professional identity as a doctor.

4.4 Chapter Conclusion

This chapter addressed the first research question and the research objectives 1 & 2 by presenting Simulation Survey findings from three perspectives. Section 4.3.1 evidenced a SBME transformative learning framework which was suggested to be inclusive of the four constructs long-associated with Mezirow's (1991) Transformative learning theory: disorientating dilemmas, reflection, dialogue/feedback, and planning action. Findings inferred these could be experienced differently and suggested that participants could have placed different meanings upon their learning reflective of their *a priori* levels of medical knowledge and clinical experience. These differences suggested that simulation-learning sessions could have taken-on more specific meaning (or temporal development) as participants developed their clinical knowledge, skills and expertise.

Findings presented in section 4.3.2 depicted participants' senses of change or outcomes from their simulation-learning experiences. These were suggested to have included changes in assumptions and ideas about medicine, refinement to aspects of themselves, new ways they viewed the doctor's role, and new ways they envisaged themselves in the future as a doctor. A temporal theme was also evidenced throughout these findings, where early-stage students may have adjusted their initial ideas about medicine, middle-stage students may have refined their ideas about themselves, and later-students and doctors could have refined the ways they viewed themselves as being a doctor. The theme of devolvement of a professional identity was then suggested to have emerged from these findings.

Section 4.3.3 presented findings where associations between the TLT phases and SBME outcome results were evidenced. Findings inferred a nexus which led to the suggestion being made that the simulation-based medical education setting was a Transformative learning context. Findings also inferred that participants' meaning applied to their learning may have surrounded new understanding in how they envisaged themselves in a future medical role. The overall theme of this section's findings was suggested to be the transformative development of participants' identity as a doctor, and its transfer to the clinical setting.

This chapter's statistical findings have provided reasonably strong empirical support of this study's originally posed tentative model, and suggest the simulation-learning setting is able to trigger and support transformative learning which can be associated with development of a professional identity as a doctor. The evidenced differences between the six cohorts are less certain, which is further investigated in the next chapter.

Findings from the qualitative stage of this study are presented next, where the Transformative learning framework evidenced in this chapter is expanded to gain further understanding of the nature of the identity-related dimensions of participants' simulation-learning experiences, together with the differences between each cohort which were identified in this chapter's analysis.

5 Identity 'Redecoration'

> *Our furnishings and ourselves are accreted idiosyncratically, and while "redecorating" our identities may be exciting and clashes are inevitable… Identities often conflict, as they may do as we acquire new identities over time… Identities are not uniform and there is a great deal of individual variation in how people experience….and how their identities will interact with a new professional identity* (Costello, 2005, p. 24 & 25)

5.1 Introduction

The Simulation Survey findings presented in the previous chapter provided reasonable strength to suggest that participants' simulation-based medical education (SBME) experiences could be transformative in nature, through changed assumptions and ideas about themselves, the medical profession, the doctor's role, and how they viewed themselves as a future doctor. Findings also inferred differences between this thesis' six participant cohorts, with the notion of apparent progression from 1st year medical students to practicing doctors. Whilst survey findings were less certain about the nature of these differences, they provided evidence to suggest that simulation-learning experiences could reach beyond discrete skills acquisition, and extended to participants' development of their evolving professional identities in medicine. The interview and observational findings presented in this chapter complement and expand upon these quantitative results and so triangulate findings. The second research question and the second and third research objectives are addressed in this chapter:

***Research question 2*:** What are the identity related dimensions of learners' Transformative simulation-learning experiences?

***Research objective 2*:** To understand the nature of participants' transformative learning as triggered and supported by their SBME experiences, and

***Research objective 3*:** To understand how SBME supports professional identity development.

Interview and observational findings presented in this chapter illustrate the overall varied nature of medical students' and doctors' experiences of '*redecorating*' aspects of their identities, as triggered and supported by participation in simulation-learning activities. Resonating with Costello's quote above, these experiences are described as '*exciting*' but are also characterised by the complexity of various tensions and ambiguities where '*clashes are inevitable'*. Findings exhibit such identity related clashes often arose from conflict with elements of participants' self-concept and newly experienced aspects of the doctor's role. This is shown to have prompted agentic negotiation of such conflict aimed at resolution, and so expand participants' understanding of the doctor's role and how they could envisage themselves occupying this privileged social position. The Transformative learning theory (TLT) framework, as evidenced in the previous chapter, is seen to inform this active resolution as participants transition towards finding their place in the medical community. This chapter's findings also provide clearer understanding of the cohort differences inferred in the previous chapter's quantitative analysis.

Section 5.2 presents interview and observational findings structured around the phases of the Transformative learning framework: **Disorientating dilemma** (phase 1), **Reflection** (phase 2), **Collective learning** (phase 4), **Planning action** (phase 6), and **Dialogue/feedback** (phase 9). This integration of findings captures the essence and meaning of participants' experiences voiced in their narratives and observed in their actions during both simulation scenarios and post-simulation debriefing sessions. Deeper understanding of *why* participants' experienced their simulation-learning as they did, together with cohort differences is further uncovered, which helps to clarify some of the less certain results which remained following quantitative analysis of Simulation Surveys.

Appendices *E* and *F* show examples of interpretation and presentation of observation findings for 1st year medical students' BLS sessions and doctors' high-fidelity simulation scenarios and post-simulation debriefing sessions. The four main themes identified throughout observation data analysis were: *Behaviour*, *Vernacular*, *Knowledge Application*, and *General Demeanour*. These findings encapsulate the observed development and refinement of participants' professional identity as a doctor which can take place during SBME.

This merger of quantitative and qualitative findings forms this thesis' empirical response to its tentative model, and captures participants' transformative simulation-learning experiences associated with their temporal formation of a professional identity as a doctor. This thesis' Simulation Identity-formation Model (SIM) encapsulates this response and is diagrammatically presented and discussed in section 5.3.

Delineated below is the number of one-hour individual interviews, observed SBME sessions (each 2 to 3 hours), and electronic interviews which formed the data sources of this chapter's qualitative findings.

Table 5.1

Individual Interviews

Interviewee	No.
1st Year*	4
2nd Year*	5
3rd Year*	6
4th Year*	5
Interns	2
PGY+ Doctors	4
Total	**26**

* Medical Students

\+ Post Graduate Years 1 & 2

Table 5.2

Observed SBME Sessions

SBE Participants	Observed Sessions
1st Year*	7
3rd Year+	6
4th Year+	6
Interns+	8
PGY Doctors+	5
Total	**32**

*Basic Life Support (BLS)

+Advanced Life Support (ALS) & Formal Post-Simulation Debriefing

Table 5.3

Electronic Interviews

Interviewee	No.
1st Year	4
2nd Year	2
3rd Year	2
4th Year	1
Interns	2
PGY Doctors	1
Total	**12**

5.2 SBME & Professional Identity Formation

To being the presentation of the qualitative findings of this thesis, Table 5.4 sets-out the structure of how these are organised into substantive themes and their respective dimensions to orient the reader to the extensive range of findings.

Table 5.4 *Schema of Qualitative Findings*

Substantive Themes	Dimensions
Identity Misalignment	• *Dropping the ego* • *How close should I get?* • *Communication and rapport* • *Social complexities* • *Impediment to my learning*

	• *I think and react differently* • *Leadership ambiguity* • *I can't enact my professional identity* • *Am I supposed to be a doctor?* • *I feel safer in my clinical role*
Identity Transformation	• *Pretty helpless* • *A little fish* • *Up to Scratch* • *My patients would appreciate it* • *Asserting my authority* • *I am a Doctor*
Internally-steered	**Reflection:** • *I can 'do' something* • *My 'doctor' image* • *Holistic approach* • *Things I've gone in with* • *Unconsciously competent* • *You can get through anything* • *A normal part of the job* **Planning Action:** • *Effective and safe doctor* • *I can do this* • *Thinking like a doctor* • *I feel I'm good at that* • *Refining the process* • *I have to know enough* • *Manage that stage*
Externally-steered	**Feedback:** • *Safety Net* • *Just that little bit better* • *Real-time & Dynamic* **Collective Learning:** • *A more objective view* • *Constructive critique* • *Able to steer us* • *We crave it*

The four substantive themes presented below are: *Identity Misalignment*, *Identity Transformation*, *Internally-steered*, and *Externally-steered*. The titles for these themes and their dimensions were taken from participants' words where possible to reflect the linguistic nuances and often deeply felt meaning underlying their rich stories - *in vivo* codes (Strauss & Corbin, 1998; Charmaz, 2006).

5.2.1 Identity Misalignment

Findings presented in this section reinforce the Simulation Survey finding which showed the majority of participants (n=128 or 84% of 153) could experience feeling 'out of [their] comfort zone' (TLT phase 1) during some simulation activities. Identity misalignment is seen to arise from the identity dilemmas or conflicts experienced as participants engaged in simulation-learning activities which incorporated a mixture of the elements that constituted the medical role. The dimensions of identity misalignment presented capture the array of conflicts often experienced as participants encountered a myriad of medical tasks and developed their ideas of what 'becoming' and 'being' a doctor involved. Participant's identity misalignment therefore surfaced as their understandings of the medical role evolved. For example, expectations, norms and values of the professional role did not always align with assumptions and ideas of themselves i.e. 'the self as reflexively understood by the person'(Giddens, 1991, p. 53). Costello (2005) has called this misalignment 'identity dissonance' where aspects of one's self-identity are dissonant with those of a newly pursued professional identity. Participants in this study consistently and emotively expressed such dissonance during their interviews, notwithstanding whether they were a 1st year medical student or clinical doctor.

Identity misalignment findings resonated with the ambiguity and complexity notions inferred by Simulation Survey findings which showed that identity misalignment could be experienced across the six participant cohorts. Findings presented throughout this chapter illustrate participants' transformative experiences were not random, and so meaning was attached to such changes, and were not made 'for change sake'(Illeris, 2014).

The dimensions of Identity Misalignment are : *Dropping the ego*, *How close should I get?*, *Communication and rapport*, *Social complexities*, *Impediment to my learning*, *I think and react differently*, *Leadership ambiguity*, *I can't enact my professional identity*, *Am I supposed to be a doctor?*, and *I feel safer in my clinical role*. These dimensions illustrate the diverse nature of identity conflicts which could be triggered by new and often unanticipated components of the doctor's role experienced during SBME sessions. Narratives were pervasive with the notion of inauthenticity, with participants recognising they were attempting to play a role rather than doing things which came 'naturally' to them (Costello, 2005). Each of these ten dimensions is discussed below.

5.2.1.1 Dropping the Ego

'Dropping the ego' was a relatively broad and commonly experienced identity dilemma noted by 1st year medical students. James' narrative succinctly illustrates how they often encountered such conflict early in their medical education through simulation-learning. Identity misalignment in this instance arose when James' high self-regard and views of self did not 'fit' with the expected enactment of various aspects of the medical role during simulation activities.

James 1st year medical student:

> *'….a lot of people don't like being told what they're bad at and I definitely don't… I came to medicine too confident with what I know and who I am [and]like yeah, medical school definitely taught me to, kind of, drop my ego'*

It is evident from what James narrated that as his understanding of the doctor's role began to develop, his long-held ideas about himself, as reflexively understood, were challenged and questioned. His comment also indicated there was a certain degree of negotiation required between views of self and views of the medical role in order to form new understandings and gain more meaning of what 'becoming' a doctor entailed.

5.2.1.2 How Close Should I Get?

Another example of the discomfort experienced by early-stage medical students where they were taken out of their comfort zones, was evident with their close proximity to patients as part of the doctor-patient relationship. Susan's discomfort appeared associated with important internal values regarding personal space, physical contact, or 'proximity' preferences, which did not coincide with her newly experienced expectations or requirements of the doctor's role.

Susan 1st year medical student:

> *'I think it [SBME sessions] has highlighted the fact that I'm quite anxious in situations where I'm actually having to touch an SP, patient or mannequin. I feel quite tentative about touching and I feel quite anxious… I probably still don't actually know how close I should get…because that's still something that I'm trying to develop in my head. I'm still unsure'*

It is clear Susan's feelings provoked ambiguity, anxiety and stress for her in terms of knowing and understanding how to enact or carry out early-stage medical simulation activities involving close contact. It also appeared that Susan was trying to form new meanings about her experiences in order to guide future action, and so examined her reflexively understood 'proximity' preferences in order to meet her professional

expectations. This finding was reinforced in the observations of seven 1st year simulation sessions, in which participants showed similar anxiety as expressed by Susan, and where awkwardness and general discomfort in relation to touching patients was clearly evident.

5.2.1.3 Communication and Rapport

Medical students are socialised early during SBME sessions to use communication and rapport-building skills as important aspects of the medical role. As this study's graduate-entry students come from an eclectic range of backgrounds, it is perhaps unsurprising many experienced a sense of discomfort when their ideas or preferences for communication and interpersonal interaction did not fit with expectations or norms of the medical culture. For example, James clearly regarded himself as being highly skilled in communication with children as a result of his previous career as a primary school teacher, and this was held in high regard by him and informed important aspects of himself. However, he clearly articulated a '*weaknesses*' surrounding his communication and rapport-building skills with adults. This reflected the experiences of other participants in this study who encountered a dilemma when unable to 'be their usual selves' when communicating with others during SBME sessions.

James 1st year medical student:

> *'I've done a bit of teaching and that kind of thing, so, I do know I'm good at developing rapport with children, but, adults are different and I had only a vague understanding, and this [SPs] kind of confirmed it. It identified my weaknesses and what I need to get better.*

It can be seen that identity misalignment arose when James was unable to enact his communication and rapport skills with adults. He experienced difficulty in making meaning of the new medically-based communication strategies encountered during simulation sessions. It is evident however, that James was motivated to refine these aspects of himself in order to address his acknowledged weaknesses to improve his communication skills to be a better doctor, he said: '*I need to get better*'.

5.2.1.4 Social Complexities

1st and 2nd year students frequently narrated dilemmas surrounding the social complexities of the social status of a doctor and the hierarchical nature of the medical profession. Stephen encountered identity misalignment through '*not knowing*' how to make meaning of and interpret newly encountered medical social situations. During his interview he indicated his evolving understanding of the social realities of the medical culture was in conflict with deeply-felt personal elements, and so his 'place' or social position was ambiguous and uncertain.

Stephan 2nd year medical student:

> *'...they're [SBME sessions] very, very kind of abnormal situations that you haven't encountered socially which make it very awkward, and the simulation presents that to you… it was more of a social thing where I wasn't prepared for these very different, awkward situations that I hadn't encountered before –I think the anxiety came with not knowing[and] maybe my social kind of things have changed, and like I'm on my way to get [understand] that'*

Stephen's narrative exemplified how participants could be taken out of their comfort zones by the unanticipated and complex social dynamics of the medical profession experienced

during simulation-learning activities. Despite the experienced ambiguity and stress, Stephen confidently stated the motivation to resolve his dilemma or identity conflict: '*I'm on my way to get [understand]* that'. Stephen therefore acknowledged these instances of conflict and ambiguity as learning opportunities that could resolve his feelings of identity misalignment and '*not knowing*'.

5.2.1.5 Impediment to My Learning

Other important personal concepts often challenged by simulation-learning were participants' beliefs and values regarding knowledge and ways of knowing. It was evident that some medical students had expectations of learning with 'real' patients rather than clinical simulated 'proxies', and therefore experienced dissonance when these expectations were not realised. For example, Meghan responded with deeply felt conviction about the misalignment between her ideas and preferences for knowledge and learning and that presented by the simulation-learning context. Her narrative reflected her difficulty in suspending disbelief, a process that simulation educators argue is important to get the most out of learning in simulated medical scenarios.

Meghan 2nd year medical student:

> *'Because the patient is acting and I know that they are acting [it] feels a lot more like acting than actually practicing medicine…I felt uncomfortable because it [SP interview]sounded quite a false situation. SimMan - I still don't really think of it as a real life situation ever, it is too far removed… the scenarios and the mannequins that talk to you and stuff, that doesn't work for me at all really… I think it doesn't prevent me [from learning], but it certainly is an impediment to it'*

This nature of identity misalignment was shared by other 1st and 2nd year students whose expectations about knowledge and learning had been formed in other settings, previous careers, and during prior undergraduate study. Meghan's background as a lawyer meant that she valued factual and evidential knowledge and ways of knowing, both of which are privileged in the legal industry. The type of knowledge and forms of knowing encountered within SBME clearly did not fit with these expectations, and so ambiguity and conflict surrounded her experiences of learning, making meaning and taking action. However, Meghan's comment '*it doesn't prevent me*' suggested that she was negotiating her dissonance to help her continue learning in a new setting, through finding 'a fit' with her previous professional self as a practicing lawyer and her current identity now as a medical student pursuing a new career direction i.e. a professional identity as a doctor.

Phillip experienced a similar identity misalignment, triggered by his past career as a physiotherapist. His preference was for learning with '*real patients*' for making meaning in order to guide action, and simulation did not enable him to realise these expectations to enact his already established identity as an allied healthcare professional.

Phillip 3rd year medical student:

> *'I think all anxiousness there [SBME] is completely from within [but] for me, a lot of the time is with the SimMan stuff… when I did physio from second year we were with patients and that's how we learnt that's how I learn…real patient have a complete life story [and] simulation completely ignores the psycho-social side of medicine …that's why I think when it came to medicine and then with everything is attempted to be done through simulation it's hard, it felt like a bit of a backward step'*

Phillip's identity dilemma is interesting, as he entered medical education from a healthcare background, yet still experienced intense misalignment with the need for developing a new

identity as a medical student. Both Meghan and Phillip revealed another dimension of the sense of ambiguity and challenges participants experienced in relation to their evolving understanding of the medical role and their self-concept as reflexively understood (Giddens, 1991).

5.2.1.6 I Think and React Differently

Another aspect of self identity that was often challenged by simulation-learning sessions related to participants' expectations regarding their thought-processes and reactions. Collette indicated she experienced an intense discord between her thought processes and behaviours as enacted during simulation sessions, which were misaligned with the more logical and reasoned processes expected in medical practice. Collette's use of '*shocked*' and '*quite surprising*' suggested she experienced intense challenge to previously unquestioned ways of thinking and reasoning, and so perceived a degree of uncertainty and misfit with the medical role.

Collette 3rd year medical student:

> *'I was quite shocked myself, I honestly did find it quite surprising [as] my reactions to things [during SBME sessions] are sometimes different to what I think and the way I react is different than I expect to react…I found that I became quite disorganised and not necessarily as logical as I thought I would be in that situation… I guess it does make me more aware that in that situation I am not as logical and so I need to be more prepared.*

Despite her misalignment, Collette stated '*I need to be more prepared*', suggesting she understood the nature of her dissonance and was motivated to resolve this conflict and so resolve future similar dilemmas. Collette's conflict with altering her thinking patterns was

mirrored by other students, and illustrated the challenges in becoming clinical thinkers which was often a new domain of reasoning for medical students. Such misalignment resonates with both Bourdieu (1977) and Costello's (2005) constructs of habitus or unconscious identity, and was often unanticipated and encountered with shock or surprise. Collette's dissonance was often observed during debriefing sessions of 3rd year students following advanced life support scenarios, where 'surprise' and sometimes 'disbelief' was stated in reference to the ways they thought through and enacted fast-paced medical situations. This was observed to create heightened discomfort.

5.2.1.7 Leadership Ambiguity

The construct of leadership was often another trigger for identity misalignment, whereby expectations about self as a leader conflicted with the medical leadership role expected to be enacted during simulation sessions. Such conflict was narrated by students in the later stages of their education and doctors when participating in high-fidelity scenarios. For example, Simon was taken out of his comfort zone by the conflict between his personal leadership values and orientation, as shaped by his military background, and the leadership role and values expected within the medical profession. His previous role as a military tank commander no doubt shaped his frames of reference and self-identity, which the more '*fluid*' '*leadership values*' of the medical culture challenged. This meant that for Simon, the entire foundation on which he based his ideas about leadership and made sense of and enacted his role during SBME scenarios was threatened.

Simon 4th year medical student:

> *'…coming from a position where leadership was defined quite clearly as to what it did and it didn't involve and what your role was, I found it at times a bit challenging… I have a military background as a tank commander and you're expected to show leadership [and]it's very clearly defined as to what that does and does not involve, as opposed to in the [SBME] setting where that leadership role is almost a flawed concept, where, depending on the situation, the leadership values change… so it's a very fluid concept…So I've found personally that you're a team member [and] no one is any better or any worse than anyone else'*

Simon's dissonance regarding leadership and teamwork was clearly articulated, and despite this identity misalignment, Simon was an additional exemplar of an individual enacting the motivation to resole his conflict. He indicated he worked through his ambiguity over time to better align with the leadership style expected of a medical professional identity, as shaped by the team member concept - '*you're a team member'*. Such renegotiation was a significant change from his military background where leadership was '*very clearly defined*'.

Another example of leadership ambiguity was provided by Kim whose prior career as a Registered Nurse (RN) had firmly shaped her self-concept leadership values and assumptions surrounding autonomous decision making. Her assumption '*other people would know more*' reflected the professional cultural values reinforced during her time as an RN, and which had no doubt shaped a central part of her self-identity. This was challenged by the leadership expectations within the SBME learning environment and triggered identity dissonance for Kim.

Kim PGY 2nd year:

> *'I think as an RN, with that RN stuff, I still hung back a little bit or assumed other people would know more than I did, so it's something I have to force a bit more in myself… I've realised with the*

[SBME] scenarios that it is an effort for me to go - I'm the decision maker here…I think if you come into medicine without that [RN background] you have a natural – maybe it's not natural, but you develop a belief very quickly that supports you just naturally taking a leadership role'

Kim was a clear example of the potential leadership dissonance between healthcare professions. However, Kim's comment '*I've realised with the [SBME] scenarios that it is an effort for me to go - I'm the decision maker here*', illustrated she was aware of the reasons for her discomfort and was using the SBME context as an opportunity to reconcile her nursing-based leadership values and the dissonance with that of medicine. Kim's story was a powerful example of transformative professional identity development of an already practicing clinical doctor, and showed such formation can be an on-going journey. Observation findings also uncovered doctors' wish to both display and expand their clinical knowledge and skills for transfer to their clinical practice.

5.2.1.8 I Can't Enact My Professional Identity

For participants with a firm foundation of clinical experience i.e. 4th year students, interns, and PGY doctors the contextual change to the SBME setting often triggered dissonance related to the sensed inability to enact their perceived established professional identities at their respective levels of knowledge and experience. This inability to be 'who they were' in the clinical setting was an overt situational dilemma for these participants. Martin firmly stated his dissonance with being unable to enact his developed and internalised professional identity in the SBME context. He commented '*it's frustrating and I can't forget how I am on the wards*', reflecting that as a fourth year student he had spent considerable time in the clinical setting and now viewed real patient interaction as a key

element of his professional identity. This illustrated he had become immersed in and internalised the cultural norms of the medical profession.

Martin 4th year medical student:

> *'There's a bit of dissonance that you feel, especially after going through a few years of medicine dealing with a dummy compared to a real patient…my reactions and behaviour are different in that room [SBME lab] than it would be in a patient's room [and]I felt uncomfortable in the sense that I wanted to treat it [mannequin] like a real patient but I wasn't comfortable doing that…so I think it's just a matter of learning to work within the confines of the [SBME]system [so] that I perhaps stop seeing it as a simulation and more of a clinical exercise'*

Martin's story illustrated that, as students internalised a sense of a medical professional identity and were becoming more socialised (via the formal and hidden curriculum) into the norms of the medical profession, they experienced increasing discomfort and ambiguity with not being able to enact such identities within the SBME context. Martin however, stated his motivation to resolve his dilemma: *'I think it's just a matter of learning to work within the confines of the [SBME]system',* which resonated with the experiences of other fourth year students and doctors who similarly stated the resolve to accept their SBME experiences as opportunities to 'polish' their skills, to then transfer to their clinical roles. These were other examples of embracing instances of identity dissonance as learning opportunities in order to resolve conflict and progress learning.

5.2.1.9 Am I Supposed to be a Doctor?

Another identity dilemma experienced and expressed by fourth year students related to an overall doubt with themselves as they transitioned to being an intern. Liz's comments reflected her perceived ambiguity regarding her impending junior doctor position and her

capacity to appropriately enact this role. As with Martin above, she had become immersed in and internalised the cultural norms of the medical profession, and her personal and professional identities had been shaped accordingly, which were now challenged during SBME examinations.

