

Developing a facilitated reflection tool using video technology, during a laparoscopic simulation activity, for doctors in postgraduate Obstetrics & Gynaecology training.

Division of Child Health, Obstetrics & Gynaecology
School of Medicine

Dr Venkatesh Subramanian

BMedSci (Hons) BMBS MRCOG MRCS

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Declaration

Except where acknowledged in the text, I declare that this dissertation is my own work and is based on research that was undertaken by me in the Division of Obstetrics & Gynaecology, School of Medicine, University of Nottingham.

Venkatesh Subramanian

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Finally I could not have achieved this without the constancy and support from my wife and parents to who I owe everything and I dedicate this thesis to them.

“only through reflection, active learning, and placing ourselves in an uncomfortable situation are we fully able to develop our understanding of the world and of ourselves”

Jack Mezirow 1991

Abstract

The evidence for laparoscopic simulation as an effective educational intervention is well established with benefits such as shortening the learning curve, increased learner self-efficacy and developing surgical skills without compromising patient safety.

What has not been explored widely in the literature is what are the educational mechanisms that facilitate this effective learning in laparoscopic simulation. Lack of curriculum, limited simulation design or insufficient understanding of learner's needs may not achieve cost effective educational outcomes or lead to a principle goal of laparoscopic simulation - translation of learning into the operating theatre.

Reflection has been postulated in the literature to be the most important educational mechanism that enhances effective learning in simulation. Thematic analysis from the literature review, exploring reflection in surgical simulation, uncovered four important phenomena. Firstly reflection in surgical simulation can be enhanced through facilitated reflection with a teacher, secondly the use of video technology synergistically amplifies this process, thirdly the centrality of emotion to the simulation learning environment and finally integrating learning frameworks can theoretically structure facilitated reflection in surgical simulation.

Through the theoretical research conducted in this thesis, a facilitated reflection educational tool has been constructed, using video technology, that can be applied in a laparoscopic simulation context.

The design of the facilitated reflection tool has been theoretically scaffolded from Mezirow's works on critical reflection and transformative learning and is discussed in this thesis along with the justification for selecting this theoretical orientation.

An instructional programme for the integration of the facilitated reflection tool using video technology is developed in this thesis, along with elaboration of the technical and theoretical steps to pragmatically implement the tool during a laparoscopic simulation activity.

It is believed that this facilitated reflection tool, in conjunction with video technology, will lead to an improvement in laparoscopic procedural skill performance through the development and enhancement of learner reflection.

A paradigm shift resulting in the development of learning interventions based on educational theory is much needed in the Obstetrics & Gynaecology training armamentarium and the facilitated reflection tool is one step towards that direction.

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Glossary Of Conceptual Terms

Key conceptual terms used in this thesis are defined here with the rationale for the definitions found in the relevant chapters.

Term	Definition
Accommodation	Where a learner experiences an unexpected event which in turn reveals inadequacy of existing frameworks of knowledge
Automaticity	The ability to perform tasks without occupying thoughts consisting of basic details
Community Of Practice	A group who share a common aim, in the case of laparoscopic simulation development of procedural skills
Deliberate Practice	Educational methodology for developing skill expertise
Disorienting Dilemma	An emotive experience that triggers questioning of underlying presuppositions, often occurring in simulation

Flow	The ability to move or progress smoothly in the simulation with unbroken continuity
Knowing Edge	The boundaries of a learners knowledge which when encountered can cause feelings of unfamiliarity or consternation
Learner	Postgraduate Obstetrics & Gynaecology doctors in training.
Laparoscopic Simulation	Any simulation activity that focuses on developing laparoscopic procedural skills
Lifelong Learning	A continuation of medical education with an ongoing process of professional development along with self-assessment, which enables physicians to maintain the requisite knowledge, skills, and professional standards
Mentor Effect	Where the learner feels pressurised when observed by a teacher and strives to achieve to their expected standards.
Metacognition	An awareness of ones thought processes – thinking about thinking

Perspective Transformation	A major change in learners beliefs and values through critical reflection and can occur in simulation.
Reflective Discourse	Dialogue that scrutinizes underlying learner presuppositions through critical reflection. This can through group (learner, surgical teacher and peers); peer (peer and learner) or individual (surgical teacher and learner).

Presupposition	An implicit existing belief, perception, value or view that is either challenged or validated through transformative learning
Procedural Skill	Ability to perform operative tasks during surgery
Reflective Discourse	A dialogue exploring presuppositions through reflection and resulting in a judgment based on reflection
Self-Efficacy	Learner's belief in their own potential or ability to complete a task
Surgical Simulation	Any simulation activity that focuses on developing procedural skills which may or may not include laparoscopic simulation.
Surgical Teacher	An individual that has both surgical (subject) and teaching (educational) expertise with a primary aim of engaging students in learning activities and facilitate achievement of learning goals
Threshold Concept	A cognitive portal, opening up a new and previously inaccessible way of thinking about something

Aim & Objectives

The aim of this study is to develop a facilitated reflection tool using video technology, during a laparoscopic simulation activity, that is underpinned with educational theory.

Objectives

1) To discuss the theoretical justification for developing a facilitated reflection tool during a laparoscopic simulation activity.
2) To select and justify the theoretical orientation for the facilitated reflection tool to reside in.
3) To construct the conceptual framework for the facilitated reflection tool.
4) To design the facilitated reflection tool and integrate it into a laparoscopic simulation activity using video technology.

Objective 1

To Discuss The Theoretical Justification For Developing A Facilitated Reflection Tool During A Laparoscopic Simulation Activity

Chapter 1 - Why Laparoscopic Simulation

This chapter explores the importance of conducting research into laparoscopic simulation and the intentions for choosing this educational intervention.

Simulation can be succinctly defined as an educational intervention that facilitates learning through an interactive and immersive experience by imitating reality (Haerizadeh and Frappell, 2013).

Laparoscopic simulation as a modality, provides learners the chance to develop procedural skills, whilst also uniquely addressing the patient safety agenda (Burden et al., 2014, Grantcharov and Reznick, 2008). Attendance at a simulation experience is already a mandatory requirement for Obstetrics & Gynaecology postgraduate training curriculums in the UK, which requires novice trainees to attend a basic laparoscopic simulation activity (RCOG, 2017).

Reduction in surgical training time due to the European Working Time Directive, decreased case exposure secondary to the advancement of non-surgical treatment options and a shortage of experienced surgeons throughout the country, has had a great impact on the laparoscopic opportunities available to trainees. Figure 1.1 from the Royal College Of Obstetrics & Gynaecology (2010) survey of trainees illustrates that nearly 75% of UK trainees do less than three major Gynaecological procedures a month. Therefore, learning of laparoscopic skills needs to be structured in an effective manner that maximizes all opportunities available.