Liz 4th year medical student:

> *'I came back after that [SBME] exam thinking "am I really supposed to be doing this job? Am I supposed to be a doctor? I should have known that, why didn't I know that?... going into the simulation labs I didn't do it on a dummy and yet I could do it for a real person [and] I felt really bad.*

This sense of identity misalignment and the intensity of this self-doubt was perhaps the most overt example of why 4th year students were the only cohort that selected (n=11) disorientating dilemmas as their most experienced Transformative learning theory phase. The SBME context therefore appeared to result in unanticipated situational identity conflict, where participants like Liz and Martin were able to function as a competent medical professional in some settings (i.e. the clinical setting) but not others (e.g. SBME context). This appeared to override participants' enactment of their established professional identities and so challenged self-concepts of 'being' a doctor.

5.2.1.10 I Feel Safer in My Clinical Role

Another identity misalignment narrated by doctors was related to their perceived reduced level of safety within the SBME context. This was surprising, as it could have been reasonably anticipated that doctors participated in simulation sessions with firm confidence to enact their professional identities in a safe and non-threatening educational

environment. Hazel's quote indicated her identity dissonance appeared to be related to being under the spotlight during simulation sessions, combined with the notions that medicine is about progressive independent autonomous practice, and aspirations towards enacting this ideal forms a part of professional identity development. The medical situations presented in the simulation setting however, did not enable Hazel to enact this, thus resulting in an experience of conflict between her personal expectations and her performance within the simulation activity. Hazel's dilemma was elevated by a feeling '*my superiors are watching*' which suggested she felt under scrutiny and like a 'student again' rather than a fellow doctor learning collectively in the clinical setting, which illustrated a significant contextual identity change and misalignment.

Hazel PGY 2nd year:

> *I'm very conscious that I'm not always doing the ideal solution to the situation and can't help being aware of that at and knowing that my superiors are watching [and]sort of thinking, mmm that's not very good <laughs> not many of us deal with these situations frequently [so] it's not something that I have the solution to on the tip of my tongue[and]that's the expectations of the educators that we'll be able to do that…I am more confident in my clinical role [where]I feel much safer than I do in simulation scenarios. I still don't enjoy them, I find them quite stressful [and]I'm not looking forward to more'*

Thus, doctors' professional identities appeared to be threatened by the SBME context, where newly encountered ambiguities threatened their internalised sense of themselves as a doctor. This firmly resonated with the inclusion of nine TLT phases within doctors' top five (Table 4.9), which depicted that they were tolerant to feeling such dissonance and sought to expand their understandings informed by the idealised notion of developing autonomous and independent practice, through being exposed to unfamiliar medical situations during simulation-learning sessions.

The above findings highlighted the complex and diverse nature of identity misalignment often experienced through simulated medical situations, and how such conflict made participants feel. Mezirow's (1991) typology of meaning perspectives or frames of reference was exemplified by these disorientating dilemmas. As a whole, dilemmas resonated with Erikson (1968) and his belief that identity conflict was not only misalignment with a surrounding culture, but first of all a disagreement with one's self. Findings also firmly displayed participants' motivation to resolve their identity dilemmas in order to evolve their understanding of themselves and the doctor's role, so that their frames of reference were more functional, inclusive, and integrative (Mezirow, 1991, 1994) of the aspects constituent of a professional identity as a doctor. This further resonated with Erikson (1968) and his view that identity development was a process which implied uncertainty and conflict, and that positive identity development often led to adoption of dominating norms and an identity incorporating a desire for change.

Findings which make up the next substantive theme, Identity Transformation, provide further understanding of what identity dissonance meant and participants' motivation to agentically navigate and resolve these dilemmas. The primary drive is illustrated to be expansion of participants' understanding of what 'becoming' a doctor entails and what 'being' a doctor involves, and how they picture themselves in such a role. After all, as Costello (2005) has suggested, it is the resolution of identity dissonance at which professional identity formation is aimed.

5.2.2 Identity Transformation

Identity Transformation findings capture the progressive expansion of participants' understanding of themselves, the doctor's role, and how they see themselves to be the type of doctor wished for. Simulation Survey findings initially raised this temporal theme by highlighting cohort differences in experienced Transformative learning theory phases and SBME outcomes appearing to be associated with *a priori* levels of medical knowledge and clinical experience. This raised the notion of provisionally occupied identity-positions along participants' learning trajectories, until further transformed understanding could enable them to 'depart' and progress towards another. Transition between identity-positions was overtly observed during SBME sessions, where changes in participants' general demeanour, use of medical lexicon, interaction with simulation artefacts, relational teamwork, and overall evolving confidence were repeatedly noted. Thus, a sense of development of a professional identity as a doctor became further evident. This sense of development through identity-positions resonated with Dreyfus and Dreyfus (1980), Dreyfus (2004) and their proposed model of professional expertise through a series of stages from novice to expert, where the components of context-free, analytical, situational, and intuitive mediate how adult learners and gain knowledge and skills.

The identity-position of each participant cohort is illustrated by the following findings: *Pretty helpless*, *A little fish, Up to Scratch, My patients would appreciate it*, *Asserting my authority*, and *I am a Doctor*. Transition between these identity-positions resonated with Costello's (2005) notion of positive identity dissonance, where learners source empowerment and motivation from their evolving professional identities.

5.2.2.1 Pretty Helpless

James exemplified the general embryonic identity-position narrated by 1st year students who felt '*pretty helpless*' about their identity when they began simulation activities due to their limited understanding of the medical role and uncertainty of how they may 'fit' with it. Despite feeling this way, James' motivation to navigate towards a more functional and participatory position was illustrated by his statements '*I want to get it right*', '*as we go on*' and '*I'm trying to up my game*'. All interviewed 1st year students echoed this agentic drive in order to present '*a competent student medical professional*' identity.

James 1st year medical student:

> *'I'm not sure I've quite got my identity quite yet…at first you feel pretty helpless [as] I didn't know what I was meant to be doing…I'm developing a broader range of skills [through SBME] as we go on [and] so now I'm definitely beginning to feel more comfortable with being a medical student. So, yeah, if that's what you mean by medical identity[a] sense of belonging, I guess. Yeah.' I want to get it right because, yeah, I definitely feel like I'm trying to up my game [and] I'm trying to better present myself as a competent student medical professional,*

The support provided by the simulation context to facilitate James' transformation towards a more developed identity-position was captured by: *'I'm definitely beginning to feel more comfortable with being a medical student*' and indicated that James was progressing towards achieving '*a sense of belonging*' to the medical profession - or a more defined and embodied identity-position. Observational data gathered from 1st year student simulation-learning sessions complemented this finding and clearly displayed uncertainty with initiating basic medical interventions and a general lack of confidence to participate. Each of the four main observation themes of *Behaviour*, *Vernacular*, *Knowledge Application* , and *General Demeanour* capture other aspects of why early year medical student could feel pretty helpless during simulation-learning activities.

5.2.2.2 A Little Fish

Navigation away from 1st year students' embryonic identity-position and transition to a more embodied identity-position was narrated by Stephen. His comments clearly showed a transformation and a sense of accomplishment from *Pretty helpless* to now experiencing a '*social kind of step-up*' to occupy the *A little fish* identity-position where he had integrated new differentiated meanings to better understand, gain confidence and achieve a better sense of equilibrium: '*I feel comfortable with it*' which appeared to fuel his agency to '*move on'* and transition towards a new identity-position. Acknowledgment of '*I haven't learnt it all*' supported the temporal and progressive nature of professional identity formation.

Stephen 2nd year medical student:

> *'I'm still a little fish but I can definitely recognise…um…I suppose I conceded with myself, I haven't learnt it all and that's okay…Yeah, it [SBME] gives me confidence that I can move on. I know definitely I receive a feeling of accomplishment and that social kind of step-up where I've completed it, I can move on [to new learning]and I feel comfortable with it'*

The language used by Stephen powerfully illustrated the potential for growth and further transformation as he continued along his professional identity formation journey. Stephen exhibited personal growth such that his confidence had increased and he was beginning to more clearly see himself as a future doctor. Additionally, this more embodied professional identity evoked the motivation '*to move on*' and further plan or plot a course of action to further facilitate transition to another more developed and functional identity-position.

5.2.2.3 Up to Scratch

Belinda exhibited progressive identity transformation from being '*Pretty helpless*' and '*A little fish*' to now being '*Up to scratch'* as a 3rd year medical student. She expressly narrated the importance this had for her professional identity. She clearly understood the difference between 2nd and 3rd years as reflected in the '*expected level of competence*' she now felt necessary as a third year student which was summarised in her statement *'I have to be up to scratch now'*. Belinda spoke of her identity-positions in the medical course as '*checkpoints*' where understandings were reflected upon and tested against '*the basic and necessary competencies and interpersonal skills to be a safe practitioner*'. Belinda clearly captured transformation in professional identity of all 3rd year students, as they approached their full-time clinical placements.

Belinda 3rd year medical student:

> *'I find it important that I identify myself as a third year medical student, as opposed to a second year medical student, because they're very different years…and I think the way that it ties in with the simulation stuff, is that there's an expected level of competence [and] we have to be up to scratch now… Several points of the course serve as "checkpoints" in my opinion, at which point we need to be competent in our transition to our new "identity"[and] the mould I imagine is one that outlines the basic and necessary competencies and interpersonal skills to be a safe practitioner.'*

Observation of 3rd year high-fidelity scenarios and debriefing sessions also indicated that this cohort of participants occupied this identity-position, whereby they used more considered vernacular and collective actions which were more representative of those expected and required in the clinical setting. The four main observation themes of *Behaviour*, *Vernacular*, *Knowledge Application*, and *General Demeanour* capture this sense of an identity-position and the meaning which participants could attach to occupying it. Belinda's use of '*we*' and '*our*' with reference to identity also aligned with the

emergence of the meaning participants attached to collective learning within the simulation setting, as suggested by Simulation Survey findings.

5.2.2.4 My Patients Would Appreciate It

Transition to a more formed and embodied professional identity was narrated by Simon, a final year student when he spoke of '*my patients*'. The '*switch*' from a medical student to this more integrated identity-position on the cusp of transition to the junior doctor role represented a transformative juncture for Simon, where sense of himself as a doctor was of significant meaning, as he was soon to have patients under his direct care. This transformation was clearly expressed when Simon said; '*I would actually like to be good at my job, my patients would appreciate it*'. This reference to '*my patients*' emerged consistently during 4th year interviews and post-simulation debriefing sessions, which exhibited an identity-position commensurate with their approaching internship year. Simon expressly stated '*it's [SBME sessions] certainly made me grow*', implying transformation in aspects of himself and a growing ownership of his developing professional identity as a doctor.

Simon 4th year medical student:

> *'And I've particularly found a switch if you like between third year and fourth year, where you go from "Okay, I'm going off and I'm doing a simulated session, it's about skills acquisition and I'm doing it because it may be in the examinable content" – [to] a more cognitive focus to then going "I want to know this because I would actually like to be good at my job, my patients would appreciate it"...I think it's [SBME sessions] certainly made me grow…in terms of personal and professional development.*

The simulation-learning focus of '*skills acquisition*' and '*personal and professional development*' was evident within Simon's narrative. This was complemented by other 4th year students' reports about '*polishing*' their identities prior to their internship year, which the SBME context was often stated to support in a clinically '*safe*' setting. All 4th year student interviews ascribed meaning and value to the simulation context, as it facilitated transformation to the intern identity, as captured by Martin's quote presented at the beginning of chapter four.

5.2.2.5 Asserting My Authority

Transition from a '*medical school mentality*' to a more confident and assertive junior doctor identity-position was narrated by Kurt, an intern. He identified the support provided by simulation sessions to aide development of his evolving professional identity. His frames of reference about himself and the doctor's role were continuing to be refined as he pursued development of '*sound decision making*' which he saw as an important aspect of the doctor's identity. The temporal nature of this identity progression was illustrated when he recognised – '*I'm certainly not anywhere near proficient yet*'. His motivation and agency to continue with such changes was captured by him stating; '*although improving all the time*'. A predominant element of Kurt's motivation and emerging professional identity was development of his ability to assert authority, which he had embodied as an important element of himself as a professional junior doctor. This appeared to allow him to feel and interact with seniors and consultants more '*as an equal*', and no doubt contributed to Kurt feeling more like a member of the medical profession.

Kurt - Intern:

> *'I think the process of developing sound (and reasonably quick) medical decision making is a very gradual process, and I'm certainly not anywhere near proficient yet (although improving all the time). I think ongoing simulation work allows me to feel confident in my abilities and allows me to assert my authority with less self-doubt and second guessing…I think that [simulation sessions] made a big difference compared with how I performed on day one of this internship, where I was still in a medical school mentality…as you get more medically competent and just more confident generally with managing situations, you are able to interact with seniors and consultants more as an equal'*

Similar to Simon above, Kurt displayed a growing ownership of the doctor identity which was further strengthened by '*ongoing simulation work*'. Both Intern interviewees made clear and repeated references to their acknowledged 'junior doctor' identity-position rather than 'doctor', and the role that continuing simulation-learning played to facilitate their transition to the '*I am a doctor*' identity. This claiming of more authority was also observed during SBME scenarios and displayed with more confident vernacular and adoption of a leadership position. Debriefing sessions similarly displayed participants' willingness to voice medical opinions and challenge others' ideas. On several occasions, interns were observed to question a consultant's suggested medical interventions.

5.2.2.6 I am a Doctor

Constance encapsulated the sense of transformation or '*jump*' to a doctor identity as facilitated by her simulation-learning experiences. She used powerful language such as: '*just play acting a doctor, you're not actually a doctor'* and '*this year I feel like a doctor*', which illustrated a deeply-felt sense of transformation in her embodied professional identity. Constance's statement - '*being an intern and RMO is the steepest* [learning curve]

that you'll find' inferred significant transformation in understanding of the complexity of medical norms in order to gain more ownership of her professional identity as a doctor.

Constance PGY 1:

> *'... this time last year I was still sort of like in my head, oh you're just play acting a doctor, you're not actually a doctor. You still have that concept of not feeling like you're actually a doctor whereas this year I feel like a doctor... there was a jump and I think part of that is that the exponential learning curve between being an intern and RMO is the steepest that you'll find…Certainly it was something that was more evident after that simulation session…The more I practice this medicine business [in SBME sessions] the more I think I realise that you become an amalgamation of the doctors that you've worked with'*

Constance's reference to '*you become an amalgamation of the doctors that you've worked with*' illustrated a collective or communal nature of learning to be a doctor, which complemented doctors' having the highest ranking of collective learning as documented by their Simulation Survey findings. This emphasis placed on collective learning was clearly observed in their advanced life support simulation scenarios and debriefing sessions, where strong interaction and the willingness to engage in challenging dialogue in order to resolve ambiguities surrounding which medical interventions to employ were displayed. Appendix *F* provides examples of observational findings which resonate with this doctor identity-position.

The above identity-position findings illustrated the temporal nature of participants' transformative development of their professional identities which could be facilitated by their SBME experiences. Findings also exhibited participants could begin to develop tolerance to experienced ambiguities, and a general reduction in uncertainty about their

envisaged future medical roles i.e. they became and felt more comfortable with their evolving and progressing professional identities.

The findings presented thus far have illustrated participants' professional identity formation from two distinct perspectives: 1) *Identity Misalignment* exhibited identity dilemmas could trigger professional identity development, and 2) *Identity Transformation* depicted participants' could enact agentic responses to resolve encountered identity dilemmas, which necessitated transformation in understanding about aspects of themselves and the doctor's role to enable transition between identity-positions. How such transition could be effected is captured by the next two substantive themes: *Internally-steered* and *Externally-steered*. These further extrapolate the Transformative learning framework quantitative findings of reflection (TLT phase 2), planning a course of action (TLT phase 6), dialogue/feedback (TLT phase 9), and collective learning (TLT phase 4). Findings illustrate these phases could operate synergistically on two levels, individually via reflection and planning, and externally via collective learning and dialogue/feedback. These findings show how participants' professional identity can be understood through the experience of 'being' who one is, both internally as an experience of self, and externally in relation to others (Illeris, 2014).

5.2.3 Internally-Steered

Internally-steered findings depict participants' enacted internal navigation of what 'becoming' and 'being' a doctor meant to them. The two dimensions of reflection and

planning action expand upon the importance placed upon these Transformative learning theory phases as identified by Simulation Survey results. Findings show why reflection and planning action could have significant meaning to participants' professional identity formation.

5.2.3.1 Reflection

Reflection appeared to play a very important transformative role in participants' simulation-learning, and the significance of this across this study's cohorts is illustrated by the following findings: *I can 'do' something*, *My 'doctor' image*, *Holistic approach*, *Things I've gone in with*, *Unconsciously competent*, *You can get through anything*, and *A normal part of the job*. These seven dimensions provide rich insight into the diverse nature of reflection which could assist participants to internally-steer their understanding of the doctor's role and how they pictured themselves in such a position.

I can 'do' something

All first year medical students emphasised that reflection was an important catalyst in the transformation of their embryonic medical identities, and in their transition away from their *Pretty helpless* identity-position. Susan exemplified the importance reflection played in first year students' pursuit of being able to '*do something that a doctor should be able to do*', where focus was often on instrumental or '*action skills*' as this shaped their emerging ideas of what constituted a professional identity. The intensity of this experience was revealed by Susan using a '*pillow*' at home to practice and then '*actually reflecting on it*' to expand her understanding and how she may see herself performing such a medical task.

Susan 1st year medical student:

> *'I think that the development of real physical skills has made me feel that I am now able to "do" something that a doctor should be able to do…I really have had to take advantage of doing those simulations and then going home and actually reflecting on it and then maybe even practicing on a pillow or something at home...to develop my action skills [and] it makes me feel more confident [and] getting better at the sims does help me gain a bit of confidence that I can do it and I'm not going to be too much of a disaster'*

Susan clearly took advantage of simulation-learning to raise her confidence and internally recognise her evolving identity of '*I'm not going to be too much of a disaster*'. Reflection was therefore illustrated as being central to 1st year students' identity transformation towards the 2nd year *I'm a little fish* identity-position.

My 'doctor' image

Another aspect of reflection occurred around students' doctor image of themselves as enacted during interviews with simulated patients (SP), and the support given for these reflections by the activity of reviewing these recorded interviews. Michelle exemplified the reflective focus of 1st year students' to transition away from basic demonstrable skills to their 'doctor image' as enacted during SP interviews. In essence, their evolving understanding of what it meant to be a doctor led to reflection around the construct of a medical demeanour. The review of video recordings were seen as an important catalyst for this reflection and allowed learners to '*see yourself from an outsider's point of view*' and to enable '*another step up*' in their self-reflective analysis. Michelle narrated that this activity facilitated her reflection on '*posture*', '*tone of my voice*', and thought processes which helped her form these aspects of her evolving professional identity.

Michelle 1st year medical student:

> *'I think probably the most beneficial thing* [of SBME] *was being recorded when you were in those standardised patient interviews because then you can go back to reflect and really see how you act. You don't really get that chance ever to see yourself from an outsider's point of view...Yeah. I've noticed little things like posture, the tone of my voice, and that kind of thing. And I've tried to change that as much as I can if I found that it was negative in some way [and] seeing it afterwards is just like another step up. You can really analyse it if you want to…Sometimes I would be a bit scattered, and I try to make my mind more clear, my thoughts more confident, so that it comes out that way as well'*

Michelle's narrative illustrated 1st year students' early stages of embodying expected medical norms and their efforts to integrate these with aspects of themselves -'*I've tried to change that as much as I can*'. This illustrated embodiment and navigation along their professional identity trajectories to make more discriminating and functional meaning of their professional identities, which all students avidly pursued throughout their medical education. The four main observation themes of *Behaviour*, *Vernacular*, *Knowledge Application* , and *General Demeanour* shown in Appendix *E* capture and corroborate with Michelle's focus on her doctor image through participation in SBME.

Holistic approach

Second and third year students' progression to deeper levels of reflection was illustrated by Johnathan, where the focus had turned to asking '*why*', or to critiquing the premises which had construed interpretation and performance of the medical role. His comments illustrated how his reflections had transitioned towards a deeper and more metacognitive level i.e. '*why you have performed to the level you have*'. This illustrated a more refined focus on the aetiology or premises of his actions (Mezirow, 1995) in order to broadening his ideas about a future doctor position from a '*holistic approach*' to patient engagement. Other 2nd

year and most 3rd year student narratives mirrored this progression in reflection away from the more instrumental or task driven focus of first year students.

Johnathan 2nd year medical student:

> *'I'd say my reflective philosophy has now changed and is definitely like – is to have a more sort of holistic approach, not just the task but also to assess why you function in different areas...seeing how you performed in terms of a checklist, but then reflecting on why, you know, you have performed* [SBME tasks] *to the level you have'*

This finding strongly resonated with 2nd year students' transition from the *I'm a little fish* to the *Up to scratch* identity-position, as new ways to integrate and make meaning of the doctor's role evolved to a more '*holistic approach*'. Such a change to a deeper reflective level exemplified the critical importance of self-critique as a component of Transformative learning theory (Mezirow, 1991).

Things I've gone in with

Another example of progression to deeper levels of reflection was articulated by Christopher, a 3rd year student who experienced a challenge to aspects of his long-held frames of reference, which prompted him to reflect on his expectations or '*the things that I've gone in with*'. Other third year students often narrated similar reflective instances where they questioned long-held ideas and assumptions about themselves and what a doctor was perceived to do in such a socially privileged role. Christopher's assumptions such as - '*who they are and what they're like and their conditions*' - had proven to be ineffective or to not fit with expected medical norms, which led him to realise - '*but talking to them I've found out something very different*'. His reflection, in response to this

identity dilemma, was then focussed upon his assumptions made and his wish to make meaning from another perspective i.e. adopting/testing another emerging identity-position.

Christopher 3nd year medical student:

> *[reflection] 'is also one of the things that I've gone in with. So I might have gone in [to SBME sessions]and done a visible audit of the person [actor] and made an assumption of who they are and what they're like and their conditions, but talking to them I've found out something very different and so I reflect back on that and go "Well don't assume anything"… The reflections, I really do enjoy that side of things and I'm hoping that I will continue that when I'm a doctor'*

Christopher's transformation of some of his assumptions was illustrated by comments such as; '*Well don't assume anything*'. This firmly resonated with the identity transition from *Up to scratch* towards the 4th year identity-position of *My patients would appreciate it*. Thus Christopher displayed deeper immersion into medical norms inherent in the doctor's role, and the embodiment of such into his evolving professional identity. Similar negotiation of new ways to view patients was also observed to be discussed in some 3rd year SBME debriefing sessions, where students examined 'other' ways to 'think' about a patient to facilitate assessment and implementation of some medical interventions.

Unconsciously competent

Most 3rd year and 4th year students commented on reflection around being '*unconsciously competent*' as an important component of their evolving professional identities. Collette's reflection stemmed from her identity dilemma where assumptions about herself associated with thought structure and reactions did not fit with those expected at the third year *Up to Scratch* identity-position. She used her SBME experiences to test how to - '*act in a way*

that you need to do in a clinical situation' in order to guide her deeper and often intense reflection.

Collette 3rd year medical student:

> *'…it [SBME] gives you the chance to be in a situation and act in a way that you need to do in a clinical situation. I guess things that you wouldn't normally think of until you're in the situation become more apparent in the simulation [and] so it gives me time to sort of reflect on that. And if I was in a real situation I'm going to need to know[so]I think it's that whole concept of being unconsciously competent. In any moment in a [SBME] scenario you want to be, it needs to be second nature'*

Collette exemplified the value 3rd and 4th year students placed upon their simulation-learning sessions to reflect and transform an array of long-held ideas and expectations to become '*unconsciously competent*', and so more clearly sense development of their professional identities as a doctor. These students were beginning to inform their identities based on the notion of becoming an independent and autonomous doctor, which they saw as '*needs to be second nature*'.

You can get through anything

Fourth year students' deeper levels of reflection, in order to feel more ready for their fast approaching transition to the junior doctor role, was exemplified by Liz as she responded to her identity dilemma of *Am I supposed to be a doctor?* Liz's reflection led her to acknowledge '*maybe you just don't know enough yet*' which prompted her to '*suck it up and learn*' and '*constantly questioning*' her performance during simulation-learning sessions. Liz's reflection aligned with 4th year students' highest ranking of disorientating dilemma as documented by the Simulation Survey findings.

Liz 4th year medical student:

> *'If you can get through third year you can get through anything, was the first thing I said to myself… And I've done it [medical skills] with family and a really ill husband, and a couple of other external things… [so]I literally sat down one night, and I thought you know maybe you just don't know enough yet. Maybe you do need to practice more [in SBME]and pretty much suck it up and learn…so I'm constantly questioning after the fact, Did I do the right things? Did I do it the right way?'*

The intensity of Liz's reflection mirrored other final year students who brought in external evidence, such as an ill family member, to frame their reflection and provide internal validation of their 4th year identity-position of *My patients would appreciate it*.

A normal part of the job

Reflection as an integral element of 'being' a doctor was illustrated by Constance. As a PGY doctor year 1 she viewed reflection to be a '*normal part of the job and it's good to get that understanding early.*' Constance's placement of reflection as an element of her professional identity differed from medical students' instances of reflection.

Constance PGY 1:

> *'I think and do reflection around what and why. I don't know that you can really do one without the other [and] it's very useful to do that as well in a simulation because you do that in real life too, and it's good to know that it's a normal part of the job and it's good to get that understanding early as well.'*

This strongly resonated with Hazel's identity dilemma related to the notion that medicine is about progressive autonomous practice (or the independent doctor ideal), and that reflection formed a central element to facilitate such transformative professional identity

development for doctors. Constance displayed the agency to enact reflection as part of her doctor identity which linked with doctor's highest ranking of planning action (TLT phase 6) as she negotiated further changes to her professional identity. The following findings further examine the role planning action played in participants' SBME facilitated transformative identity development.

5.2.3.2 Planning Action

Transformative learning theory is all about change, and phase 6 reflects the personal agency to plan a course of action to implement new understandings to enable such change (Mezirow, 1991). Simulation Survey findings suggested that planning action was significant across the participant spectrum, which inferred SBME could form a focussed learning context for participants. The findings presented below illustrate there were repeated references to planning action during SBME activities, as participants transitioned to (or perhaps navigated away from no longer functional) identity-positions as better meaning of themselves and the medical role unfolded.

The primary dimensions of planning action were: *Effective and safe doctor*, *I can do this*, *Thinking like a doctor*, *I feel I'm good at that*, *Refining the process*, *I have to know enough*, and *Manage that stage*. These six findings capture the progressive nature of participants' of identity formation, and better exemplify such development from the 1st year medical student *Pretty Helpless* identity position towards the *I am a Doctor* identity.

Effective and safe doctor

The early recognition to become '*an effective and safe doctor*' was illustrated by Jo, a 1st year student. Simulation formed an important part of her learning to envisage (or plan) to become such a doctor. Jo's plan of action '*to be*' an effective and safe doctor illustrated 1st year students' planned navigation away from their *Pretty helpless* identity-position as they made more progressive and differentiated meaning of the doctor's role, and how they saw themselves to occupy such a future position.

Jo 1st year medical student:

> *'[SPs and BLS]has made it easier to recognise that I am developing the skills to be an effective and safe doctor. It reduces the dissonance between my position as a junior medical student and my future role, and allows me to imagine myself as a doctor in a more real/informed way'*

It was clear that Jo's '*dissonance*' or aspects of her identity dilemma were reduced, as her simulation-learning experiences had '*made it easier to recognise*' or internalise what an effective and safe doctor meant. This could be understood as increasing her confidence to plan action or better '*imagine myself as a doctor in a more real/informed way*', thereby reducing her uncertainty surrounding becoming a doctor and so support her transition towards new identity-positions as her education continued.

I can do this

This was commonly experience by 2nd and 3rd year medical students as they began to understand and unpack the practice of medicine and what it meant to be a doctor. Meghan's quote resonated strongly with the '*A little fish*' identity-position and signalled transformation to her ideas and expectations of the doctor's role - '*medicine has been*

somewhat demystified for me'. Meghan then used her new insights and understandings to navigate more confidently her transition towards a future professional identity of '*being responsible for patients' care'*, which she now viewed as '*seems easier*' and '*less daunting now*'.

Meghan 2nd year medical student:

> *'I think the practice of medicine has been somewhat demystified for me [and] my thoughts about what doctors do is probably less now than it was. I see that it's [a] list of things you go through rather than some sort of genius ability to diagnose and treat people. [SBME sessions] have just made me feel less anxious about it and more comfortable that I can do this. It seems easier… the thought of practicing in the future and being responsible for patients' care and outcomes is less daunting now'*

The notion of planning action was well exemplified in Meghan's quote and resonated with the Simulation Survey finding indicating the increased importance placed upon TLT phase 6 for participants with more developed levels of medical knowledge and experience. Observation of 3rd year students' simulation sessions clearly displayed their focus on planning, both during intensive interaction during high-fidelity scenarios, and then in considered and thoughtful dialogue during debriefing sessions. Instrumental action was the general focus during scenarios, and teamwork communication and patient engagement strategies often formed aspects of discussion in debriefing sessions.

Thinking like a Doctor

Another fundamental aspect of participants' actively planned identity progression was 'thinking like a doctor'. Stephen commented that he was '*running through a check list in my head, so I could immediately do it*' before simulation sessions commenced, and this

typified how study participants planned their framework of thinking as representative of a foundational element of a functional professional identity as a doctor.

Stephen 2nd year medical student:

> *'So after the first couple of goes [SimMan] I kind of got the hang of it and then I remember towards the end doing the fifth and sixth session I was thinking of what I needed to do before the patient flat lined and go, "Okay, get the oxygen, put the bed down" and running through a check list in my head, so I could immediately do it. I suppose it was really validating. It was – it made me more confident I would be able to do it if I was put in the actual situation.*

Stephen described the space simulation-learning provided for learners to plan their actions and enact the expected medical 'thinking' framework. This was often stated with firm conviction and showed the intensity and situated focus of such planning, and how it increased in complexity as learners unpacked the doctor's role, and so progressed how they saw themselves as a doctor. This finding showed the general way participants steered their thinking during SBME sessions in order to manage the scenario at hand and so display an identity commensurate with their levels of learning. Fourth year students and doctors were the participants most frequently observed thinking 'allowed' before their simulation scenarios began. I asked them how this was helpful to plan, and they responded - 'so I get the order of thinking right'. The four main observation themes of *Behaviour*, *Vernacular*, *Knowledge Application* , and *General Demeanour* resonate with Stephen's simulation-learning focus on developing a framework of thinking like a doctor.

I feel I'm good at that

Students, often mid-way through their courses, initiated plans to pursue a certain medical career path as a result of transformed ways they saw themselves to be a future doctor, as

the medical role and their place therein was more understood. Belinda explained how SBME facilitated such transformation and led her to pursue a specific future doctor identity '*yeah I'm going to go to general practice*'. This now formed Belinda's new embodied view of her future professional identity in medicine i.e. a general practitioner (GP).

Belinda 3rd year medical student:

> *[SBME] allows you to pursue and build your skills, and learn… Yeah, I think if I hadn't had the opportunity to practice in a simulated environment I think my learning would have been more stunted, and my perceptions of my competence would have been slower to progress. 'I've sort of realised, because, no matter what role you're in, there's more importance than I had previously thought on the communication side, on counselling patients, and listening to patients… and I feel I'm good at that as well, so I'm kind of, yeah I'm going to go to general practice.*

Belinda's comments clearly displayed the role SBME played to help shape and structure her transformed ideas about how she now planned her future career. These included the aspects such as '*communication side, on counselling patients, and listening to patients*', which she now felt '*I feel I'm good at that*'. Such was the influence of Belinda's simulation-learning experiences, she clearly stated '*my perceptions of my competence would have been slower to progress*' had she not participated in simulation sessions. Belinda now confidently pursued her new career plans and actively used the SBME setting to facilitate her progress and transition along this trajectory to 'becoming' a GP.

Refining the process

Full-time clinical placement represented an important transition juncture for 3rd year students, as they planned to impart their professional identity capabilities in the clinical setting. Rosanne's plan of '*refining the process*' was triggered by this important identity

formation junction - '*it's time to see me impart that in a not simulated environment*' reflecting an internal realisation that *'I'm getting closer and closer to doing these things on real live sick patients*'. When asked which aspects she felt strongly the need to refine, Rosanne stated these included '*patient interaction'*, '*teamwork'*, and '*communication'*, which generally reflected later year students' plans, as shaped by deeper immersion into the medical role.

Rosanne 3rd year medical student:

> *'I'm getting closer and closer to doing these things [medical skills] on real live sick patients, and [I'm]making sure that I've made the most out of my simulation learning, because it's time to see me impart that in a not simulated environment…I think that's a huge part, particularly for me, but I also think for everyone, a huge part of the learning curve, is going from a medical student to a junior doctor, to the registrar, to a consultant is refining the process'*

This finding echoed other 3rd year students' narratives which were often emotively stated, and illustrated the significance of this identity transition as students planned to progress towards a more clinically orientated professional identity. The important place the simulation setting played in planning such identity transition was clearly stated with '*making sure that I've made the most out of my simulation learning*'. Rosanne clearly displayed 3rd year medical students' planned transition towards the 4th year *My patients would appreciate it* identity-position.

I have to know enough

Planned transition away from 4th year students' identity-position of *My patients would appreciate it* towards the intern identity position of *Asserting my authority* represented an important transformative juncture for final year students. Martin stated the positive

influence simulation sessions had on his identity transition plans: '*I know I have to know enough to make the right decision*' in order to '*become a better doctor*'. This was stated emotively as Martin described his planned navigation towards his internship year, in which he consciously recognised '*I have to take advantage of this year*' and '*Being in the sim lab, in particular the last couple of weeks, has really put a fine focus on it*'. Again, the four main observation themes of *Behaviour, Vernacular, Knowledge Application,* and *General Demeanour* capture later-stage SBME participants' often intense focus on capturing the simulation context as a space to know enough for enactment in the clinical setting.

Martin 4th year medical student:

> *'As we've progressed through the simulation sessions, I've realised that you are afforded a huge amount of responsibility even as a brand new junior intern [and] that to me is what has changed, my expectation of what I need to do as a doctor has changed. I know I have to know enough to make the right decision and I have to take responsibility for that no one else will [and] now that I'm in fourth year, and on the cusp of being a doctor, a lot of stuff has led me to that realisation that I actually have to learn and I have to take advantage of this year to become a better doctor…Being in the sim lab, in particular the last couple of weeks, has really put a fine focus on it'*

Martin's quote exemplified the narratives of all other 4th year students and their focus on *I have to know enough*, and the educational place simulation scenarios provided to facilitate this planning of action. Post-simulation debriefing sessions also provide a setting where these students were observed to actively seek guidance, as often displayed by intense and focussed dialogue. They also displayed a more defined identity as a doctor in their demeanours. Overall, the SBME context was illustrated to be a setting which significantly supported 4th year students to plan departure from their medical student identity to '*a brand new junior intern*' professional identity.

Manage that stage

Development of the independent and autonomous doctor notion previously discussed resonated firmly with this 'planning action' finding, where doctors and interns recognised simulation-learning as providing opportunities to facilitate transition to a doctor identity shaped by increasing complex and unfamiliar medical situations. Constance clearly recognised simulation scenarios as providing a context to learn about '*dealing with the situation and knowing*' in order to '*manage that stage*' when unfamiliar medical situations arose. Constance's question '*what am I going to do?*' mirrored the doctor identity dilemma previously described where there was a mismatch between current capabilities and that presented in the simulation scenario. In response to such identity misalignment, Constance plotted a course of action, creatively stated as '*learning how to manage that stage*', and supported by the metaphor '*practicing up against a wall with your tennis ball*'. Such a planned learning strategy was indicated as helping to manage '*other clinical scenarios that I would dread'* and so clearly showed Constance's planned action towards a more autonomous professional identity was supported by her simulation-based learning experiences.

Constance PGY 1:

> *[SBME] It's about learning how to manage that stage* [and] *it's about dealing with the* [medical] *situation and knowing, I mean you can't know everything so there's always going to be a situation you come across no matter what level you're at,* [and say] *what am I going to do? I don't think that being thrown in the deep end and into the reality of the situation* [is] *as valuable a learning tool as the simulation because you practice it and then you do it and that's I think the ultimate reinforcement… It's like practicing up against a wall with your tennis ball…it's helped me with other clinical scenarios that I would dread'*

All doctor and intern interviewees narrated very similar planned action as they engaged in simulation sessions to expand the skills which constituted a professional identity as a

doctor. They overtly identified simulation as a valuable learning tool, and that it could be '*the ultimate reinforcement*' of their evolving identities. Debriefing sessions were also observed to align with this situated learning focus, where review and discussion of both simulation performance and new various medical approaches by which to expand their medical 'repertoires' were noted. This highlighted doctors' acceptance of ambiguity to be a meaningful characteristic of their professional identities.

The next section presents the externally-steered transformative findings which could support participants' identity related transitions.

5.2.4 Externally Steered

In addition to the above *Internally-steered* transformative findings, participants also made repeated references to the highly valued external learning sources they experienced as supportive for professional identity development. The below findings depict these external sources as feedback/dialogue (TLT phase 9) and collective learning (TLT phase 4), which were identified by Simulation Survey findings as important simulation learning processes across the participant spectrum. Findings provide deeper insight into *why* feedback was influential for 1st and 2nd year students, and the 'switch' to collective learning experienced by 3rd year students, interns, and doctors as found in the previous chapter.

5.2.4.1 Feedback

These findings exhibit feedback on performance during simulation activities was highly valued by early-stage medical students as a mechanism to progress their embryonic identity-position development when introduced to the doctor's role. Findings show feedback could be very influential for 1st and 2nd year students as they began to transform their understandings of themselves and find a better 'fit' with the complexity of the elements that constituted the medical role. Three findings captured this strong meaning attached to feedback: *Safety Net, Just that little bit better, Real-time & Dynamic*.

Safety Net

1st year medical students began simulation-learning activities from their *Pretty helpless* identity-position as narrated by James. Feedback formed an important support or '*safety net*' as they commenced their transition away from this identity location towards a more integrated and differentiated understanding constituent of the 'next' 2nd year identity-position. Michelle clearly illustrated the importance feedback had for these students as they began to envisage themselves as a future doctor: '*Feedback helps me build a proper image in my head of what me as a doctor is'*. The most striking element of Michelle's quote was her use of '*safety net*' as an analogy to describe the security to which she could refer '*if you need to*' for validation of her evolving understanding and meaning of the doctor's role, and how she displayed this during simulation activities.

Michelle 1st year medical student:

> *'If I don't have the tutor giving me feedback on what I'm doing and how I'm doing it, then I don't feel like I'm getting anything more out of it than I would be practicing it at home…Feedback helps me build a proper image in my head of what me as a doctor is. I could look across and see my*

tutor's expressions and see whether she was smiling, or frowning, or looking worried, or concerned. And so that could maybe give me a bit of a trigger as to how I was going. It's just like a safety net to know that you can check if you need to, to watch their response to you'

Michelle's reference to both verbal and non-verbal feedback suggested each to be an effective strategy to provide feedback, and was therefore an important transformative phase to both prompt and support students to steer away from their *Pretty helpless* identity and transition towards the *A little fish* 2nd year identity-position as understanding of medicine and students' place therein was unpacked. The transitioning nature of simulation-facilitated professional identity formation was exhibited by this finding.

Just that little bit better

Another valued aspect of feedback often expressed during interviews was illustrated by James' statement that feedback could '*make it just that little bit better*'. This further highlighted the supportive nature of feedback and the agentic motivation of early stage students to better understand what 'becoming' a doctor entailed and meant to them. James' preference for direct and up-front feedback: '*you want someone to tell you you're doing fine, if you are, or your not doing it right*' reflected early-stage students' high focus on skills acquisition and their need to feel they were doing it 'right'. James' quote '*I definitely don't get offended by anything negative in the feedback*' indicated feedback had been an important transformative learning element by which he had resolved his initial identity dilemma of '*dropping the ego*'. This exhibited a transformative learning event along his professional identity formation trajectory as he tried '*to figure out what's the best for me*'.

James 1st year medical student:

> *So, that's the kind of feedback that you want, you want someone to tell you you're doing fine, if you are, or your not doing it right. But, if you're doing fine, here's what you could do to make it just that little bit better… I'm just trying to, like, get my skills better as opposed to being offended, I definitely don't get offended by anything negative in the feedback. so, by people telling me what was wrong and right I try to figure out what's the best for me.*

This finding mirrored other participants' narratives which also referred to feedback as central to 'get on with the job' and 'soak-up' as much new knowledge and skills as possible during simulation sessions. This finding captured how tutor feedback both supported and informed professional identity formation, and firmly resonated with the provisional and temporal developmental themes discussed previously. Participants' agentic motivation to transition to more functional and contributory identity-positions was also exemplified by James' narrative.

Real-time & Dynamic

2nd year medical students maintained the learning importance attached to feedback. However, this finding illustrated the type of feedback preferred took on a more real-time and dynamic clinical nature. Therefore, students' identity-position of *A little fish* appeared to have progressed expectations of feedback in-line with their expanded understandings of the doctor's role. Nathan's emotive narrative depicted this general emphasis placed on feedback as 2nd year students transitioned towards full-time clinical placement in 3rd year, and no doubt internally sensed the need occupy its respective *Up to Scratch* identity-position. This finding also illustrated feedback was expected to include active clinical demonstration in order to disseminate tutors' '*wealth of experience in their clinical judgement*' which Nathan inferred as being highly sought after and necessary in order to

facilitate transition and so sense he was 'becoming' more like a doctor - '*I find it absolutely essential*'.

Nathan 2nd year medical student:

> *'first of all you have to have the feedback session…to have someone there providing real time dynamic feedback about performance and to actively demonstrate, of course, and to provide, you know, a wealth of experience in their clinical judgement in certain scenarios,… to always pick out positive aspects of someone's performance and reflect on those a little bit and then to identify areas that need further work…I find it absolutely essential to gauge where I am at.*

This finding vividly illustrated that students focussed on their simulation feedback '*to gauge where I am at*' in relation to their felt preparedness to enter the clinical setting and adopt a 3rd year medical student identity. Nathan narrated the importance of feedback as a transformative educational process to support development of clinical abilities to be enacted in 3rd year clinical placements, where collective learning emerged as an important identity formation external source.

5.2.4.2 Collective Learning

Collective learning (TLT phase 4) was also an important simulation-learning element for 3rd and 4th year medical students, interns, and PGY doctors, as was suggested by Simulation Survey results. The below findings expand understanding of *why* collective learning could have such strong meaning and support for these participants located at more developed identity-positions. Four findings capture this importance of collective learning during high-fidelity simulation scenarios and post-simulation debriefing sessions: *A more objective view*, *Constructive critique*, *Able to steer us*, and *We crave it*.

A more objective view

Objective feedback within the collective post-simulation debriefing setting was shown to be a much valued external source of learning for later-stage students. These participants made frequent reference to the meaning they attached to hearing an objective view on how they had performed during SBME scenarios, which they then tried to 'match' with their internal sense of their performance. A striking finding was Belinda's use of '*we*' and '*our*' as she commented on feedback during debriefing sessions, which clearly illustrated the collective nature of learning. Her comments: '*pull them into line*' and '*to bolster confidence*' illustrated the perceived learning value of objective feedback to inform professional identity formation by showing - '*how we can improve, and develop our own learning objectives*'.

Belinda 3rd year medical student:

> *'that's all part of the debriefing process as well, is getting that feedback on our simulated performance. I think it's really important. I think we – most people – well I'd say all people, find it very difficult to be 100% objective about themselves. Some people are too hard on themselves, and some people think they're the bee's knees. And I think we need the debriefing feedback to, you know, for some people it's useful to sort of pull them into line and go, actually you're not as good as you think you are* [and for others] *it's really good to bolster confidence. So I think getting that feedback is good and also for how we can improve, and develop our own learning objectives.*

Belinda's use of expressive language was consistent with many other interviewees who also referenced the learning benefits gained from the collective context of intimate debriefing sessions with peers and clinical doctors. This emphasis corroborated the emergence of phase 4 within the top five TLT phases for 3rd year students and above. Observation of advanced life support simulation scenarios and debriefing sessions displayed the collective learning nature of participants' identity progression, as evidenced by the increase use of brief and focussed medical vernacular, seeking views of others, and

more synchronised movement as they anticipated the actions of peers during dynamically simulated situations. Thus the responsive actions of peers and educators formed an objective feedback mechanism by which participants gauged their enacted professional identities, inclusive of instrumental skills, communicative and teamwork strategies.

Constructive critique

Constructive critique, as an informative and supportive external learning source, was also valued by later stage students and doctor participants. This finding illustrated that critique formed a deeper source of feedback which resonated with the increase in meaning placed upon reflection across the participant spectrum as previously discussed. Martin's reference to '*now I know that someone else noticed them as well*' strongly affirmed the influence of collective learning on professional identity formation - '*go learn more*' which firmly aligned with the importance of such critical collective discourse in Mezirow's (1991) Transformative learning theory.

Martin 4th year medical student:

> *'Constructive criticism or feedback, to me the debrief at the end of the sim session, is probably the most important part of it [SBME]because just doing the simulation and trying to reflect on your own is really difficult but having others tell you, in a constructive way, what you did wrong and what you did well is what prompts me to then go learn more* [and]*I'm much more likely to fix what I've done wrong because not only were they things that I noticed, but now I know that someone else noticed them as well'*

This finding illustrated constructive critique during post-simulation debriefing sessions further enhanced Martin's motivation and agency to '*fix what I've done wrong*', which had no doubt challenged his embodied sense of his professional identity as a 4th year student. This resonated with Liz' identity dilemma where she questioned should I be a doctor? This

importance on constructive critique was not surprising, as it had been previously found 4th year students placed intense focus on their transition to the approaching '*Asserting my authority*' identity-position as an intern. Similar constructive critique themes were narrated by other 3rd and 4th year students, both Interns, and all doctors which complemented the increasing collective learning (TLT phase 4) Simulation Survey trend, and the importance this had for professional identity development.

Able to steer us

Shamus' expectation '*to hear ways to improve yourself*' among '*a small group of people*' clearly illustrated this collective learning finding stated by both intern interviewees. This also illustrated debriefing was a much valued learning space as a junior doctor newly transitioned to the clinical setting, which Shamus indicated as '*able to steer us in the right direction*'. His references to both '*us*' and '*we're*' again highlighted the collective nature of professional identity formation as supported by the simulation-learning context.

Shamus - Intern:

> *'So, you walk in there [debriefing]and you think, what have I done wrong and you're expecting to hear ways to improve yourself, of course, if we get it wrong they're able to steer us in the right direction… I don't feel like I worry about the other people thinking that I don't know what I'm talking about. It's just a small group of people and understand it's something we're still learning to do and haven't done before and we don't do often, so yeah I don't find it intimidating. I find it fine. Yeah, it doesn't bother me. I think that feedback from the tutor is the best way to learn'*

This finding again resonated with the overall temporal professional identity formation theme of this thesis, and supported the previously raised notion that SBME forms a context where learners focussed on identity progression, comprising the various abilities which

constitute the doctor's role. Both intern participants expressed this learning focus as they began to agentically transition away from their *Asserting my authority* identity-position towards their anticipated *I'm a doctor* position over the next year, or as both interns clearly stated '*being a real doctor*'. Similar to Martin above, Shamus' narrative merged the self and collective constructs of *we* and *I* which complemented TLT phases 4 and 9 sharing the same relative learning importance for interns as shown by the Simulation Survey findings in the previous chapter. Therefore, interns placed important meaning to both feedback and collective learning as external learning sources. Collective learning is exhibited by the next finding as continuing to be of high importance for clinical doctors.

We crave it

Doctors' strongly felt value applied to collective learning for progression of their professional identities was captured by the title of this externally-steered finding. Jamila's intensity illustrated doctors' focus on their identity-related learning during simulation sessions. This aligned with the independent and autonomous practitioner notion previously raised. Jamila echoed the value of debriefing sessions to provide collective learning and compared this to her student days where she received '*so much feedback*' to assist with her 'becoming' a doctor.

Jamila PGY 1:

> *'Debriefing is vitally important* [and] *best part of a* [SBME] *scenario because I think your perceptions of how you've behaved and everyone else's perceptions don't necessarily line up. It's the external expert validating something from an observing point of view… we don't get that on the ward* [and] *I think we crave it after being students for so long and getting so much feedback, suddenly being thrown out into the world where you're doing dangerous things and not necessarily getting feedback'*

Jamila's narrative highlighted that collective learning remained a central learning process for doctors, will all stating debriefing as the most beneficial part of their simulation-learning experiences. For example, collective learning was also echoed in Constance's narrative when she stated '*The more I practice this medicine business [in SBME sessions] the more I think I realise that you become an amalgamation of the doctors that you've worked with'*. Thus a collective nature to a professional identity as a doctor was felt. It also appeared as though doctors favoured 'returning' to being a student within the simulation context in order to further steer their professional identity progression, and so expand and maintain their 'full membership' in the medical profession. This finding complemented Simulation Survey results which indicated doctors experienced the most Transformative learning theory phases (9 of 10 within their top five) through their simulation experiences. Also, doctors were the only cohort to have TLT phase 8 - Provisionally trying out new roles for planned transfer to the clinical setting, within their top five results. This suggested focus on transformative changes to aspects of their professional identities for translation to their clinical roles. The four main observation themes of *Behaviour*, *Vernacular*, *Knowledge Application* , and *General Demeanour* presented in Appendix *F* again resonate with Doctors' learning focus often enacted during their SBME sessions.

The richness and depth of the findings presented in this chapter mirrored Costello (2005, p. 33) and her suggestion that learners who pursue a new profession focus on 'the adoption of a professional identity and the displacement of the conflicting personal identity, thereby resolving identity dissonance into consonance'. Findings portrayed how participants could negotiate such resolution of their dissonance through both internally and externally steered Transformative learning elements, in order to feel a better fit with 'becoming' and 'being'

a doctor. These transformative experiences also resonated with Illeris (2014, p. 40) and his recently proposed definition of transformative learning:

> 'The concept of transformative learning comprises all learning that implies change in the identity of the learner'

This chapter integrated qualitative findings with the quantitative Transformative learning framework and showed *how* and *why* simulation-based medical education experiences could trigger and support professional identity formation. This complex process is encapsulated by the Simulation Identity-formation Model in Figure 5.1 which represents this study's empirical response to its tentative model posited at the end of chapter 2.

5.3 Simulation Identity-formation Model (SIM)

Figure 5.1 Simulation Identity-formation Model

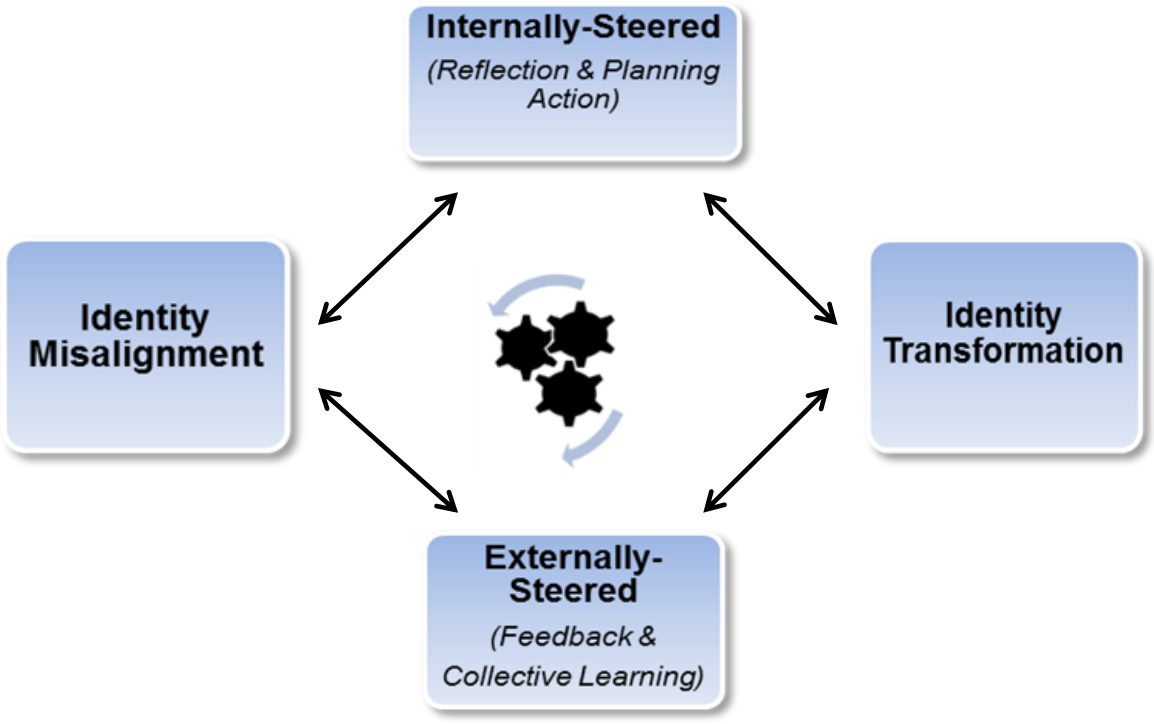


Figure 5.1 diagrammatically synthesises this study's theoretical account of development of a professional identity as a doctor that could be facilitated by participation in SBME. The 'cog-wheels' at the centre of the model reflect and connate movement, which depicts the complex and recursive interaction between this model's four substantive components, and the pervasive and ongoing nature of professional identity formation evidenced by this thesis' findings. This adds meaning to the value placed upon the Transformative learning framework evidenced by all six participant cohorts, by illustrating their pervasive focus of professional identity formation which could be enacted through simulation-learning activities.

The quantitative findings presented in chapter 4 laid down the 'skeleton' of the SIM, and revealed that participants' experiences could be transformative in nature and informed by the four central elements of Mezirow's (1991) Transformative learning theory. These findings had reasonable strength and formed the substantive components of the SIM. This framework was found to be experienced across the participant spectrum, although the nature of Transformative learning appeared to differ within each cohort due to their *a priori* differences in medical knowledge and clinical experience. Initial insights were also found regarding the types of outcomes perceived to have arisen from their simulation-learning, with the major ones suggested as changes in assumptions and ideas about themselves, the medical profession, and how they viewed themselves in the role of a doctor. Overall, quantitative findings depicted simulation-learning could reach beyond discrete skills acquisition, and extended to participation focussed on development of a professional identity as a doctor.

The qualitative findings presented throughout this chapter 'flesh-out' the SIM's initial framework and add richness and complexity to participants' identity formation journeys. The *Identity Misalignment* findings depicts identity dilemmas and associated ambiguity and uncertainties when new and unexpected elements of the doctor's role are encountered through SBME activities. *Identity Transformation* findings depict the agentic response to such dilemmas, as participants seek to resolve these and form expanded understanding of what 'becoming' and 'being' a doctor means and how they envisage themselves to occupy such a role. This is seen as a trajectory involving identity-positions which participants could provisionally occupy until transformed understandings enables them to transition towards another position. Transition is exhibited to provide valued meaning, motivation, and reduced uncertainty of participants' planned future medical identities. The SIM's notion of transition between identity-positions resonates with Dreyfus and Dreyfus (1980) and Dreyfus (2004) model of adult skill acquisition, where learners progress from novice, advanced beginner, competence, proficiency, and finally to expertise shaped by the four mental functions of: component, perspective, decision and commitment. Observation of SBME sessions across the participant spectrum firmly mirrored such progression.

The *Internally-steered* and *Externally-steered* findings suggest the transformative process of participants' transition between identity-positions. Internal transformative processes involve reflection and planning action, and can facilitate participants to better understand their developing sense of themselves as a doctor and their plans to help them manifest these ideas. Feedback and collective learning are uncovered as important and external transformative sources from which participants can gain an understanding of how others view them as presenting a professional identity during simulation sessions. As the narratives show, this can be a powerful identity-forming influences for participants which

resonate with sociologist Goffman (1971) and the notion of impression management. This shows the importance participants' seek to portray an identity-position in-line with their level of medical learning. The SIM exhibits these internally-steered and externally-steered elements as synergistically transforming participants' unfolding professional identities.

The SIM therefore moves beyond description to a theoretical understanding of just how participants' SBME professional identity development journeys can look like and what may be involved. This model does not orientate towards participants' sense of unquestionably conforming to norms and dominant understandings (Illeris, 2014) of the medical profession, rather the SIM exhibits how participants can manage and refine their understandings, ideals and convictions (Erikson, 1968) related to both their future identity as a doctor and concept of themselves. These constant refinements or changes provide a sense of security (Illeris, 2014), and so affirms participants developing professional identity as a doctor.

The SIM illustrates the development of medical competencies and a professional identity can have a hand-in-glove relationship, where competency of the numerous elements of the doctor's role contributes to learners' sense of 'becoming' and 'being' a doctor. This provides better understanding of 'being' rather than exclusively on 'doing' (Jarvis-Selinger, Pratt et al., 2012). The SIM also offers identity misalignment as a new perspective of the challenges which can be experienced through forming an identity as a doctor.

Through the Simulation Identity-formation Model it is possible to better understand *how* and *why* the SBME context can provide an educational space where learners are able to actively situate identity development through participation in the array of simulated medical activities. The SIM models that medical practice involves learning as doing, and so encapsulates entry into the medical profession involves authentic learning as belonging, and identity construction involves learning as becoming (Bleakley, Bligh et al., 2011). As such, without this perceived meaning of belonging, learning does not proceed - there is no learning and consequently no identity formation without meaning (Wenger, 1998). Meaning is 'learning as experience' (Bleakley, Bligh et al., 2011, p. 72).

This study's participants have shown that they can attach value and meaning on the SBME context as an experiential clinical setting in order to enact this learning focus. The complexity of this temporal identity development journey should not be underestimated, as the SIM encapsulates this as participants adjusting aspects of themselves to newly encountered elements of the doctor's role, often to unexpected realities. Therefore, finding a 'fit' is a complex and often ambiguous process inherent to identity formation as a doctor.

The next chapter discusses three key findings of the SIM as evidenced by both quantitative and qualitative findings: 1) Situated and progressive identity formation, 2) Tolerance of ambiguity and reduced uncertainty, and 3) SBME - a transformative bridge of complexity.

6 Discussion

6.1 Introduction

This thesis has provided a different look at simulation-based medical education (SBME) through testing a tentative model that it can play a transformative role in medical students' and doctors' formation of their professional identity as a doctor. This look has provided insight into another aspect of SBME. As such, it contributes to the boarder canvas of simulation education experiences as presented in the extant literature, reflecting that learners are immersed in an increasingly clinical learning environment with expanding roles and graded levels of responsibility.

The conceptual framework presented in Chapter 2 formed the new exploratory standpoint of this thesis by integrating extant knowledge and theory associated with SBME, Mezirow's (1991) Transformative learning theory, professional identity and related identity theory, and reflexive understanding of my experiences with simulation-based education. This resonated with Eva (2010) and his call to merge concepts and ideas from different theories to translate into new perspectives on familiar educational terrains. The merging of these constructs informed a theoretical lens not previously applied to SBME, which has uncovered new insights and understandings of medical students' and doctors' experiences with simulation-based medical education. Such new insights and understandings contribute to the developing evidence-base of SBME knowledge and practice.

This exploration of SBME necessitated a flexible and pragmatic cross-sectional research design by which to address this study's aims, questions, and objectives to arrive at an empirical response to the tentative model. The mixed methods research approach used provided such a design through the pragmatic integration of four data gathering methods, its six independent participant cohorts spread across four locations, multiple analytical methods including statistical and constructivist grounded theory qualitative analysis. The suitability of this approach was established in the previous two findings chapters, through presentation of an in-depth range of results which together illustrated the complexity and depth of the transformative nature of participants' learning experiences which can result from participation in SBME. The Simulation Survey findings, participant interviews ,and observational results provided a rich evidence-base to illustrate how participants' transformative experiences could represent temporal and progressive formation of their professional identity as a doctor. Transformation was depicted as changes in participants' ideas about themselves, assumptions and expectations of the doctor's role, and changes in the ways they saw themselves as a doctor. It is important to note that doctor experiences of SBME was restrained to relatively junior doctor levels of PGY 1&2, which may not capture the experiences of more experienced medical officers such as intensivists, consultants, or surgeons who are no doubt continuing to shape their professional identity.

The Simulation Identity-formation Model (SIM) adds substance and form to this thesis' originally posed tentative model, and provides a theoretical account of *how* and *why* the SBME context can trigger and support transformative professional identity development. This uncovers new knowledge to the simulation and broader medical education literature domains. The SIM therefore brings new understanding which contributes to established acknowledgment of the important place SBME occupies within medical students' and

doctors' journeys to 'becoming' and 'being' a doctor. The SIM also resonates with Kneebone (2015) and his recent suggestion that education is primarily about engagement and interaction where 'reciprocal illumination' between participants can lead to new understandings and fresh insights, where how others see us can often be the most useful insight of all. The SIM depicts the importance learners can place on how others view their performance during simulated medical situations through interactional learning.

The four substantive components of the SIM are: *Identity Misalignment*, *Identity Transformation*, *Internally-steered*, and *Externally-steered*. The SIM suggests that professional identity development can often be triggered by conflict or dissonance between long-held assumptions and ideas of learners' self-concept and the emerging facets of the doctor's role encountered during SBME activities (*Identity Misalignment*). This misalignment is modelled to motivate learners to resolve these identity dilemmas through transformation in understanding of themselves, what 'becoming' and 'being' a doctor entails, and how they see themselves to occupy this role. This temporal development in 'feeling more' like a doctor is shown to involve occupation of identity-positions until further transformation enables departure from one, and transition towards another identity-position (*Identity Transformation*). This reflects expanded understanding of themselves, the complexity of the doctor's role, and how they 'fit' together to form a professional identity. As Transformative learning theory presupposes that 'something' must transform (Mezirow, 1991), the SIM encapsulates this 'something' to be aspects of participants' long-held assumptions and ideas of themselves, together with their understanding of what constitutes the socially privileged position of a doctor.

The SIM depicts *Identity Transformation* can occur on two levels: *Internally-steered* and *Externally-steered*. The former illustrates learners are consistently reflexive about aspects of themselves not 'fitting' with their evolving understanding of what constitutes 'becoming' and 'being' a doctor. The SIM exhibits reflection and planning-action can be the primary transformative learning elements which facilitate participants to internally-steer and inform their developing professional identity towards the type of doctor they wish to be. The SIM's *Externally-steered* component illustrates the transformative value and meaning of dialogue/feedback and an objective response to skills, abilities, and demeanour displayed whilst participating in simulation-learning activities. *Externally-steered* is associated with learners' acceptance that SBME is a legitimate setting in which they can enact and gain feedback on their overall professional identity at their respective levels of knowledge and experience. The SIM therefore synthesises the processes that learners can experience as they enter the SBME setting with an aim of developing and refining the multidimensional and interrelated elements which constitute an identity of a doctor, so that they may then transfer and enact in the clinical setting, whether as a student or clinical doctor.

The SIM therefore models that learning within the SBME context can extend beyond discrete instrumental skills acquisition, and includes a social dimension (Dieckmann, Gaba et al., 2007) incorporating relational interdependence between participants and the medical profession which is therefore co-constitutive (Billett & Somerville, 2004) throughout participants' identity formation trajectories. The SIM depicts SBME can be an educational context where learners find a place to pay attention to, and focus their energies on, becoming a functional, competent, and contributory member of the medical profession in a progressive and temporal fashion.

Three key findings emerged in the previous two chapters which are embedded throughout the SIM. These key findings are: 1) Situated and progressive identity formation, 2) Tolerance of ambiguity and reduced uncertainty, and 3) SBME - a transformative bridge of complexity. This third finding represents the culmination of this study as it theoretically integrates findings to form the overall conceptual density (Corbin & Strauss, 2008) or richness to explain what this study is all about. These three key findings are discussed below in sections 6.2, 6.3, and 6.4 respectively.

6.2 Situated and Progressive Identity Formation

The focus of this section is on discussing simulation-learning as a situated and progressive educational context where learners encounter legitimate opportunities to develop knowledge and skills to inform their evolving professional identities for transfer to the clinical setting. This theme gives new insight into the importance of SBME to scaffold clinical learning, and so further blurs the distinction between that which is simulated, skills laboratory teaching and clinical realities, a notion previously raised by (Kneebone, Kidd et al., 2005).

The situated and progressive nature of professional identity formation associated with simulation-learning was a key theme throughout this study's findings. Overall, this theme illustrated the importance and meaning participants attached to their simulation-learning as a progressive identity formation trajectory. The term progressive incorporates temporal transitions as illustrated by the *Identity Transformation* findings. This key finding reflects the way learners experienced the SBME setting as an accepted clinical-proxy or authentic

context (Bleakley, 2006) in which the complexities of medical practice and the doctor's role can be situated and enacted in order to construct an identity as a doctor.

The SIM's notion of *Identity Transformation* echoes Cruess, Cruess et al. (2014) and their recent conceptualisation of professional identity:

> A physician's identity is a representation of self, achieved in stages over time during which the characteristics, values, and norms of the medical profession are internalised, resulting in an individual thinking, acting, and feeling like a physician. (pg. 2)

Identity Transformation findings give theoretical basis for Cruess et al's (2014) view of a progressive professional identity, whereby the characteristics, values, and norms of the medical profession are associated with 'becoming and feeling' like a doctor. The identity-positions of each participant cohort illustrate this formative progression from *Pretty helpless* (1st year medical students) to *I am a Doctor* (doctors PGY 1&2). The SIM depicts how such progression involves navigation from one identity-position towards another. Hence, professional identity formation is an on-going process of interpretation and re-interpretation of experiences, that is accurately represented by the metaphor of *becoming* (Clarke, Hyde et al., 2013). Each cohort's identity-position is both forward-looking and expansive (Illeris, 2014) towards something better and more advanced, which functions as a source of motivation for continuing identity transformation.

The SIM encapsulates 'more advanced' to represent learners feeling an ability to actively participate in simulated medical situations at a more competent, functional and contributory level. This more active participation is shaped by the deliberate practice construct (Weller et al., 2012; Rosen, 2008). The SIM depicts how participation in SBME

can have significant influence on learners' on-going process of interpretation and re-interpretation of the meaning of a professional identity as a doctor, and how they 'feel' enacting this role whilst participating in simulation-learning activities. Findings show that deliberate practice strongly supports learners to deconstruct previous assumptions about themselves and the doctor's role, and then to reconstruct these as part of the on-going refinement to their understandings of what constitutes 'becoming' and 'being' a doctor. The *Identity Misalignment* findings illustrate the diversity of these deconstructed ideas and assumptions, for example. *Dropping the ego* and *I think and react differently*. The *Internally-steered* and *Externally-steered* findings display transformative reconstruction of such through *reflection, planning action, feedback*, and *collective learning* i.e. on the individual and social levels. The *Identity Transformation* identity-position findings exhibited the resultant transformed and new understandings. This key finding therefore warranted an overarching learning perspective to assist with deeper construal of meaning.

As discussed in Chapter 2, various educational theories have been applied to simulation-based learning, the two predominant ones being andragogy (Knowles, 1985) and experiential learning (Kolb, 1984). Succinctly, these educational frameworks share the epistemological tenets that adults are active agents in developing knowledge and understanding of the world through experience, reflection, and active participation by using already acquired knowledge as resources to interpret new experiences. The SIM findings resonate with these long established tenets, and point to the value of sociocultural learning theories in providing a fit-for-purpose explanatory and predictive framework for simulation-based education. The SIM also highlights the importance of context (situated learning) and process (dynamic learning) (Bleakley, 2006).

Sociocultural learning theories include the work of Vygotsky who conceptualised knowledge as a form of capital that is shared and commonly owned (Bleakley, 2010). The SIM reinforces this social dimension of learning by showing participants' simulation-learning experiences are inherently socially interactive, collective, and dynamic. For example, Simulation Survey findings illustrated the significant trend of increased meaning attached to collective learning (TLT phase 4), and the *We crave it* finding of the *Externally-steered* SIM component showed the value learners placed on collective learning within the simulation setting. Therefore, a sociocultural lens offers an informative framework for simulation-based education, where the role of social processes, interactions and relationships influence learners' experiences and therefore learning is highlighted. From this perspective, situated learning through legitimate peripheral participation (LPP), as postulated by Lave and Wenger (1991), usefully illustrates and provides a new view of SBME as depicted by this key finding of the SIM. Succinctly, during the act of participation, socialisation occurs that embodies 'transformative possibilities of being and becoming' (Lave & Wenger, 1991, p. 32) and learning is a meaningful social act of participation rather than an accumulation of knowledge, skills and values (Bleakley, Bligh et al., 2011).

Lave & Wenger (1991) formulated learning as an integral and inseparable dimension of generative social practice during which the development and transformation in the identities of people, knowledge and skills are realised through engagement and participation in the sociocultural practices of a community. They proposed that LPP offers a way to examine the relations among 'newcomers and old-timers about the activities, identities, artefacts, and communities of knowledge and practice' (Lave & Wenger, 1991, p. 29) as it concerns the process by which newcomers become a part of a community of

practice. Transitions between this study's identity-position findings firmly illustrate this generative nature of LPP. For example, the progressive transitions from *Pretty Helpless* to *My patients would appreciate it* illustrate developed immersion into the doctor's role and the recognition of having patients as a significant element of this socially privileged position. This study's identity-positions resonate with Wenger (1998) and the description of identity construction as 'modes of belonging' to a community of practice. This involves entails different levels of engagement in practice where meaning for learning is negotiated (Bleakley, Bligh et al., 2011). Such a generative perspective of becoming part of the medical community has been largely unrecognised within the SBME literature. Learners therefore apply legitimacy to the SBME context in providing engaging and generative social practice to inform professional identity formation.

Lave & Wenger's (1991) emphasis on engagement and participation in generative practice resonates with Kneebone (2015) and his recently proposed idea of education as framed by engagement rather than authoritative transmission of knowledge. By this, Kneebone (2015) means engagement as the open-minded exchange of perspectives which can result in 'reciprocal illumination' for everyone who takes part. Thus Kneebone's (2015) encapsulates the notion of education as primarily about interaction, and shaped as a process in which everyone expects to gain new insights i.e. 'reciprocal illumination'. He suggests that such engagement in educational activities can bring new understandings into focus and that fresh insights can emerge, such as how others see us which may be the most useful insight of all (Kneebone, 2015).

Legitimate peripheral participation describes how authentic clinical experiences can assist inexperienced learners to acquire and hone their skills and knowledge alongside clinicians as they progressed from simple to more complex clinical activities (Lave & Wenger, 1991). The SIM exhibits how LPP occurs in simulation contexts through authentic engagement in medical situations. LPP can therefore be used as 'a descriptor of engagement in social practice that entails learning as its integral constituent' (Lave & Wenger, 1991, pg. 35) within the SBME setting. Although, LPP was identified as being potentially applicable to SBME (Bradley & Postlethwaite, 2003), its utility in this context was not empirically validated.

This study's SIM shows how LPP underpins socially-based learning within the SBME context. It reflects the situated progression of participants' identities, skills and knowledge through active participation in the various simulation-learning activities via deliberate practice. The SIM synthesises participants' progressive and situated transformation in 'becoming' and 'being' a doctor, for example, *I can do this* and *I feel I'm good at that*. This suggests another dimension of the deliberate practice construct, whereby identity progression or development can be seen as a learning focus of deliberate practice.

The socially situated nature of LPP subsumes the learning of knowledgeable skills (Lave & Wenger, 1991). In other words, becoming positioned or socialised into a community takes precedence over learning discrete skill-sets. Participation in simulation-learning goes beyond the learning of discrete medical knowledge and skills, to developing understandings of the relationships between the components that make-up the doctor's role. For example, findings include concepts such as, *Social complexities*, *Communication*

and rapport, *Holistic approach* and *Manage that stage*. A legitimate peripheral perspective of SBME also allows exploration of the complexity of the relationships between these components which make-up the socially-based doctor's role. The SIM therefore illustrates SBME as a socially-situated educational context in which learners are provided legitimate opportunities to agentically construct and refine their evolving professional identity as a doctor. This aligns with Ibarra (1991) who has suggested that through participation in simulation-based education learners can experiment with provisional selves and engage with multiple roles, ranging from simple to complex.

Other studies have also emphasised the importance of participation within a medical learning context. Boor, Scheele et al. (2008) found that an expansive approach to participation played a central role and promoted a good learning climate. Dornan, Boshuizen et al. (2007) suggested that 'supported participation' was pivotal in clinical learning and was significantly shaped by students' human interactions. Goldie (2012) saw participation and integration of learners into the social networks of medical schools as very important for them to develop meaning about their future selves as clinical doctors. This study's SIM similarly evidences the importance of social participation as expansive and progressive, but relates this to the discrete SBME setting as fostering professional identity development. The levels of progressive participation are captured by the SIM's *Identity Transformation* identity-position findings.

How learners view the nature of their participation in simulation sessions is also shown in this study to be a significantly influential and empowering aspect of their learning, which can trigger the agency to further expand understanding to increase future levels of

participation. The value that participants place upon being able to participate at these increasing levels during their SBME sessions is clearly exhibited by the SIM, and further illustrates legitimate peripheral participation as an informative lens through which to view and gain further insight into the meaning learners' attach to their simulation-learning experiences.

This is exemplified by the SIM which shows that the change or transition between identity-positions follows expansion of learners' *knowing* of what 'becoming' and 'being' a doctor' means at each position. This is a fundamental theoretical element of the SIM, as ways of *knowing* are not only conditions of a sense of belonging, but also represent evolving forms of membership, and therefore identity, knowing, and position are interrelated to one another (Lave & Wenger, 1991). Such evolving forms of membership resonate with Dreyfus and Dreyfus (1980) and their posed five-stage process of learning related to transition from novice to expert. In their model, as adult learners become more skilled they 'depend less on abstract principles and more on concrete experience' (pg. 4). The Sim's identity-positions of *Pretty Helpless* to *I am a Doctor* align with such transition from novice to expert. The nexus with legitimate peripheral participation can be readily seen as evolving forms of membership, knowing, and therefore identity - or the centripetal progression from peripheral participation to a more contributory member of a profession. Further understanding of why participants experienced such value through transition between identity-positions is gained from the term 'peripheral' as suggested by Lave and Wenger (1991).

Lave and Wenger (1991) used 'peripheral' as a positive term to reference the development of more inclusive ways of being engaged in the activities as defined by a community of practitioners. This is reflected in centripetal movement from the peripheral location of 'newcomers' towards central and full participation of 'old-timers'. Such locations within a community of practice are living relationships between a person and their participation within that community. (Lave & Wenger, 1991). This centripetal movement is also central to motivate individuals to expand understanding and meaning necessary for further transition towards fuller participation (Lave & Wenger, 1991). This movement is clearly encapsulated by the SIM, through transition between identity-positions i.e. from *Pretty Helpless* (1st year medical students) to *I am a doctor*. The *Internally-steered* and *Externally-steered* findings illustrate the nature of reduction in peripherality e.g. *My doctor image*, *Thinking like a doctor*, and *Manage that stage*. The SIM builds upon Lave & Wenger's (1991) notion of LPP by identifying the discrete identity-positions learners occupy along, and place significant meaning to, their professional identity formation trajectories. Lave & Wenger (1991) did not conceptualise similar identity-positions as part their work.

The increasing levels of fidelity and associated levels of complexity can also be seen to represent the centripetal movement from the 1st year peripheral level to the doctor's full participation in simulation scenarios. The SIM therefore illustrates the SBME context provides learning opportunities that support development of learners 'sense of belonging', or perhaps of being a more active and contributory member of a community, as they progress their participation and consolidate their evolving professional identities. Findings such as *Holistic approach, Unconsciously competent,* and *My patients would appreciate it* capture the diverse nature of learners' 'sense of belonging'. These again evidence that

SBME supports learning beyond discrete knowledge and skills acquisition, to include processes, language, and principles (Burgess & Nestel, 2014).

Lave & Wenger's (1991) perspective of participation reflects the predominantly challenging (dilemma driven) nature of sociocultural learning, the relational character of knowledge and learning, and the negotiated character of meaning. This study's SIM mirrors these concepts whereby the dilemma driven nature of participants' experiences is captured by the *Identity Misalignment* findings, the relational character of knowledge and learning is exemplified by the *Identity Transformation* findings, and the negotiated character of meaning is captured by the *Internally-steered* and *externally-steered* transformative findings. The SIM therefore provides a basis to view SBME as a holistic means for learners to comprehensively understand and develop a professional identity as a doctor, which encompasses the whole person rather than focusing just on 'receiving' factual knowledge on activity (Lave & Wenger, 1991) or the procedures which shape medical practice. As such, the SIM displays SBME to be a bridge between an emphasis on cognitive learning and an emphasis on social practice as a primary outcome (Lave & Wenger, 1991) which exhibits an alternative way to understand SBME as an important cultural tool and context for medical education. This is another new insight provided by this study and opens-up a new way to understand and think about the potential outcomes of simulation-based medical education.

Thus far, legitimate peripheral participation has been discussed as a new theoretical framework to explain learners' SBME experiences as modelled by this study's SIM. There are however further insights provided by the SIM which are minimally addressed by Lave

& Wenger (1991) and which potentially expand the notion of LPP within the simulation context. Although Lave and Wenger (1991, p. 115) overtly state that 'learning and a sense of identity are inseparable', they only discuss identity transformation in relation to the potential interpersonal conflict between newcomers and old-timers rather than potential intrapersonal conflict. The SIM's *Identity Misalignment* findings clearly show that simulation-learning experiences trigger personal conflicts or identity dilemmas where long-held assumptions and ideas are questioned, as illustrated by *Dropping the ego, I think and react differently*, and *I feel safer in my clinical role*. Such conflict resonates with Costello's (2005) notion of identity dissonance which encapsulates the difficulties faced by individuals in the formation of a new professional identity. The SIM captures the identity dissonance learners experience as they participate in simulation-learning sessions. By not addressing such identity conflict in-depth, Lave & Wenger (1991) ignore the potential disruption to their assumed linear progression of learning through LPP. The findings of this thesis illustrate identity misalignment may be a barrier to development of a professional identity which may delay learners adjusting to an identity as a doctor, as illustrated for example in the finding *Am I supposed to be a doctor?* As such, the SIM presents a view of LPP within the simulation context as a less than smooth and non-lineal process of transformative professional identity development.

LPP also does not address the reactions of learners in response to identity conflict. This study addresses this deficit by showing learners are motivated to agentically resolve encountered identity dissonance through self-critique of assumptions and deeper exploration of what 'becoming' and 'being' a doctor means to them. The SIM evidences an overall positive response to identity conflict aimed at resolution, which resonates with Costello's (2005) use of the term positive identity dissonance to describe a similar learner

response. The *Internally-steered* and *Externally-steered* findings exhibit this agentic resolution of identity conflict as transformative in nature.

Whilst Lave & Wenger (1991, pg. 113) clearly state 'our attention [has been] on the structure of social practice rather than privileging the structure of pedagogy as the source of learning', they make frequent use of the term 'transformation' to depict the learning through LPP and associated changes in ways of knowing and construction of a new identity. This implies a tacit reference to some form of pedagogy, but none has been suggested. This study uses Mezirow's (1991) Transformative learning theory as a new theoretical lens for LPP within the SBME setting, which richly explains the complexity underpinning how participants develop their sense of belonging and being in the medical community. This thesis confidently claims that Mezirow's (1991) TLT provides an informative theoretical lens for understanding learners' legitimate peripheral participation within the SBME setting for progression of their sense of belonging in the medical community i.e. their evolving professional identity as a doctor.

Additionally, although Lave and Wenger (1991, p. 54) argue that progression in a sense of belonging 'can be neither fully internalized nor fully externalized', they do not describe the premise of this argument. The SIM's *Internally-steered* and *Externally-steered* findings specifically show the transformative nature of how participants' develop their sense of belonging. This is modelled to involve the synergistic operation of an individual's reflection and planning action, and the external learning sources of dialogue/feedback and collective learning. These findings illustrate the depth to which learners can examine and plan changes to aspects of themselves which are embodied as meaningful changes. This

level of internal-steering towards a professional identity via transformation can be viewed as a window into the realties of increasing immersion into more complex and demanding simulated clinical situations.

The significant meaning attached to objective or external feedback on displayed identities during SBME is also a vital force impacting on a sense of belonging to the medical community. The SIM therefore provides deeper understanding of the notion of these two levels of transformation as part of legitimate peripheral participation. It is important to note here that this thesis' reference to external influences does not capture the other potential external influences participants may encounter through SBME. Therefore the influence of the surround milieu within the SBME context is not captured. As such, this study's identification of feedback and collective learning can be suggested to be a window into the potential influence of external influences experienced.

The integration of Mezirow's (1991) Transformative learning theory and legitimate peripheral participation provides a new way to understand the notion of 'becoming' and 'being' a doctor as facilitated by the simulation-learning context. SBME can thus be regarded as transforming and promoting ways 'of knowing as activity by specific people in specific circumstances' (Lave & Wenger, 1991, p. 52). The expansion of such knowing reflects the pivotal role that LPP plays in 'providing access to a nexus of relations otherwise not perceived as connected'(Lave & Wenger, 1991, p. 36). The SIM echoes such ambiguous potentialities at the 'peripheral' level of each cohort for example, *Dropping the ego, Social complexities, Impediment to my learning,* and *Leadership ambiguity*. The SIM indicates that ambiguities motivate learners to unpack their understandings and reconfigure

them in ways not previously anticipated as connected, and this is fundamental to how the SIM encapsulates professional identity formation. The SIM also indicates increasing tolerance to the inherent ambiguities of the doctor's role and the synchronous reduction in learners' uncertainty about 'becoming' and 'being' a doctor. Indeed, the SIM reveals that learners embrace ambiguities as potential learning opportunities, which depicts the challenges and ambiguities surrounding the possibilities of making 'things' fit together (Illeris, 2014). These 'things' are illustrated by the SIM to be aspects of learners' self-concept and elements of the doctor's role. This leads us to the second key finding of this thesis.

6.3 Tolerance for Ambiguity and Reduced Uncertainty

This key finding encapsulates the tolerance to ambiguity and reduced uncertainty associated with medical students' and doctors' formation of their professional identities. Various authors have discussed the notions of ambiguity and uncertainty, for example Luther and Crandall (2011, p. 800) have commented 'more self-tolerance of being good enough to be a doctor [and] it is essential to carry forward these professionalism ideals into the clinical years,', and Geller (2013, p. 581) has suggested 'that tolerance for ambiguity is an important characteristic in medicine'. Yet neither has overtly discussed and formed a nexus with professional identity formation. Additionally, SBME has not been empirically identified as an educational context in which learners negotiate and manage ambiguity and uncertainty in relation to professional identity development. The SIM illustrates the SBME setting can enable such negotiation.

By illustrating that SBME can be a setting where individuals develop mechanisms to manage ambiguity and uncertainty, this study responds to contemporary calls for medical education to offer both students and doctors educational tools to help them respond to these often neglected and pervasive elements of medicine (Luther & Crandall., 2011; Wayne et al., 2011). Several authors have suggested that the consequences of not addressing these matters can result in anxiety and distress (Benbassat, Baumal et al., 2011), thoughts and feelings of inadequacy (Luther & Crandall, 2011), reduced general work satisfaction, together with low patient satisfaction (Bovier & Perneger, 2007; Cooke, Doust et al., 2013), and increase risk of burnout (Cooke et al., 2013). Suggestions have been made that educational tools to adequately address ambiguity and uncertainty may facilitate students and doctors to better communicate and relate with patients (Luther & Crandall, 2011), promote humility (Geller, 2013) and engage in shared decision making (Politi & Légaré, 2010). The SIM's *Social Complexities*, *Dropping the Ego*, and *A More Objective View* findings resonate with these suggestions, and reveal how the SBME setting can be an effective educational tool to prompt and support learners' responses to ambiguity and uncertainty.

Discussion of ambiguity and uncertainty is well established within the medical education literature (Bosk, 1980; Geller, Faden et al., 1990), where it has been repeatedly noted that students and doctors were encouraged to downplay and restrain ambiguity and uncertainty rather than being taught to manage and accept them (Benbassat, 2013). Authors such as Luther and Crandall (2011) have emphasised that openly discussing and addressing these topics in medical education is of crucial importance, as they are pervasive aspects of the medical role. This key finding adds a new dimension to the literature by illustrating ambiguity and uncertainty are significant aspects encountered by medical students and

doctors along their professional identity formation trajectories. The SIM depicts the SBME setting to facilitate learners to manage ambiguity and uncertainty aspects, and so plays an essential role in transferring their developing identities as a doctor to the clinical setting.

As professional identity formation is a recently renewed medical research focus (Chapter 2), this study's SIM provides timely and valuable insights into the nature and meaning of identity-related ambiguity and uncertainty. The pervasive and diverse nature of ambiguities associated with experienced identity conflict is clearly illustrated by the *Identity Misalignment* findings, for example, *I think and react differently*, *How close should I get?*, and *leadership ambiguity*. The SIM shows that tolerance to ambiguity develops and provides the motivation to resolve future encountered areas of ambiguity. Uncertainty is modelled by the SIM to be reduced through learners' temporal transitions between identity-positions i.e. *Pretty Helpless* (1st year students) to *I am a Doctor*. Thus, this key finding exhibits a synergistic nexus between development of tolerance to ambiguity and reduced uncertainty i.e. identity conflict is a pervasive experience which must be accepted and managed in order to transition to the 'next' identity-position. Findings within the *Internally-steered* SIM component illustrate this progressive development of tolerance i.e. '*I can do something*' of 1st year medical students to the broader clinical setting with '*Manage that stage*' for doctors.

Other authors have also recognised the need to openly discuss and address ambiguity and uncertainty in medical education, as they see medicine as a complex system which is often 'messy' with inherent uncertainty, thus doctors need to tolerate the instability and ambiguities that this presents (Plsek & Greenhalgh, 2001; Doll & Trueit, 2010; Bleakley,

2010). The SIM illustrates that the SBME setting promotes open discussion of ambiguity and shows the significant value and meaning learners place upon post-simulation debriefing sessions which assists them to negotiate ambiguous situations. On many occasions definitive consensus was not reached, and so learners left with acknowledging 'things can be done in many ways'. Learners were thus being socialised to accept that ambiguity is a pervasive reality of medical practice and so requires a degree of acceptance. Findings within *Collective Learning* illustrate this emphasis on open discussion of ambiguous medical responses to clinical situations e.g. *Able to Steer Us* and *We Crave it*.

Overall, study findings show the simulation context offers learners a safe environment in which to explore the notion of ambiguity and better understand this as a part of 'becoming' and 'being' a doctor. The SIM exhibits that SBME prepares learners to practice confidently and competently though learning how to manage ambiguity, as a ubiquitous aspect of medical practice (Han, Klein et al., 2011; Luther & Crandall, 2011). Once again, this thesis' suggestion that simulation-learning extends beyond discrete skills acquisition is reinforced by these findings.

The SIM also reveals how the development of tolerance to ambiguity occurs at the individual and collective levels. Bleakley (2006) has previously argued that tolerance of ambiguity is necessary for doctors to work within complex and dynamic medical contexts, and that such tolerance is held both individually and collectively. Findings within the *Internally-steered* component of the SIM exhibit the importance of reflection and planning action to navigate ambiguity. For example, the *Things I've gone in with*, *A normal part of the job, and Thinking like a Doctor* findings illustrate some of the participants' experiences

as they unpacked what 'becoming' a doctor meant and negotiated the ambiguities they encountered. The collective level is illustrated by the Ex*ternally-steered* findings where feedback and collective-learning were key elements of temporal development of tolerance to ambiguity. These findings demonstrate how simulation-learning experiences provide valuable opportunities to become tolerant to ambiguity as a professional identity evolves. Supporting this finding, Han, Klein et al. (2011) have suggested tolerance of ambiguity needs to be assessed in the clinical context. As the SBME setting is intended to be an experiential clinical context, various simulation modalities can be utilised to reveal learners' level of tolerance to ambiguity to both themselves and educators. This uncovers another new dimension of the utility of SBME to prepare learners for the realities of contemporary medical practice.

Better understanding of this key finding is gained through differentiation of ambiguity and uncertainty, as some authors within the medical education literature see these as related, yet conceptually different (Han, Klein et al., 2011; Hancock, Roberts et al., 2014). Grenier, Barrette et al. (2005) have proposed a time-oriented differentiation which fits with the SIM's modelling of ambiguity and uncertainty as linked to professional identity formation. They view uncertainty as related to a *future* event, whereas they see ambiguity connected to circumstances of the *present*.

In light of this study's findings, uncertainty surrounds participants' pursued *future* goal of an identity as a doctor. Findings within the *Identity Transformation* SIM component illustrate a temporal reduction in this uncertainty whereby: 1st and 2nd year students' identity-positions of *Pretty Helpless* and *A little Fish* illustrate high uncertainty of

'becoming' a doctor, and 3rd and 4th year students' positions of *Up to Scratch* and *My patients would appreciate it* suggest a marked reduction in their uncertainty of 'becoming' a doctor. Intern and doctor identity-positions of *Asserting my authority* and *I am a Doctor*, depict even less uncertainty with 'being' a doctor, as they are already enacting their professional identities in the clinical setting. Therefore the SIM exhibits simulation-learning facilitates students to feel less uncertain about 'becoming' a doctor, and doctors less uncertain about 'being' a doctor.

This temporal reduction in uncertainty aligns with Ellsberg's (1961) view that uncertainty carries the known probability of a particular outcome. Therefore, transition between the identity-positions affirms to participants they will reach their goal of acquiring a professional identity as a doctor. So, it can be understood that participants view progression to each identity-position as carrying the probability of 'being' a doctor. The notion of reduced uncertainty was pervasive throughout participant narratives and was often attached to emotive language. This reduction in uncertainty also links with earlier discussion of legitimate peripheral participation which explained participants' centripetal transition towards more participation in the medical community. The SIM therefore illustrates the central role simulation-based medical education plays in reducing learners' uncertainty surrounding formation of a professional identity as a doctor.

Ambiguity is discussed by Grenier, Barrette et al. (2005) as relating to circumstances of the *present*, and Geller (2013) suggests ambiguity is linked to situations containing more shades of grey, which are marked by a greater urgency for resolution and so require tolerance in order to manage. Ellsberg (1961) has suggested that the probability of an

outcome surrounded by ambiguity is unknown, and so greater emphasis is placed on locating a solution. The SIM encapsulates these notions of ambiguity. The *Identity Misalignment* findings are diverse examples of 'shades of grey', where participants were immediately confronted with ambiguity of what '*becoming*' and '*being*' doctor meant. These findings also depicted the urgency participants experienced to find solutions to these identity dilemmas, as reflected in the motivational influence these dissonances exerted to progress to the next identity-position in order to find a deeper embodied 'fit' with the doctor's role. The *Internally-steered* and *Externally-steered* findings illustrated the temporal and transformative nature of learners' active responses to resolve these instances of ambiguity, and the empowerment they experience as a result of their developing levels of tolerance. This active seeking of resolution in such circumstances has long been conceptualised as linked with tolerance for ambiguity (Budner, 1962).

Geller (2013) has suggested there may be a connection between learners' tolerance to ambiguity and their stage of learning or training, and so suggests that serious consideration should be given to assessment of ambiguity tolerance upon admission to medical school, as at intervals during formal training to assess development thereof. Geller (2013) suggests that ambiguity tolerance is a meaningful characteristic for medical students, and that incorporation of innovative educational interventions designed to cultivate tolerance for ambiguity is needed to develop positive feedback loops by which students' tolerance for ambiguity increases. This developing nature of tolerance is modelled by the SIM to be linked with study participants' *a priori* ordering of their medical knowledge and clinical experience. For example, the *How close should I get?* and *Impediment to My Learning* identity dilemma findings of early-stage medical students depicted elevated ambiguity, whereas the *Manage that Stage* finding of a doctor participant firmly indicated a higher

level of tolerance to ambiguity in order to manage the medical situation at hand. The SIM therefore shows increasing acceptance of ambiguity underpins learners' trajectories to reach better understanding of what 'becoming' and 'being' a doctor entails, and the central role of SBME in this development.

This *a priori* ordering resonates with Dreyfus and Dreyfus (1980), Dreyfus (2004) and their proposed model of professional expertise and skill development through a series of stages from novice to expert. Their model depicts that as learners become more skilled, dependence upon abstract principles becomes less and more focussed on concrete experiences, which illustrates progressive changes in learners' ways of seeing their task environment - i.e. progression from novice to expert. This thesis' SIM resonates with the Dreyfus and Dreyfus (1980) model of novice to expert by showing the progression in tolerance to ambiguity commensurate with transformative transition between the identity-positions across the medical student to doctor PGY 1&2 spectrum.

Discussion thus far has highlighted there are calls to facilitate acceptance of ambiguity as an important endeavour in medical education (Luther & Crandall, 2011). However, Hancock and Mattick (2012) have suggested caution with facilitating this until much more is known about the consequences associated with such efforts. They pose the question 'is an increased tolerance of ambiguity beneficial for every clinician?' (Hancock & Mattick, 2012, p. 834), and urge medical educators 'to be alert to the possible unintended consequences that may be associated with moves toward increasing undergraduates' tolerance of ambiguity' (Hancock & Mattick, 2012, p. 834). The SIM firmly illustrates that ambiguous encounters exert a motivational influence on participants across all cohorts to

agentically navigate the ambiguities surrounding development of a professional identity. This mirrors Geller's (2013) suggestion that individuals with tolerance to ambiguity are drawn to or captivated by the unknown. Therefore, tolerance to ambiguity is captured by the SIM as a critical element which facilitates both students and doctors to find their place and belonging within the medical community. Surely this is a beneficial consequence for all doctors, the patients under their care, and the profession as whole. Indeed Geller (2013) has further suggested that tolerance to ambiguity might improve the quality of care and the humility necessary for moral character formation. This thesis provides a counter response to Hancock and Mattick (2012) and their concerns around the unintended consequences associated with educating for tolerance to ambiguity.

In fact, very little is known about how medical students' changes in tolerance to ambiguity can occur during their time at medical school (Shaw, Lewis et al., 2010), and Hancock, Roberts et al. (2014) have questioned whether it can indeed be modified over time. This study's SIM illustrates that SBME facilitates an increase in learners' tolerance of ambiguity through internal and external transformative learning experiences, and further shows this to occur in a temporal and progressive nature. Indeed, the SIM shows that this study's participants view situations of ambiguity as potential resources for learning rather than a threat (Bleakley, 2010) which motivates them to continue to evaluate, think, and plan (Han, Klein et al., 2011; Luther & Crandall, 2011) their professional identities. This study therefore illustrates how tolerance can be developed and that it can be modified over time, and these are newly identified outcomes of simulation-based medical education.

The two key findings of this study's SIM discussed above: 1) Situated and progressive identity formation and 2) Tolerance to ambiguity and reduced uncertainty, provide a new view of professional identity formation as a doctor through simulation-learning experiences. As noted, movement towards a more central location in the medical community via legitimate peripheral participation involves expansion of the complexities of knowing and the transformation and progressive development of knowledge and identities (Lave & Wenger, 1991). Such complexity has been illustrated by the SIM as the relationships or links between the elements which make-up the identity-positions of each participant cohort. This notion of complexity also emerged in discussion of how participants develop tolerance to ambiguity and the synergistic reduction in their uncertainty of 'becoming' and 'being' a doctor. This pervasive nature of complexity throughout this study's findings leads us to the next key finding of: SBME - a transformative bridge of complexity. The notion of complexity has emerged as a contemporary perspective from which to examine medical education (Bleakley, 2010; Mennin, 2010c; Fenwick & Dahlgren, 2015).

6.4 SBME - A Transformative Bridge of Complexity

SBME - a transformative bridge of complexity represents the core finding of this thesis. It illustrates the final step in theoretical integration of the Simulation Identity-formation Model mixed-methods findings to form an explanatory whole. The SIM embodies this key finding and gives empirical substance and form to the tentative model posed at the beginning of this thesis:

> ‘Transformative learning occurs in the simulation-based medical education context, as it can trigger and support development of a professional identity as a doctor’.

The centrality of this core finding and its elucidation of the role SBME can play in the education and professional development of students and doctors led to its adoption as the title of this thesis. This core finding provides new insights about simulation-learning within contemporary medical education. It builds upon Stacey’s (2003) transformative teleology inherent to complex adaptive change by introducing Mezirow’s (1991) transformative adult learning theory to further inform such a process of transformation.

The SIM exhibits SBME can be a transformative bridge of complexity to the clinical setting, along which learners attach expanded and more differentiated meaning on action and knowing associated with evolution of their professional identities. Transformative depicts the complex nature of simulation-triggered significant changes which can occur on both the individual and social levels. These transformations are suggested to include new ways learners can view themselves, reshaped and new understandings of the doctor’s role, and how they are able to picture themselves to occupying this social position of a doctor with the responsibility of medical care. The term bridge illustrates the nexus between the SBME setting and the clinical environment, along which learners co-form their professional identities in preparation for transfer to their future clinical roles. The notion of complexity portrays learners’ dynamic and adaptive responses to the continuously changing, interactive, and challenging circumstances which often arise during simulation-learning activities. It is these adaptive changes, informed by transformed understandings, which can enable transition between identity-positions and trajectory along learners’

professional identity formation journeys. The SIM depicts such transition between identity-positions as movement towards a future as a doctor, which is under perpetual construction where there is not a 'final' or complete state or position of a professional identity as a doctor.

The SIM suggests this thesis' participants' professional identity formation as an adaptive complex system, as defined by Mennin (2010b) and Stacey (2003), whereby the multitude of elements which make-up a professional identity as a doctor are continuously self-organised to form an identity with which learners find an evolving 'fit'. This self-organisation is suggested by the SIM to be inherently related to the complex properties of interaction, responding, and relating which form a causal framework of transformative teleology (Stacey, 2003). Self-organisation forms a complex adaptive process of relating shaped by perpetual reorganisation of the patterns which constitute such relating (Stacey, 2003). These patterns involve individual mind and social interactive or relational patterns, which themselves form continual patterning processes (Stacey, 2003).

Whilst complexity theory has recently emerged to examine simulation-based education, for example Fenwick and Dahlgren (2015), Lefroy and Yardley (2015), and Ma (2015), it has not been used to explore learners' simulation-learning experiences. The use of complexity theory therefore allows us to navigate familiar educational territories from a different perspective (Mennin, 2010b), and Eva (2010) has suggested that fresh perspectives can symbolise the unlocking of traditional ways of thinking by merging concepts and ideas from different realms. The SIM attempts to unlock traditional ways, and models new

thinking of the *how* and *why* questions of learners' simulation-based medical education experiences.

Application of complexity theory to medical and other healthcare education is a recent phenomenon, and is still in its infancy (Bleakley, 2010). Debate has arisen about interpretations of the notion of complexity, its appropriation into healthcare and its education, and how it can be used. Paley (2010) suggests complexity theory offers a plausible explanation of how particular patterns of behaviour within the healthcare industry have arisen. Within the health professions education context, Davis and Sumara (2010) have suggested complexity theory might be properly construed as a theory of education, while Fraser and Greenhalgh (2001) have argued that it can inform the development of new healthcare educational approaches which Arrow and Henry (2010) have suggested to include improvements to the functioning of multidisciplinary healthcare groups. Specifically, Mennin (2010a) sees that medical curriculum and practice can be understood as complex adaptive systems in which arise the conditions favourable to transformation and learning. Bleakley (2010) highlights the relationships between complexity theory and social learning theories in the context of medical education which he sees to promote learning as transformation.

Additionally, Mennin (2010a) and Bleakley (2010) regard contemporary medical education as increasingly complex as it moves towards emphasis on more authentic curricula which focus on integration and relational small-group learning. So, Mennin (2010a) and Bleakley (2010) view complexity theory as an informative interpretative framework to explore the dynamics of medical learning. This emphasis on authentic and

relational small-group learning mirrors the nature of learning within the four simulation-facility settings of this study.

This thesis' SIM can be seen as a hybrid of the above views i.e. complexity theory provides an understanding of how learners' socially informed temporal experiences of SBME, can trigger and support transformative development of a professional identity as a doctor. As such the identity formation trajectory as exhibited by the SIM can be suggested to form a complex adaptive system. It must be noted here that the above terms of transformation and learning, as used by Mennin (2010a), Bleakley (2010), and Stacey (2003) are not made with reference to Mezirow (1991). The SIM therefore integrates Mezirow's (1991) Transformative learning theory to perhaps better inform *how* and *why* simulation-learning can be understood as transformative when viewed through the complexity theory lens.

Complexity theory emphasises the relational production of learning and knowledge through exchange and collaboration between learners, where understanding consists of transaction and translation (Stacey, 2003; Bleakley, 2010; Mennin, 2010a). Learning is always relational and interactional, whether it is forming a relationship with tools or instruments, languages and codes, or with persons in and across specific communities of practice (Stacey, 2003; Bleakley, 2010). These descriptions of learning resonate with the essence of SBME, where learners engage with medical equipment, closely interact with peers and clinical educators, and develop medical vernacular and its unique language codes to facilitate the negotiation and management of the medical situation at hand. The SIM encapsulates this relational or collective production of knowledge and understanding

and complexity theory informs how learners' collective SBME experiences were associated with evolution of their professional identities as an adaptive complex system. After all, formation of an identity as a doctor is in itself a complex experience involving diverse and numerous interacting elements, which as a whole, form what 'becoming' and 'being' a doctor means to each individual i.e. a personal or embodied identity as a doctor they wish to be.

The SIM suggests that these numerous interacting elements of a doctor identity as a whole cannot be understood by analysing each element independently which, as Cilliers (1998) suggests, reflects the overall complexity of the interconnected or relational elements which make-up a complex system. These relational elements as identified in the SIM include: *My doctor image*, *Social complexities*, *Asserting my authority* and *Manage the stage*, which together capture the temporal nature of professional identity formation, where *how* and *why* these elements form the complex matrix of an identity of a doctor are encountered, explored, navigated, and organised in an evolving understanding of what a professional identity as a doctor may be. The SIM further encapsulates that such evolution in understanding is often unique to each individual.

Description of *how* and *why* these elements are related is gained from Mennin (2010b) and his suggestion that change in one element changes the context for the others. The SIM reflects such connections of change as transformation of assumptions and ideas (or reconfigured understanding) of the elements that constitute what 'becoming' and 'being' a doctor means. This is suggested to facilitate transition along the identity-position spectrum with new and increasing levels of complexity. Thus the SIM portrays they way learners'

identity formation trajectories can evolve as a complex system which adapts (i.e. learns) in response to changing conditions encountered during SBME sessions. This suggests that SBME provides a space in which learners can make better meaning of the elements that comprise the doctor's role. Mennin (2010b) suggests such a process of adaption therefore has a history. Each identity-position finding within the *Identity Transformation* SIM component illustrates this adaptation and change, and portrays the history behind learners' identity formation journeys. The process which describes such adaptive understanding or learning is self-organisation (Mennin, 2010a) which provides clearer meaning to the SIM's notion of change.

Self-organisation is a core process of complexity theory, through which learners experience progressive adaption to new and changing circumstances, which leads to a new state of understanding (McDaniel & Driebe, 2001; Bleakley, 2010), or reconfiguration over time of the non-linear relational characteristics of the elements constituting a particular complex system (Stacey, 2003; Mennin, 2010a)). Complexity theory sees non-linear relationships as small changes in one element leading to large effects in the others (Mennin, 2010b). The SIM suggests professional identity formation can be a 'particular complex system' and regards the non-linear components as the elements which collectively construe an identity as a doctor. The SIM shows these non-linear relational elements through the diverse *Internally-steered* and *Externally-steered* findings, for example, *My 'doctor' image*, *Unconsciously competent*, *Thinking like a doctor*' and *Manage that stage*. The 'reconfiguration' of the relationships between these elements is illustrated by the *Identity Transformation* findings which suggest the progressive or temporal transition between cohort identity-positions i.e. from 1st year students' *Pretty Helpless* to clinical doctors *I am a Doctor*. The SIM therefore captures learners'

cumulative and transformative progression to larger and broader changes (via self-organisation) to construct their temporally evolving professional identities. The temporal nature of complexity theory's progressive and responsive adaption has evident parallels with Mezirow's (1991) cumulative course of transformative adult learning.

The key elements underlying self-organisation are reflection, feedback, dialogue and collective learning which function as non-linear recursive loops (Plsek & Greenhalgh, 2001; Radford, 2008; Mennin, 2010a). Such recursive processes have been suggested to be part of deliberate practice which is seen as a catalyst for developing expertise as a self-organising process (Schön, 1983; Ericsson, 2004). Perhaps this is the reason doctors in this study placed increasing meaning on their transformative learning SBME experiences. The SIM encapsulates these key self-organisation elements within the *Internally-steered* and *Externally-steered* components as the transformative nature of self-organisation, as meaning of the doctor's role is unpacked and reorganised to reflect how participants saw their role. As such, these self-organisation non-linear recursive loops are suggested to be triggered and supported throughout simulation scenarios and debriefing sessions. Overall, the *Internally-steered* and *Externally-steered* findings show *how* and *why* SBME can facilitate participants to configure transformative understanding of the complexities inherent in the doctor's role, on both the individual and collective levels, which parallels the macro (collective) and micro (individual) levels of complexity theory's adaptation (Mennin, 2010a; Radford, 2008).

The SIM depicts the synergy between the individual and the collective as a central, if not, essential component of participants' identity formation as facilitated by SBME. Without

this juncture where ‘who I think I am’ and ‘who others think I am’ meet, reconfiguration or transformation in understanding the complexities of the doctor’s role is suggested to impede progress to more functional and contributory identity-positions. For example, interns would perhaps encounter more difficulty to transition from their *Asserting my authority* position to the *I am a Doctor* professional identity. Therefore the SIM helps us understand that the meaning attached to each identity-position advances to a new level of complexity as relations between the macro (collective) and micro (individual) levels are further unpacked and integrated into each learners’ professional identity via reflection, feedback, collective learning, and experience i.e. self-organisation.

The SIM also elucidates such adaptive self-organising identity development is a cumulative process which does not necessarily have a discrete end-point. This aligns with complexity theory claiming self-organisation as an open-ended process in which the past and present provide a basis for the future without limiting and controlling it (McDaniel & Driebe, 2001; Stacey, 2003). Again, the SIM illustrates participants’ experiences of their previous and current identity-positions can inform and provide motivation to further their learning. However, limitations are not imposed, as self-organisation or reconfiguring transformative processes provide the scaffolding and agency to progress towards more contributory participation in the medical profession. In other words, development of an embodied professional identity as a doctor and sense of belonging. The SIM portrays this open-ended identity formation process as new understandings generated at identity transformation junctures i.e. identity-positions when the aspects of becoming a doctor can be further unpacked and embodied as part of learners’ unfolding professional identity. This implies that learners are engaged in moving towards consideration about what gives value

and meaning to themselves and work more broadly (Iedema & Scheeres, 2003) when participating in the various modalities of simulation-based medical education.

In further congruence with complexity theory, the SIM shows that transformative development of participants' identities can be influenced by an external gradient or force. Mennin (2010a) defines such an external gradient as something that disrupts the status quo or equilibrium, and so triggers self-organisation. This external gradient is captured throughout participants' narratives in the form of expectations for learners to receive feedback from educators and learn with clinicians who reveal knowledge and practice gaps. This external pressure to conform to medical norms is evidenced by the SIM identity-position findings, for example 3rd year students' *Up to Scratch*, 4th year students' *My patients would appreciate it*, and Intern's *Asserting my authority*. Hence, external influences form another relational and bridging element in the complex adaptive system of learners' professional identity formation as a doctor.

Therefore the SIM shows SBME facilitated professional identity development as a complex adaptive system which unfolds over time, with periods of greater and lesser stability, in which such restlessness can trigger and support identity formation in order to adapt to continually changing conditions. The SIM further shows the transformative and self-organising nature of SBME learning by which people can move toward an unknown future in order to realise both continuity of an individual and collective identity i.e. an individual professional identity as a doctor, without necessarily a prescriptive 'blueprint'.

6.5 Chapter Conclusion

This chapter presented and discussed the three key findings embedded throughout this study's Simulation Identity-formation Model: 1) Situated and progressive identity formation, 2) Tolerance of ambiguity and reduced uncertainty, and 3) SBME - a transformative bridge of complexity. These findings have introduced new theoretical insights to further understand learners' simulation-learning experiences, and so adds to the broader canvas of already identified research by introducing a new aspect of SBME learning with a nexus to professional identity formation.

This thesis' insights are informed by the socially-based legitimate peripheral participation perspective of learning, the constructs of ambiguity and uncertainty, and complexity theory, which show *how* and *why* SBME can play a central role in the formation of a professional identity as a doctor. This study offers new theoretical understandings of SBME which can be used to further facilitate preparation of medical students and doctors for the demands of contemporary medical practice, and for functioning effectively in a complex and changing healthcare environment, together with the increasing focus on multidisciplinary interaction.

This chapter has shown that SBME can be viewed as an educational space which provides legitimate opportunities for learners to develop and transition along their identity-forming trajectories. This progressive nature of identity development as a doctor can explain learners' movement towards fuller participation in the medical community via legitimate peripheral participation. This thesis' notion of legitimacy resonates with Kneebone, Kidd

et al. (2005) and their suggestion that simulation-based teaching is feasible and perceived by participants to be educationally useful. The SIM depicts how learners often place significant meaning and value on such centripetal transitions and embody these as a deeper sense of belonging to the medical profession through evolution of their identity as a doctor. This is the first study to apply legitimate peripheral participation to SBME as a socially-based theoretical model.

This study's SIM has also identified that SBME is able to facilitate learners' development of their tolerance to ambiguity with a concurrent reduction in their uncertainty about 'becoming' and 'being' a doctor. Transition between identity-positions corresponded with these developments, as participants further unpacked the meaning of the doctor's role and how ambiguity was a pervasive aspect. Such unfolding tolerance was seen to contribute to learners' reduction in uncertainty with seeing themselves 'fitting' with the socially privileged role of 'being' a doctor. Simulation-based medical education has not been previously identified as an educational context in which participants are facilitated to negotiate and manage ambiguity and uncertainty associated with their evolving professional identities. This study has therefore responded to contemporary calls for medical education to assist both students and doctors navigate the inevitable ambiguities of medical practice.

The core finding of this study encapsulates SBME as a transformative bridge of complexity to the clinical setting, along which learners can be seen to attach expanded meaning on action and knowing associated with their developing identity within the medical profession. Overall identity development is illustrated that it can be viewed as a

complex adaptive system, where self-organisation is transformative in nature and focussed on the non-linear relational array of aspects that constitute what 'becoming' and 'being' a doctor entails. In line with complexity theory, the SIM suggests that the evolution of learners' professional identities is interwoven with internal factors and external social relations. This core finding has provided the theoretical basis for what this study is all about, and it establishes the nexus SBME can have with learners' translation of their simulated-assisted professional identity to the clinical environment. The SIM's notion of a bridge for learning goes a long way to dissolve the artificial separation of simulated and real clinical experiences, as suggested by Bleakley, Bligh et al. (2011). This can therefore be viewed as a new dimension to the deliberate practice construct upon which contemporary SBME is based.

The Simulation Identity-formation Model offers new pedagogical possibilities within the SBME setting, and clearly suggests that simulation-learning opportunities are able to extend beyond discrete skills acquisition, towards the complex processes constituent of professional identity formation. The SIM exhibits the simulation-learning context as an effective pedagogical space in which the development of the multidimensional and interacting elements of 'being' a doctor are frequently encountered by learners, who are then supported to form these into a functional and contributory identity as a doctor.

Finally, this chapter has portrayed how the use and integration of multiple theoretical frameworks can be fruitful in capturing new knowledge. These frameworks include: Mezirow's (1991) Transformative learning theory, Lave & Wenger's (1991) legitimate peripheral participation, and complexity theory. These have been combined to provide a

theoretically different way to understand and think about simulation-based medical education, and its preparation of learners with the multiplicity of skills and abilities which comprise a doctor's professional identity for transfer to the clinical setting. These three theoretical frameworks have been combined to suggested that the SBME context offers learning through time as well as in space, where the construct of professional identity is framed by learning which is dynamic, future oriented and unfolding (Bleakley, Bligh et al., 2011). Additionally, this chapter has highlighted the contribution the Simulation Identity-formation Model provides to the increasing range of theoretical perspectives being conceptualised, adapted, and applied to simulation-based health professional education (Nestel & Bearman, 2015b).

Overall, the SIM's three key findings discussed in this chapter have provided theoretical perspectives which contribute to the emerging literature which examines SBME learning as more than the accumulation of knowledge, skills and values, and extends to the processes of meaningful participation in activities that leads to 'becoming' as a person and 'being' as a specific professional identity (Bleakley, Bligh et al., 2011). As such, simulation can become not just an activity but a way of seeing, which can then change how participants' perceive their clinical practice (Kneebone, 2010) and their place or identity therein. So, the transformation suggested in the SIM can also be viewed as a window on the range and degrees of immersion into medically simulated simulation scenarios, where participants develop their sense of 'becoming' and 'being' a doctor as they engage and enact medical interventions and activities.

The SIM's key findings also contribute to emerging research which has begun to locate professional identity development within the simulation-based learning context, by offering a new theoretical perspective of how and why this can occur. Additionally, the SIM encapsulates that SBME participants are able to deal adequately with transfer across simulated and real settings, by showing flexible management of their professional identity according to setting, a notion recently raised by Bleakley, Bligh et al. (2011). The SIM suggests that SBME participants can identify and view learning opportunities to focus their attention on their professional identity development, which resonates with Pelletier and Kneebone (2015a) who view simulation-education as capturing forms of instruction for teaching how and what to desire.

The next chapter concludes this thesis, reviews it as a whole, and considers the scholarly implications of the SIM and suggests avenues of further research. Strengths and limitations of this study are also discussed, together with SBME practice implication suggestions.

7 Conclusion

7.1 Introduction

This chapter provides a conclusion to this thesis and addresses research objective 4: To build upon SBME knowledge and theoretical premises, and identify future research avenues, and objective 5: To contribute to SBME practice. Section 7.2 begins with a brief summary of this study as presented in the foregoing chapters, followed by examination of the scholarly significance of the Simulation Identity-formation Model (SIM) in section 7.3. Review of this study's strengths and limitations is presented in section 7.4, and practical implications of the SIM are outlined in section 7.5. Avenues for further research are suggested in section 7.6.

7.2 Summary of Thesis

The overall aim of this thesis was to cultivate knowledge and understanding of participants' simulation-based medical education experiences from a new theoretical perspective. To facilitate this, the conceptual framework presented in chapter 2 posed the tentative model that SBME could play a transformative-learning role in medical students' and doctors' development of their professional identity. This was informed by integration of SBME and its extant research, Mezirow's (1991) Transformative learning theory, and the theoretical constructs of professional identity and identity formation. As suggested by

Bryant and Charmaz (2007), in forming this tentative model I adopted the position of a conceptual entrepreneur, which aligned with this thesis' different research perspective of SBME. The tentative model was posed as:

> 'Transformative learning occurs in the simulation-based medical education context, as it can trigger and support development of a professional identity as a doctor'.

Mezirow's (1991) Transformative learning theory was used as a theoretical lens to unpack the notion of 'transformation' experienced during simulation-learning activities. This was integrated with the concept of professional identity development to examine the nature and process of such learning, on both the internal and external levels, which could trigger and support identity formation. This tentative model's perspective was the first of its nature to be applied to SBME, and so addressed a gap in contemporary simulation and medical education literature. This thesis' examination of a possible nexus between professional identity and the simulation-learning context contributed to the recent literature which had begun to explore a similar notion. The tentative model was tested through a mixed methods and cross-sectional research design.

The mixed methods design provided a constructivist and pragmatic research approach which obtained the range of empirical findings that illustrated participants' simulation-learning experiences could often be associated with transformative and temporal development of their professional identities. A cross-sectional design was used to capture a point-in-time of each of the six participant groupings in an effort to gain a progressive or temporal feel of their immersive simulation-learning experiences. This study's four

settings, four data collection methods, and statistical and constructivist grounded theory analytical methods uncovered the richness of study findings which were theoretically integrated to form this thesis' Simulation Identity-formation Model (SIM).

Simulation Survey findings depicted the transformative learning (TL) framework experienced across the participant spectrum included the four central constructs of Mezirow's (1991) Transformative learning theory: disorientating dilemma, reflection, planning action, and discourse/feedback. These were experienced differently by each cohort which appeared to reflect their *a priori* levels of medical understanding, knowledge and clinical experience. The evidenced SBME outcome findings indicated new ways participants' were prompted to view aspects of themselves, elements of what the doctor's role entailed, and how they envisaged themselves to occupy such a role. Simulation Survey findings formed this thesis' initial response to its tentative model, and suggested the SBME setting could be a learning context where Transformative learning was both triggered and supported, and provided initial insight into the nature of such learning. Findings from this thesis' quantitative stage were further explored in the following qualitative stage.

The rich qualitative one-on-one interview, observational, and electronic interview findings added substance and form to this thesis' TL framework. The diversity and in-depth nature of these findings enabled each of the framework's TL substantive phases to be unpacked, where more meaning was given to why participants had made their Simulation Survey selections. The richness of these findings presented the ambiguities and complexities which could be often associated with development of a professional identity as a doctor, as

facilitated by participants' SBME experiences. Again, this thesis' cross-sectional design enabled differences across the participant spectrum to appear to reflect their *a priori* levels of medical understanding, knowledge and clinical experience. These differences also gave insight into the degree and type of immersion often associated with engagement and the enacting of medical activities during SBME sessions.

Quantitative and qualitative findings were then theoretically integrated to form this study's Simulation Identity-formation Model (SIM), which encapsulated the central role SBME can play in the transformative development of a professional identity in medicine, which provided new understanding to address the *how* and *why* questions associated with 'becoming' and 'being' a doctor. The cross-sectional design of this study facilitated the uncovering of this new knowledge to enable theorisation of a temporal nature to 'feeling' more like a doctor via the relational learning context offered by the SBME setting.

The SIM exhibited this temporal and transformative nature of the professional identity development trajectory, comprising four substantive components: 1) *Identity Misalignment*, 2) *Identity Transformation*, 3) *Internally-steered*, and 4) *Externally-steered*. The first represented the various ways by which participants could often experience identity misalignment or dissonance between aspects of themselves and newly encountered elements of the medical role. The second component illustrated the often response or agentic navigation of such dissonance and the transformation of learners' assumptions and understandings of themselves, together with the doctor's role, in order to find a better 'fit' with how they saw themselves as a doctor. This navigation was seen to involve learners occupying different identity-positions reflective of understanding, medical knowledge and

experience, or provisional ‘ports’ until such time new and transformed understandings enabled them to ‘up anchor’ and navigate towards another more functional and contributory identity-position. The SIM captured learners’ overall navigation towards the collective professional identity goal of being an independent and autonomous doctor.

The *Internally-steered* and *Externally-steered* SIM components displayed the transformative nature by which participants’ could steer and navigate their evolving understandings at both the individual and collective levels. These levels were illustrated to operate synergistically to facilitate transition to the ‘next’ identity-position. Overall, the SIM showed that learners often applied significant meaning to their simulation-learning experiences as opportunities to form and refine their developing sense of ‘becoming’ and ‘being’ a doctor.

The SIM is therefore an empirical response to this study’s initially posed tentative model presented in chapter 2, and portrays SBME as an educational space that can substantively contribute to the formation of a professional identity within medicine. This new theoretical perspective prompts a different and thoughtful approach to SBME as dedicated to preparation for practice, and the role it can take in facilitating participants of varying levels of knowledge and experience to development and refine the matrix of elements which they see to make-up their professional identity as a doctor.

Three key findings emerged from the SIM: 1) Situated and progressive identity formation, 2) Tolerance of ambiguity and reduced uncertainty, and 3) SBME - a transformative bridge of complexity. The first finding showed that professional identity formation included

learning as an integral and inseparable dimension of social practice during which transformation in participants' understandings, identities, knowledge and skills were realised through engagement and participation in simulation-learning activities. Legitimate peripheral participation (Lave & Wenger, 1991) theoretically highlighted that participants' transitions between identity-positions could represent centripetal movement towards fuller participation in, or greater contribution to, the medical profession. The experiential learning nature of SBME was seen to provide a legitimate space for learners to focus on this identity formation. The second key finding illustrated that participants could progressively develop tolerance to the ambiguities experienced in their SBME learning as representing the 'less than certain' realities inherent in the medical role and in contemporary healthcare practice. This was seen to be synergistically associated with reduction in learners' uncertainty of seeing themselves as the type of doctor they wished to be. Developing tolerance to ambiguity via participation in SBME was uncovered to assist in affirming participants' sense of 'becoming' and 'being' a doctor.

SBME - a transformative bridge of complexity emerged as the core finding of this study. It captured the transformative nature of professional identity development as a complex and adaptive learning system in response to the challenging medical situations presented during SBME sessions. Complexity theory enabled SBME to be viewed as a setting which could trigger and prompt evolution of learners' professional identities, whereby learning emerged from the exchange and interaction between participants to result in action that became knowing (Mennin, 2010a). Thus, learning and knowing became adaptive responses to the constantly evolving circumstances as encountered during SBME sessions, which were often complex and messy (Bleakley, 2010; Mennin, 2010a). The SIM illustrated that such adaption often involved self-organisation of the multiplicity of

elements that constituted the doctor's role, and took place on both the individual and collective levels. Thus, meanings that participants attached to each identity-position was seen to move to new levels of complexity, as new relations between these diverse elements unfolded and further informed how learners' viewed their emerging selves as a doctor.

The 'transformative bridge of complexity' depicted by this core finding encapsulated the nexus between the SBME setting and the clinical environment, along which professional identity formation could be co-formed for translation to participants' clinical roles. Complexity theory therefore provided a new dimension to this evolving theoretical perspective of SBME and the nature of the dynamic, interactive, and relational learning within this experiential clinical context. This thesis' metaphor of 'bridge' also resonates with Kneebone (2010) and his recent more nuanced view of SBME as a stepping stone to gaining mastery within a complex clinical world. As such, simulation becomes not just an activity but a way of seeing, which can change how participants perceive their clinical practice (Kneebone, 2010) and their place therein.

Overall, this thesis' SIM suggests SBME learning can be structured for the transformative and complex nature of professional identity development as a doctor, along the continuum of 1st year medical students to practicing clinical doctors. The SBME context is encapsulated as an authentic community of practice (Wenger, 1998) offering the expertise to support the unfolding learning activities and requirements for participants and their respective levels of learning associated with progression towards mastery from a novice to expert (Dreyfus & Dreyfus, 1980).

The SIM also shows that the SBME context provides meaningful peripheral participation and meaningful engagement with medical practice (Bleakley, Bligh et al., 2011) and the matrix of it inherent elements, which promotes the centripetal movement towards fuller and deeper participation (Lave & Wenger, 1991) in medical practice. As such, the simulation-education provides a context for temporal development of a professional identity as a doctor through meaningful acts of participation in medically related activities. The SIM therefore offers a model for understanding professional identity construction through participation in SBME.

7.3 Scholarly Significance of the Simulation Identity-formation Model

The scholarly significance of this study's SIM is discussed below with reference to how it has addressed the first and second research objectives.

The first research objective: To understand transformative learning (TL) as triggered and supported by simulation-based medical education, is addressed by this study's SIM in several ways, and contributes valuable knowledge to the existing literature. Although Gum et al., (2011) formulated Sim TRACT™ as a new conceptual understanding of simulation debriefing as noted in chapter 2, there is further theoretical insight required of the *how* and *why* questions related to simulation-based education.

The SIM developed in this study provides new conceptual understandings of simulation-learning as informed by the four constructs long-recognised as central aspects of Mezirow's (1991) theory i.e. disorientating dilemmas, reflection, planning a course of

action, and discourse/feedback (Illeris, 2014). These elements are exhibited as a commonly experienced learning framework across this study's six participant cohorts, showing they underpin how learners make new meaning through simulation-learning activities. Also, findings show that this framework is experienced differently by learners at each location within the same course or discipline, based on an *a priori* level of knowledge and clinical experience. This illustrates that the SBME setting offers 'tailored' transformative learning experiences based on individual learning needs. In fact, the SIM shows that learners with more advanced knowledge and experience place more meaning and value on these transformative learning elements, which provides further insight into the potential of transformative experiences provided by the SBME setting for learners with more developed knowledge and clinical exposure. As such, these learners participate in SBME sessions with more focus on change for translation to practice. The SIM exhibits this new conceptual insight as the temporal formation and refinement of professional identities which forms the focus of 'tailoring' learners' SBME experiences. Overall this depicts the SIM's new conceptualisation of *how* and *why* learners' participation in simulation-learning is triggered and supported by learning of a transformative nature.

This new conceptual understanding of SBME is further expanded by the finding that shows the transformative nature of simulation-learning is often triggered by instances of identity misalignment, as learners encounter new and unexpected aspects of the doctor's role which do not 'fit' with how they see themselves in that role. This finding contributes further understanding regarding the stress and anxiety learners often associate with SBME which has already been recognised in the literature (LeBlanc, 2009; Harvey et al., 2010; Fraser et al., 2012a). This study is the first to identify that such identity related stress and anxiety is experienced as a significant disorientating dilemma. In fact, this study is also

the first to identify that these instances of identity dissonance exert a motivational influence on learners to agentically resolve such dilemmas. Therefore the SIM illustrates that identity misalignment both triggers and supports learners' transformative learning experiences as they seek explanation of such dissonance and resolution for expanded understanding in order to make new meaning. As such, the SIM is novel in showing how SBME is firmly associated with learners finding their place in the medical community via negotiation of identity conflict. No other study has linked professional identity formation in this manner with SBME informed by Mezirow's (1991) Transformative learning theory.

This study has conceptualised Mezirow's (1991) TLT to be triggered and supported on two levels within the SBME setting: the individual and collective. On the former, reflection and planning action play a central role in learners' reflection on how they see themselves in the socially privileged position of a doctor, and how they plan to manifest these ideas and expectations. Collectively, learners place significant value on objective feedback, both expressed and inferred, to how they enact their evolving professional identities during SBME sessions. These findings therefore present a new conceptualisation of the meaning placed on feedback as a central component of SBME, and contribute to other identified feedback benefits suggested by other authors such as Gum, Greenhill et al. (2011), Raemer, Anderson et al. (2011), and Rudolph, Foldy et al. (2013). The SIM is the first to show the synergistic nature of these internal and collective transformative learning levels and the value and meaning learners attached to these to facilitate identity development. In fact, the SIM captures this synergistic operation as fundamental to enable transition between the identity-positions encountered along individual identity formation trajectories.

This study's SIM, as a theoretical account of simulation-learning experiences demonstrates how these experiences form a transformative 'bridge' to the clinical setting, along which learners are supported to co-form their unfolding professional identities. This shows the SBME setting to trigger and support the deep, reflective and often challenging learning necessary to both initiate and continue with professional identity development. The SIM identifies the significant meaning and value, which is placed upon such supported and temporal transformative development, and the safety which learners feel within the SBME setting. This 'transformative bridge' is therefore seen as an essential part of preparation for practice, as learners are both prompted and supported to construct their professional identities for transfer to the clinical setting.

This study's second research objective: To understand how SBME supports professional identity development, is substantively addressed and furthers new conceptual understanding of the nature and outcomes of simulation-learning experiences. The SIM overall exhibits a new model of *how* and *why* simulation-learning provides a unique experiential learning setting in which learners focus on professional identity aspects for development. As discussed in Chapter 2, formation of a professional identity within medicine has received renewed attention in recent years, and this study's SIM provides both timely and valuable new insights, which depict SBME as a significant preparation for practice context in which learners are facilitated and supported to form their identities as a doctor, and therefore sense of belonging to the medical community.

Development of a professional identity is recognised to play a crucial role in transition from being a medical student to becoming a doctor (Monrouxe, 2010; Wong & Trollope-

Kumar, 2014) and remains equally important once in the clinical setting. Such identity formation incorporates relational, adaptive, and iterative dynamic process (Monrouxe, 2010; Goldie, 2012; Cruess et al., 2014). The SIM illustrates these processes, yet captures these as an identity formation trajectory comprising specific identity-positions which learners of different levels occupy, until such time further understanding (i.e. transformative learning) enables transition to another identity location. Transition is exhibited by the SIM to include changes of assumptions and ideas about aspects of learners' self-concept, the doctor's role, and how they see themselves in such a future position. Findings show that significant meaning is attached to these identity-positions and relates to individuals 'feeling more like a doctor', and so they embody this evolving sense of self in a future doctor role. These identity-positions are new to the literature and give further insight into the stages of development of an identity as a doctor, and the transformative nature of such development. After all, adults do not change elements of their identities if they do not have good reasons to do so (Illeris, 2014), and the SIM shows these 'reasons' to be firmly associated with development of participants' understandings of the doctor's role and how they will 'fit' with such a socially privileged position.

Further conceptual insight into how SBME supports development of a professional identity is gained by applying Lave & Wenger's (1991) legitimate peripheral participation (LPP). This provides another lens to expand the SIM's newly illustrated transition between identity-positions. LPP theorises the centripetal progression towards full participation in a community of practitioners and the value placed upon this transition to more contributory participation. The SIM exhibits this centripetal movement in the evolution of the identity-positions of each cohort, and is linked to the progression of complexity from low to high-fidelity simulation-learning activities. The SIM shows how participation in simulation

sessions contributes such progression towards more functional and contributory action intended for transfer the clinical setting - whether learners are students or doctors. The SIM therefore gives new insight into the value and meaning learners place on participation in SBME activities to affirm their sense of belonging to the medical community. The SIM also models the learning focus and process participants apply to SBME in order to facilitate this transition towards fuller participation in medicine.

This focus on identity development within the SBME context resonates with other authors who suggest that identity matters, because it influences who we are and who we are seen to be (Monrouxe, 2010), and encapsulates how an individual defines oneself to oneself and is recognised by others in a given context (Gee, 2000; Lasky, 2005). This study's SIM reflects this socially-based nature of identity development, yet offers insights about how the SBME context provides an important educational setting where learners place significant meaning upon how they are 'seen' to participate in simulation-learning activities. How learners sense their performance is modelled by the SIM on two levels: the individual and collective, and these exhibit that learners place significant meaning on how they display the complexity of aspects of the doctor's role commensurate with each identity-position. This meaning is seen to increase as transition between identity-positions continues. Therefore, the SIM exhibits occupation of an identity-position facilitates the embodiment of a developing professional identity, as does departure and transition towards another. This is a new understanding of the development of an identity as a doctor.

The term transformation is used by authors to style the experiences of professional identity development (Monrouxe, 2010; Goldie, 2012; Jarvis-Selinger, 2012; Cruess, et al., 2014),

yet the nature or processes of this have not been fully described. This study's SIM conceptualises 'transformation' as the transition between identity-positions, as each position can be viewed as a new qualitative stance where conditions are changed an experienced from new perspectives (Illeris, 2014). New choices and decisions, within the cognitive, emotional, and social domains which often reach beyond existing ideas, must then be made through further transformation (Illeris, 2014). The SIM depicts such transformations as an opened-ended or ongoing process without a predetermined end. This study provides valuable new knowledge of the 'transformative' nature of professional identity formation, which in contemporary healthcare can be suggested to involve increasing complexity.

Complexity theory also provides further conceptual understanding of professional identity development by illustrating the process can be a complex adaptive response to continuously changing and ambiguous circumstances via self-organisation and emergence of new patterns of relationships (Stacey, 2003; Mennin, 2010a). The SIM illustrates the numerous aspects of the doctor's role as encountered during SBME sessions, form a complex matrix of relational elements which informs the development of a professional identity as a whole. This is reflected in the SIM by learners adapting to and examining the relationships of these elements together with aspects of themselves in order to find a 'fit' through transition between each identity-position. This 'finding a better fit' is displayed as self-organisation via transformative learning so learners can navigate the increasing complexity associated with more functionally developed professional identities. Theorists such as Stacey (2003), Mennin (2010a), Bleakley (2010), and Fenwick and Dahlgren (2015) use the term 'transformation' to depict the potential for learning through complexity theory and its adaptive self-organisation or emergence, however, without

reference to Mezirow. Therefore, the SIM introduces new potential understanding of the process of complexity theory's 'transformation' through its integration with Mezirow's (1991) Transformative learning theory to describe the nature of simulation-learning which can be associated with professional identity formation as a complex adaptive system. This study therefore provides a new dimension to the emerging literature that applies complexity theory to the simulation-based education settling, by introducing learners' responses to their simulation-learning experiences as a responsive adaptive system by which self-organisation of meaning represents transformative development of their evolving understandings of themselves and elements of the doctor's role, to form a professional identity within medicine.

In summary, this study's new model demonstrates how SBME is not only a context for development of content knowledge or cognitive, technical, humanistic, relational and other skills and abilities. Rather, it provides a context in which identity can be formed and co-created, and where learning and knowing can be transformed and adapted to constantly evolving, uncertain or ambiguous circumstances. This thesis contributes to contemporary recognition of the relationship between clinical and simulation-based practice as a mutually dependent two-way process (Kneebone, 2010). It is hoped this study's new insights capture the imagination of educators and researchers to understand more how to apply simulation-based medical education to promote the formation a new professional identity. Such new understanding could provide additional empirical knowledge to further SBME as an essential element of 21st century medical education, and its re-emergence of the importance of professional identity development through such education.

7.4 Study Strengths and Limitations

The Simulation Identity-formation Model (SIM) offers a new way SBME can be viewed as a teaching and learning modality to prepare medical students and continue the professional development of doctors, and therefore represents the most significant strength of this thesis. This study is the first of its kind within the simulation and medical education literature to depict the transformative nature of professional identity development, as triggered and supported by the simulation-learning setting. The theoretical strength of the SIM arises from the integration and use of several diverse theoretical frameworks from which deep and rich meaning has been made about this newly uncovered outcome of SBME learning. This study's cross-sectional design enabled the SIM to adopt a temporal nature to medical students' and early-stage doctors' professional identity formation.

The integration of Mezirow's (1991) Transformative learning theory (TLT), aspects of professional identity and identity theory, Lave & Wenger's (1991) legitimate peripheral participation (LPP), and complexity theory (Bleakley, 2010; Mennin, 2010a) exhibits the theoretical strength of this thesis. This merger of perspectives has provided a new and innovative lens through which to view learners' experiences of SBME. These diverse perspectives have also provided theoretical insights into each other, and further strengthen this study's findings. For example, Mezirow's (1991) Transformative learning theory provides an informative and explanatory view of the term 'transformation' used in LPP and complexity theory. This has captured deeper meaning of the process of developing a sense of belonging i.e. a professional identity via LPP within the SBME context. Similarly, TLT has given new insight into the notion of 'transformation' and learning as espoused by complexity theory's adaptive and responsive self-organisation. Therefore the SIM opens

new avenues of thought about the *how* and *why* questions of learners' SBME experiences and the association with professional identity development. The approach taken in this thesis represents extensive application of theory to the simulation-based medical educational context.

This thesis therefore provides new theoretical insights and understandings of the educational utility and application of SBME, which include new outcomes not previously recognised. Primarily, these outcomes include the temporal nature of transformative learning that may occur via participation in SBME sessions, and the associated evolution of a professional identity as a doctor. The processes of such transformation involve learners to unpack and reshape their understanding of the complexities which make-up the doctor's role, and how they picture themselves in this privileged social position.

Another strength of this thesis was its approach to thoughtfully plan and implement a research design to effectively address its new exploratory perspective. The resultant mixed methods cross-sectional design provided the flexibility needed for data gathering within the SBME setting and the limited opportunities medical students and doctors had to offer their time to participate. These participants, within the large spectrum of *a priori* knowledge and clinical experience, provided a large amount of data, which was triangulated through the four data gathering methods. The quantitative and qualitative analytical methods further facilitated triangulation through extensive statistical and in-depth grounded theory analysis. The four settings of this study also enabled data to be triangulated across multiple sites and allowed for any differences unique to each to be captured. This design enabled findings of high informative yield to be uncovered.

My experiential knowledge of healthcare SBE and familiarity with its various simulation modalities and teaching strategies is another strength of this study. This assisted interpretation of the data gained through the four sources, as I am familiar with the general simulation lexicon, the multiplicity of narrative references participants used to describe their experiences, and other 'off-the-cuff' medically-related remarks.

Other strengths of this study relate to the four quality principles for medical research as suggested by Janneke, Frambach et al. (2013): 1) *Truth value of evidence*, 2) *Applicability of evidence*, 3) *Consistency of evidence*, and 4) *Neutrality of evidence*, together with the principle of construct validity (Dellinger & Leech, 2007). These study-strength principles are exhibited throughout this thesis as having been achieved, as discussed in chapter 3 (Section 3.9). As such, this thesis has respected the viewpoints of the quantitative and qualitative paradigms to provide a balanced research outcome as portrayed in the Simulation Identity-formation Model. Methodologically, this study has displayed a mixed-methods approach to strengthen the use of such designs to future simulation-based medical education research.

No study is without some limitations. In this study, only the experiences of medical students and doctors have been captured. Therefore this study's findings may not be representative of the simulation-learning experiences of students and practicing professionals within other healthcare professions. The focus on SBME as one element of the medical curricula within one university program can similarly be suggested as a limitation, as results privilege the SBME experiences within the Flinders University Medical School. The purposive sampling approach of this study's participants is also a

limitation. This carries an element of bias towards learners' experiences of the SBME curriculum of Flinders University, and so introduces a lack of predictive ability to other simulation-based educational settings. However, this study's four simulation settings mitigates this to an extent, as there are likely to be differences in education strategies and learner experiences between each simulation facility. The raw data gathered from the Simulation Surveys were nominal and binary in nature, and so were not the highest level of measurement possible in quantitative analysis. This limited the range of statistical analysis options to examine survey responses, which may have missed other important information. However, consultation with a statistician provided the analysis which made the best use of the data gathered to make reasonable interpretations.

It is also necessary to recognise that the stories provided by participants to describe their simulation-learning experiences were expressed from both an actual and abstracted time location along their learning trajectories. If these same participants were approached again, their recollections may change from a different time and by being interviewed by a different researcher. Also, my healthcare knowledge and SBE experiences have shaped my interpretations made throughout this study through cognitive and affective biases. However, I have been mindfully reflexive upon how these experiences may have influenced and informed this study.

Another limitation of this thesis is its cross-sectional design whereby findings were a 'snap-shot' of participants' experiences at a single point in time (Schneider, Whitehead et al., 2007; Blessing & Forister, 2013), and so the relationships between the four substantive components of the SIM may be weaker than discussed. Stronger and perhaps other

relationships may be identified via a longitudinal study design whereby the same participants could be followed for a longer period. Related to a longitudinal design, this study is limited by the relatively junior doctor level i.e. PGY 1 & 2 doctors' experiences with SBME. This misses other potentially different results from more experienced medical officers who partake in SBME for example intensivists, consultants, and surgeons. Finally, the relatively low response rates to the Simulation Survey across the participant spectrum runs the risk of being a non-representative sample (Blessing & Forister, 2013) of the population of medical students and doctors who partake in simulation-based medical education. The several strategies used to recruit potential participants mitigated this to an extent.

7.5 Practical Implications of the Simulation Identity-formation Model

This study's Simulation Identity-formation Model has uncovered findings which can have practical implications for simulation educators. It provides a framework for SBME curricula and practices to be developed to challenge, guide, and support learners in ways that facilitate development of their professional identity in preparation for practice and transfer to their clinical roles. In practical terms, issues regarding professional identity should be incorporated into every aspect of SBME and especially post-simulation debriefing as learners become more challenged over time. The SIM can be viewed as a catalyst to view simulation education practices from this perspective, where more speculative and creative approaches could be developed to develop richer and more elaborate simulation scenarios surrounding professional identity development and refinement, rather than purely clinical dilemmas.

The SIM further shows that there is an empirically established need to look beyond existing SBME practices, despite their identified utility in present and past circumstances (Billett & Somerville, 2004), and view the notion of deliberate practice can also encompass the matrix of elements which constitute a professional identity as whole. Viewing deliberate practice from this perspective would facilitate the structure of specific educational focus on how learners are developing and enacting these multiple aspects of the doctor's role during simulation activities. Specific objectives could be structured around these elements whereby educators assessed how learners are integrating and depicting these skills and abilities, for example functional relationship building strategies between doctor colleagues and other health professionals. It is suggested that such focussed simulation sessions are presented as dedicated learning opportunities aimed at professional identity development, in addition to other SBME curricula inclusions. Through such focus, more overt learning opportunities surrounding identity development are provided as well as more clearly seen focus on the importance of a professional identity. The SIM suggests that participants focus their learning on the diverse elements of the doctor's role which extend beyond discrete skill acquisition. Developing competency with these elements to then display to observing educators, fellow learners, and themselves is encapsulate by the SIM as essential for professional identity development.

This embodied need to successfully portray an evolving doctor identity during simulation-learning activities should not be underestimated by educators, as the SIM clearly shows the significant meaning learners attach to displaying their competencies, and thus showing themselves to be a more contributory member during simulation sessions and eventually the wider medical community. The strength of this meaning should also not be underestimated, and educators need to more actively recognise and embrace this for design

of future SBME curricula and practice. Simulation participants are shown by the SIM to often place significant meaning to the SBME context as a legitimate clinical proxy in which professional identity development can take place in a safe environment for eventual transfer to the clinical setting.

The areas which SBME curricula should pay close attention to include: communication abilities incorporating medical vernacular and its cultural codes, recognising when to take a leadership role and when to cede it, appropriate proximity with patients and peers, and the synchrony of interaction and movement through close and dynamic fast-paced advanced medical scenarios. The SIM models these areas combine to form what medical students see as necessary for 'becoming' a doctor, and for clinical doctors' refinement of 'being' a doctor as they pursue career aspirations. The merging of these elements could also be incorporated into the notion of 'procedural skills' as they all form the overall procedure of performing and 'feeling' like a doctor. This study's SIM shows SBME provides experiential learning with these skills, and educators should seize the opportunity to take a fresh look at current practices and build upon existing ways to facilitate learners to form a more a integrated, functional, and contributory professional identity as a doctor. This would certainly facilitate preparation for practice and lead to more confident and competent transfer to the clinical setting.

Supporting these educational suggestions are several authors within medical education literature who suggest formation of a professional identity should be the backbone or principal goal of contemporary medical education (Cooke, Irby et al., 2010; Cruess, Cruess et al., 2014). This should be another catalyst to further structure simulation-based

education as a vital and essential preparatory component of medical education. Transition from the SBME setting to the clinical setting could be smoother and less confronting. ‘Feeling’ more prepared will add to a learner’s sense of belonging to the profession and no doubt facilitate their medical practice and interaction with contemporary multidisciplinary healthcare. Therefore simulation curricula should be structured to more overtly capture this unique learning opportunity within the safety of the simulation education setting.

The identity-position findings of the SIM can also inform simulation curricula and practice, to be better aware of the meaning learners apply to their evolving simulation experiences at various educational levels. Each identity-position clearly depicts how learners ‘feel’ at their levels of understanding, knowledge and experience, and activities and guidance could be structured to more facilitate them to build-upon and expand their understandings of the doctor’s role. The SIM also depicts the motivation learners feel to transition to another more functional and contributory identity-position. Educators need to be actively aware of this value learners attached to such increased sense of belonging by expanding their competencies. After all, the SBME context is designed for experiential learning, and as such, learners regard for simulation as a legitimate setting for identity development needs to more immersed into simulation practice. Development of a professional identity in medicine plays a crucial role in transition from being a medical student to becoming a doctor (Wong & Trollope-Kumar, 2014) and remains equally important once in the clinical setting. The SIM clearly shows the SBME setting provides significant support for this, which can be further refined through curriculum and practice refinement.

The exhibited identity misalignment findings of the SIM warrant a different look by educators as to why learners can feel elevated distress and anxiousness when participating in SBME sessions. By acknowledging learners' dissonance with aspects of themselves and elements of the doctor's role, better understanding of *how* and *why* some learners implement medical activities and associated behaviour could enable more structured and individual feedback to be provided. This highlights the uniqueness of the SBME setting, where medical realities can be presented together with context to provide valued guidance to experienced challenges. This is not always possible in the busy clinical setting, where dissonance may remain unaddressed with negative ramifications. The ability for such guidance should not be underestimated as an important source for learners to find a better 'fit' with the medical role. As this thesis' SIM encapsulates, locating one's identity as a doctor within the medical professional can be a transformative experience where long-held assumptions are questioned and changed to guide future feelings and actions.

A new look at SBME curricula and practices through a complexity theory lens could also represent significant changes in structuring the learning within the small groups that depict simulation-learning sessions. The first change indicated by the SIM would be to view the simulation-learning space as a setting in which the complex adaptive process of professional identity formation can take place. Education planning therefore needs to be attuned to the adaptive self-organisation processes which are utilised in response to the rapid and constantly changing medical circumstances presented by various simulation modalities. This self-organisation as illustrated by the SIM ties in with restructuring the variety of elements which make-up the doctor's role. Adequate variety is therefore needed to increase the complexity of simulation group processes to match the complexity of tasks (Arrow & Henry, 2010) inherent to identity formation. Self-organisation requires an

external gradient (Mennin, 2010a), and clinical educators need to develop more refined awareness of and increased skill to create smoother gradients to promote active sharing and fuller participation by all members (Arrow & Henry, 2010) to become a coherent and coordinated whole. Educators need to better acknowledge that it is not what learners know that matters most, rather it is what they do i.e. how they perform what they know (Bleakley, 2011). SBME curricula therefore need to be structured to provide more opportunities to enable learners to test and experiment with the complexities of the matrix of factors which constitute their evolving and transforming professional identities.

Complexity theory provides a new look at the potentialities of simulation-based education as preparation for medical practice to provide and sustain practitioners capable of contributing creatively, skilfully and humanely (Mennin, 2010a) to people under their care. The SIM suggests that complexity theory can explain the learning experiences of SBME participants as they shape, transform, and evolve their professional identity. As such, simulation-based medical education is shown as a transformative bridge of complexity to the clinical setting. SBME curricula design should embrace this new view of *how* and *why* it can play such an essential role in preparing students and doctors to meet with and manage the complexities of modern day health care and 'being' a doctor. After all, to practice medicine students and doctors need to form a professional identity, i.e. ways of being and relating in professional contexts, and to classify their place as both an individual and a member of a collective in the medical profession (Goldie, 2012).

In summary, with the contemporary emergence of specific inquiry into professional identity in medicine, its elements and the teaching thereof, authors are re-examining

educational strategies which support its formation (Cohen, Kay et al., 2009; Monrouxe, 2010; Wilson, Cowin et al., 2013). With integration of the SIM into SBME curricula and practice, the simulation setting is further exhibited as an educational context where professional identity development can be both triggered and supported, and where learners are facilitated to define themselves within the medical profession. A new framework of ideas which illuminate understanding of how people learn and how teaching is enacted within simulation-based educational practice (Nestel & Bearman, 2015b) is therefore introduced by this study's Simulation Identity-formation Model. Simulation educators should grasp this new understanding of a simulation-learning outcome as another avenue of preparation for practice, and so further the utility of SBME as an educational modality for transfer to practice.

7.6 Directions for Future Research

This study's Simulation Identity-formation Model (SIM) opens-up avenues for enticing research to further explore the nexus between simulation-learning, professional identity development, and its transfer to the clinical setting. This could perhaps open-up a new research domain exploring the potential to develop richer and more elaborate simulation scenarios about professional identity elements and their collective enactment in a clinical context. Such focus could be either discreet and/or integrated with the well-established dedication to presenting clinical dilemmas as part of preparation and transfer to practice. The linkage to SBME and its possible role it can play in professional identity development has recently emerged, and this study's SIM offers further insight to 'step-outside of the square' and embrace new creative research avenues to shed new light on the theoretical

premises which may underpin SBME and new educational strategies and foci. This is well-placed to uncover knowledge to be used to create more elaborate and productive simulation scenarios where learning focus is on identity development rather than discrete clinical dilemma situations. Of course, the two can be combined to form high-fidelity clinical scenarios as representative realities of the contemporary healthcare industry and the demands and responsibilities medical officers assume.

One possibility is to further explore *how* and *why* participation in the dynamic and interactive experiential nature of SBME triggers and supports learners' transformative understanding of 'becoming' and 'being' a doctor. In particular, further research into learners' often experienced identity misalignment is needed to better explain the frequent mismatch between aspects of themselves and those of the expected doctor's role. The SBME provides a unique clinical-proxy context to facilitate such inquiry in a safe and structured space. Identity conflicts need further systematic exploration to expand understanding of the nature of such dissonance and the complexity of how these are recognised, negotiated, and hopefully resolved. Further research could sample learners from a wider medical speciality and experience spectrum to illustrate the nature of such changed ideas and long-held assumptions of a renegotiated identity, of both self and the professional domains. There is also a need to better understand the synergies between the individual and social nature of transformative professional identity formation. These areas of research would contribute to professional identity development in medicine, its elements, and the support thereof as demonstrated in contemporary literature (Wilson et al., 2013; Cruess et al., 2014). Simulation-based research can stand to provide insightful and perhaps more elaborate results from another educational context and perspective that

further highlights SBME can play a significant role in supporting professional identity formation for students and doctors.

Another avenue of systematic inquiry needs to be what makes learners experience and participate in simulation-learning activities as a legitimate opportunity to develop their professional identities. This could include further examination of the meaning learners' attach to SBME activities and the provisional identity-positions they occupy and place significant meaning upon, as they transition towards another more functional and contributory position. The meaning attached to these identity-positions needs to be further unpacked, as this is currently absent from the literature. Another perspective of this research should investigate how learners make the change from the SBME context as a legitimated learning space to the clinical environment, and how this may affect enactment of their simulation-facilitated professional identity. These studies would contribute to the developing translational medical research literature, where focus is on translating research into practice (Woolf, 2008), and would also respond to the recent call by Issenberg, Ringsted et al. (2011) for more translational research of simulation-based medical education. This thesis' SIM is a timely contribution to these calls for further translational medical research.

This study's SIM encapsulates the importance of reflexivity for SBME participants. This resonates with Bleakley, Bligh et al. (2011, p. 17) and their proposed 'cultural shift from reflective practice to *new forms of reflexivity*'. The SIM captures this shift by modelling that reflexivity associated with SBME can act as a kind of feedback loop on keeping professional identity development on course, and reflexivity is depicted as a deeper

process of participant inquiry into what values drive medical practices and how activities are conceived, legitimated and executed through the interplay of identity (Bleakley, Bligh et al., 2011). Further systematic study into how and why SBME facilitates deeper levels of reflexivity is needed to obtain a more nuanced understanding of professional identity development through participation in SBME. This could offer new knowledge about the ongoing quality assurance SBME can represent in both becoming and being a doctor through asking critically interrogative questions such as 'why do we do it this way and not another way?' (Bleakley, Bligh et al., 2011).

Complexity theory as a theoretical basis of SBME needs to be further explored to develop better understanding of how learners adapt and work more effectively in complex, dynamic systems through shared tolerance of ambiguity and distributed cognition (Bleakley, 2010). Specifically, the process of transformative professional identity development, as a complex adaptive system, needs further systematic examination. Future research which explores the multiplicity of the aspects which constituent the doctor's role, as experienced during SBME sessions, is needed to further uncover the meaning learners apply to their experiences, and how SBME provides support. This would provide better understanding of how and why learners unpack and then self-organise these aspects to shape their emerging professional identity as the type of doctor they wish to be. As complexity theory is gaining currency within the medical education literature, further research of its application to the simulation context will provide more knowledge to fruitfully inform simulation-based medical education as a setting dedicated to preparation for practice. The SIM's complexity theory perspective uncovers and perhaps prompts new research avenues where further knowledge about the *how* and *why* questions of professional identity formation can be creatively explored.

On a final note, this thesis' empirical identification of a nexus between SBME and its contribution to development of a professional identity as a doctor points to a need to approach future research to find richer and deeper understanding of more elaborate simulation scenarios focussed on identity formation in addition to clinical dilemmas. This could prove a productive and efficacious avenue of research where the uniqueness of the SBME setting could be further uncovered. For example, research examining the intra-professional interaction between several healthcare disciplines in a crisis scenario could uncover the intricacies of how and why individuals present their respective professional identity, and also interprets and makes meaning of the other identities presented during the close relational SBME work. This could uncover fresh knowledge to better understand the workings or mechanisms of the numerous disciplines which make-up the larger healthcare industry. Perhaps such research could be expanded further to explore more elaborate simulated scenarios where doctors are required to interact with other professions, such as the police where circumstances require liaison with non-clinical professionals. This may identify interesting knowledge, as it could be suggested that doctors pay close attention to the presentation of their professional medical identity when dealing with other non-clinical professionals. The SBME setting would provide a safe context for learners to explore and develop their professional identity in this different and perhaps more elaborate way. This thesis' new look at SBME could pave the way to develop such new an elaborate research perspectives of how and why the simulation context can play an important and perhaps unique role in formation of a professional identity as a doctor for transfer to clinical practice. Also, this possible uniqueness of the SBME setting could be explored further to uncover unexpected and sea-changing results - both theoretically and practically.

7.7 Chapter Conclusion

This chapter concludes this thesis, yet this study only begins the inquiry into the unique and valuable educational role simulation-based medical education is able take to promote and support transformative professional identity formation as a doctor. This study's Simulation Identity-formation Model is the first of its kind to exhibit this theoretical and potential outcome of SBME, and so provides a window on the dynamic, complex, and transitory nature of professional identity evolution facilitated through participation in simulation-learning activities. The SIM contributes to the broader canvas of SBME experiences, as is established in the literature, and can be viewed as a window on the range and degree of immersion into simulated medical activities with which participants engage and enact during SBME sessions, and so see themselves to both externally present levels of competencies and to internally 'feel' better with 'fitting' with these and so seeing themselves as a doctor. This thesis' SIM suggests that SBME participants often identify with this perception that the simulation context provides a learning context where medical practice is experienced to how it ought to be seen and felt, which are vital elements of a developing a professional identity.

Through the use and integration of new theoretical perspectives, the SIM provides a framework to further discuss and describe learners' simulation experiences and the meaning and value which they attach to their learning, together with its association to their evolving sense of belonging to the medical profession. The SIM fills some gaps in the theoretical understandings of SBME, as recently stated by Issenberg, Ringsted et al. (2011), Nestel, Groom et al. (2011), and Nestel and Bearman (2015b). The SIM gives a strong 'voice' to the vital and transformative educational role SBME can play in assisting

learners in 'becoming' and 'being' a doctor, and so represents empirical validation of this study's originally posed tentative model. The SIM also resonates with Kneebone (2015) and his suggestion that education is primarily about engagement and interaction where 'reciprocal illumination' among those involved can lead to valuable new understanding and insights with how others see us. Similarly, the SIM resonates with Montgomery (2006, p. 186) and the suggestion that medical education is a 'self-altering course of study.'

This study has illustrated professional identity formation as an under-recognised outcome of SBME, which extends the expectations of simulation-learning beyond acquisition of discreet skills and development of instrumental competencies. The SIM also provides better understanding of the potential transformative nature of professional identity formation in medicine. The integration of legitimate peripheral participation and complexity theory has provided deeper insight into this study's original aim and establishes the central finding of SBME as a transformative bridge of complexity, the theoretical importance of such led to it being adopted as the title of this thesis.

This thesis empirically establishes that SBME can provide a context in which participants' professional identities are co-created, and where such transformative learning and knowing are adapted to constantly evolving, ambiguous, and complex circumstances encountered through participation in SBME activities. This resonates with Kneebone (2010) and his view that SBME supports the development of competent, rounded and caring practitioners. The SIM also theoretically shows that simulation-education often reaches beyond technical psychomotor skills and presents a degree of reality for complex affective learning of communication, professional and moral behaviour (Bleakley, Bligh et al., 2011). As such,

the SIM contributes new knowledge to the contemporary re-examination of professional identity by exhibiting the interplay of Mezirow's (1991) Transformative learning theory, legitimate peripheral participation, and complexity theory. This interplay also adds to the other theories which have been recently conceptualised, adapted, and applied to simulation-based health professional education (Nestel & Bearman, 2015b) and prompts another way to think about SBME as preparation for practice. The SIM further consolidates SBME as a globally established central thread in the fabric of medical education (McGaghie, Issenberg et al., 2010), and that formation of a professional identity should be the backbone of contemporary medical education (Cooke, Irby et al., 2010; Cruess, Cruess et al., 2014). This study's Simulation Identity-formation Model adds a new dimension to the central place simulation-based education occupies in contemporary medical curricula, and also presents a new vision of *how* and *why* formation of a professional identity as a doctor can be triggered and supported, and that participants take the SBME context for learning seriously. The SIM has shown that SBME participants can use simulation as a lens for shaping perceptions of the contemporary role of a doctor and their professional identity for enacting this clinical and socially privileged role.

Appendix A: Simulation Survey - Medical Students

This survey asks about your experiences with simulation education throughout your course.

1. Thinking about your experiences with simulation **(e.g. SimMan, Standardised Patient, or Debriefing)**

   Please tick any statements below that apply to you:

   - ☐ I have sometimes felt out of my comfort zone (a)
   - ☐ I have sometimes questioned the way I would normally act (b)
     (*e.g. patient interaction, medical interventions, ethics, or professional interaction*)
   - ☐ I have sometimes questioned aspects of my knowledge, beliefs, or ideas
     (*e.g. regarding patient interaction, medical interventions, ethics, or professional interaction*) (c)
   - ☐ I have realised other people also question aspects of their knowledge, beliefs, or ideas (d)
   - ☐ As I questioned myself, I began to view some of my expectations (e) differently (*e.g. regarding patient interaction, medical interventions, ethics, or professional interaction*)
   - ☐ I began thinking about acting in ways different to my usual expectations
     (*e.g. regarding patient interaction, medical interventions, ethics, or professional interaction*) (f)
   - ☐ I thought about how to adopt these new ways of acting in future simulations or clinical settings (g)
   - ☐ I gathered more information to support these new practices or ways of acting (h)
   - ☐ I experimented with these new practices and ways of acting *(e.g. clinical roles or medical interventions)* (i)

☐ I have taken note of feedback and reactions resulting from my new practices and ways of acting (j)

☐ I have been consciously using some of these new practices and ways of acting in various settings (k)

2. Since you have been undertaking simulation activities, do you believe you have experienced times when you realised your knowledge, expectations or ideas were changing?

   ☐ **Yes**, please go to **question 3** to continue the survey

   ☐ **No**, please go to **question 4** to continue the survey

3. Please briefly describe an experience:_____

4. Looking back over your simulation experiences, have you thought or begun to think……. (*please tick any which apply to you*)

   ☐ I have left some simulation sessions seeing 'things' differently

   ☐ Simulation has helped me recognise personal attributes I did not know I had

   ☐ I have begun to reshape the way I see myself as a doctor in the future

   ☐ My beliefs and expectations of the doctor's role have been reshaped from my original ideas

   ☐ Some of my long-held views and ideas have been challenged

   ☐ My beliefs and opinions of the social complexities of healthcare have been restructured

   ☐ Simulation sessions have given me new understandings which I now consciously use

   ☐ Simulation sessions have led me to explore new ways of learning

5. Overall how would you rate simulation as a learning experience helping to facilitate deeper understanding?

   ☐ *Not at all* ☐ *A Little Influence* ☐ *Some Influence* ☐ *Very Influential*

Demographic data:

Gender: ☐Male ☐Female Cultural Background: _____

Age:_____ Student: ☐1st Yr ☐2nd Yr ☐3rd Yr ☐4th Yr

Prior Education: ☐Bachelor ☐Honours ☐Masters ☐Doctorate ☐Other:_____

Please also provide your FAN for monitoring of survey responses – this will **NOT** be used for any other purpose: FAN: _____

Follow-up Interview:

You are invited to participate in a follow-up interview to gather further information about your simulation experiences.

Are you happy to be contacted for a follow-up interview at a later date?
☐**Yes** ☐**No**

If yes: *First Name:*_____ *email:*_____

Thank you for completing this survey. Your responses are respected and valued

Appendix B: Simulation Survey - Interns and Doctors

This survey asks about your learning experiences with clinical simulation-based education.

1. Thinking about your experiences with simulation **(e.g. SimMan, Standardised Patient, or Debriefing)**

   Please select any statements below (*place an 'X' in the boxes*) that apply to you:

- ☐ I have sometimes felt out of my comfort zone
- ☐ I have sometimes questioned the way I would normally act (*e.g. patient interaction, medical interventions, ethics, or professional interaction*)
- ☐ I have sometimes questioned aspects of my knowledge, beliefs, or idea (*e.g. regarding patient interaction, medical interventions, ethics, or professional interaction*)
- ☐ I have realised other people also question aspects of their knowledge, beliefs, or ideas
- ☐ As I questioned myself, I began to view some of my expectations differently (*e.g. regarding patient interaction, medical interventions, ethics, or professional interaction*)
- ☐ I began thinking about acting in ways different to my usual expectations (*e.g. regarding patient interaction, medical interventions, ethics, or professional interaction*)
- ☐ I thought about how to adopt these new ways of acting in future clinical situations or roles
- ☐ I gathered more information to support these new practices and ways of acting
- ☐ I experimented with these new practices and ways of acting
- ☐ I have taken note of feedback and reactions from my new practices and ways of acting

☐ I have been using some of these new practices and ways of acting in my clinical roles

2. Since you have been undertaking simulation activities, do you believe you have experienced times when you realised your knowledge, expectations or ideas were changing?

☐ **Yes**, please go to **question 3** to continue the survey.

☐ **No**, please go to **question 4** to continue the survey.

3. Please briefly describe an experience:

4. Looking back over your simulation experiences, have you thought or begun to think……. (please select any and *place an 'X' in the boxes*)

☐ I have left some simulation sessions seeing 'things' differently

☐ Simulation has helped me recognise personal attributes I did not know I had

☐ I have begun to reshape the way I see myself as a doctor in the future

☐ My beliefs and expectations of my future medical role have been reshaped from my original ideas

☐ Some of my long-held views and ideas have been challenged

☐ My beliefs and opinions of the social complexities of healthcare have been restructured

☐ Simulation sessions have given me new understandings which I now consciously use in my clinical role

☐ Simulation sessions have led me to explore new ways of learning

5. Overall how would you rate simulation as a learning experience helping to facilitate deeper understanding?

☐ *Not at all* ☐ *A Little Influence* ☐ *Some Influence* ☐ *Very Influential*

Demographic data:

Gender: ☐ Male ☐ Female

Age: ☐ Cultural Background: ☐

Prior Education: ☐ Bachelor ☐ Honours ☐ Masters ☐ Doctorate ☐ Other:

Years practicing as a Doctor: ☐ Current clinical speciality: ☐

Follow-up Interview:

You are invited to participate in a follow-up interview to gather further information about your simulation learning experiences.

Are you happy to be contacted for a follow-up interview at a later date? ☐ **Yes** ☐ **No**

Thank you for completing this survey. Your responses are respected and valued

Appendix C: - Survey Pilot-Test Cognitive Interview Protocol

Interviewee Initials:	**Interviewer:**
Date:	**Time:**
Location:	**Survey Version No:**

This is the generic interview protocol. Other questions will be asked reflective of responses from each interviewee.

1. How do find the general layout of the survey? What are your immediate impressions?
2. What is your reaction to the apparent density of questions over two pages?
3. How long do you feel this survey will take to complete?

Question 1:

4. What is the first question asking you to do? & Are the instructions clear?
5. Were any of the statements in **Question 1** unclear or difficult to answer?
6. What do you think the term '**experiences with simulation'** means?
7. What do you think **'new practices and ways of acting'** means?
8. What do you think **'clinical roles'** means?
9. How do you interpret the term **'assumptions and ideas'**?
10. How do you interpret the term **'act differently'**?
11. How do you generally find the wording of the statements in Question 1?
12. Is it difficult to recall the kind of information asked for in Question 1?
13. Are the statements in Question 1 worded appropriately to capture your simulation experiences?

Question 2:

14. What is the second question asking you to do? & Are the instructions clear?
15. Was it difficult to decide which response to give?
16. What is your understanding of the term 'undertaking simulation activities'?

17. How do you interpret ‘times when you realised your knowledge, expectations or ideas were changing’?
18. Is it clear to continue with Question 3 if you answered ‘Yes’ or continue with question 4 if you answered ‘No’ to Question 2

19. Is **Question 3** clear to answer?
20. Is it clear the experience asked to be described in Question 3 referred to the same as Question 2?

Question 4:

21. What is the fourth question asking you to do? & Are the instructions clear?
22. Are there too many options to select?
23. Do these options represent likely learning outcomes or changes from simulation-learning activities?

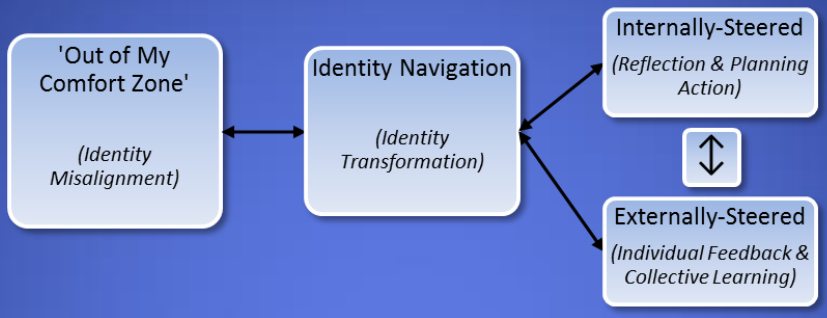
Questions 5:

24. How do you interpret the degrees of influence presented?
25. Any other comments?

Appendix D: ANZAHPE 2015 Conference Presentation

Medical Simulation-based Education: Professional Identity Learning

Simulation **I**dentity-formation **M**odel (**SIM**)



- Situated professional identity construction
- Tolerance for ambiguity and reduction of uncertainty

Simulation-based education:
a Transformative bridge of Complexity

2015 ANZAHPE Post-Graduate Student Prize

Mark Neill
School of Medicine
Flinders University

Presented at the ANZAHPE 2015 Conference, Newcastle NSW: 30th March 2015

Appendix E: Simulation Observation Findings (1)

Observational findings 1st year medical students' BLS sessions.

Present: 3 or 4 students and 1 clinical instructor (RN or doctor). **Time:** 10 to 15 minutes.

Behaviour:

- Began with displaying a sense of non-attachment to the setting and scenario.
- Awkwardness with where to place oneself and in proximity to the others.
- Fervent looking around context - assumed to be taking-in clues.
- More focus and engagement appears to develop after instruction.
- During BLS scenario, behaviour became more synchronous with other learners.
- One learner stated goal of the scenario and began to assume a leadership role.
- The other learners appeared to eagerly accept not assuming the leadership role.
- Teamwork mechanisms began to appear to be developing, although fragmented.

Vernacular:

- Non-medical language used, although appeared to include some medical words.
- Numerous 'ums' and 'what happens here' stated when beginning a scenario and when unanticipated changes arose.
- When leadership role assumed, more medical focussed language used such as 'airway' and 'respiration rate'.
- The beginning of a medical vernacular database appears to be developing.

Knowledge Application:

- Minimal evidence of knowledge application at this level.
- Overtly unsure of initial patient assessment and responses to findings - such as DRS-ABCD responses and compression depth of CPR.
- An eagerness to acquire new knowledge displayed though asking questions of both fellow students and clinical instructor. Sense to expand skills and knowledge clear.

General Demeanour:

- Unconfident when entering scenario, with clear anxiety around 'being watched'.
- Arms often folded in front of themselves as if self-protecting.
- Often smiling and laughing when 'things' did not work or unsure of what to do.
- Frequent glancing at instructor for validation, whether verbal or non-verbal.
- Appeared to end scenario with great relief, although some displayed that 'something new' had been learned.
- Clearly a demeanour of beginning medical studies with 'new realm' of knowledge.

Appendix F: Simulation Observation Findings (2)

Observational findings for clinical doctors' high-fidelity simulation scenarios and post-simulation debriefing sessions.

Present: 3 to 4 doctors, 1 registered nurse, and 1 clinical instructor. **Time:** Scenario - 15 to 20 minutes and Debriefing - 30 to 45 minutes.

Behaviour:

- Clear display of two general behaviour patterns - an eagerness to assume leadership role to manage clinical interventions, and a willingness to not assume this role and preference for taking instruction and instigating clinical procedures.
- Obvious synchrony of interaction and movement in reflection of their clinical backgrounds.
- Little deviation from task at hand and the deemed appropriate medical interventions.
- Clearly behaving or 'acting' as though in the clinical setting as part of usual practice. Application of their clinical role to the SBME setting.
- An eagerness to collectively hear the advice of consultant during debriefing.

Vernacular:

- Clear medical and focussed vernacular with very few superfluous words used.
- Short and direct sentences without deviation from task at hand or intensions.

Knowledge Application:

- Whilst scenarios may have been new or unfamiliar, knowledge application was clearly evident through asking of questions and practices used to gather medical data from which to base decisions surrounding applied medical interventions.
- A collective way of gathering data and making more meaning was clearly evident.

General Demeanour:

- All doctor participants displayed a collective medical practitioner demeanour.
- Those adopting a leadership role showed the confidence to lead and direct.
- Other participants displayed an eagerness to respond to leader instructions and enact medical interventions. A clear wish displayed to expand knowledge.
- When in debriefing, doctors displayed a subservient role to listen to clinical consultant's advice on other medical interventions.
- All doctors respected other views during debriefing, even in disagreement.
- An overall demeanour of clinical knowledge expansion evident.

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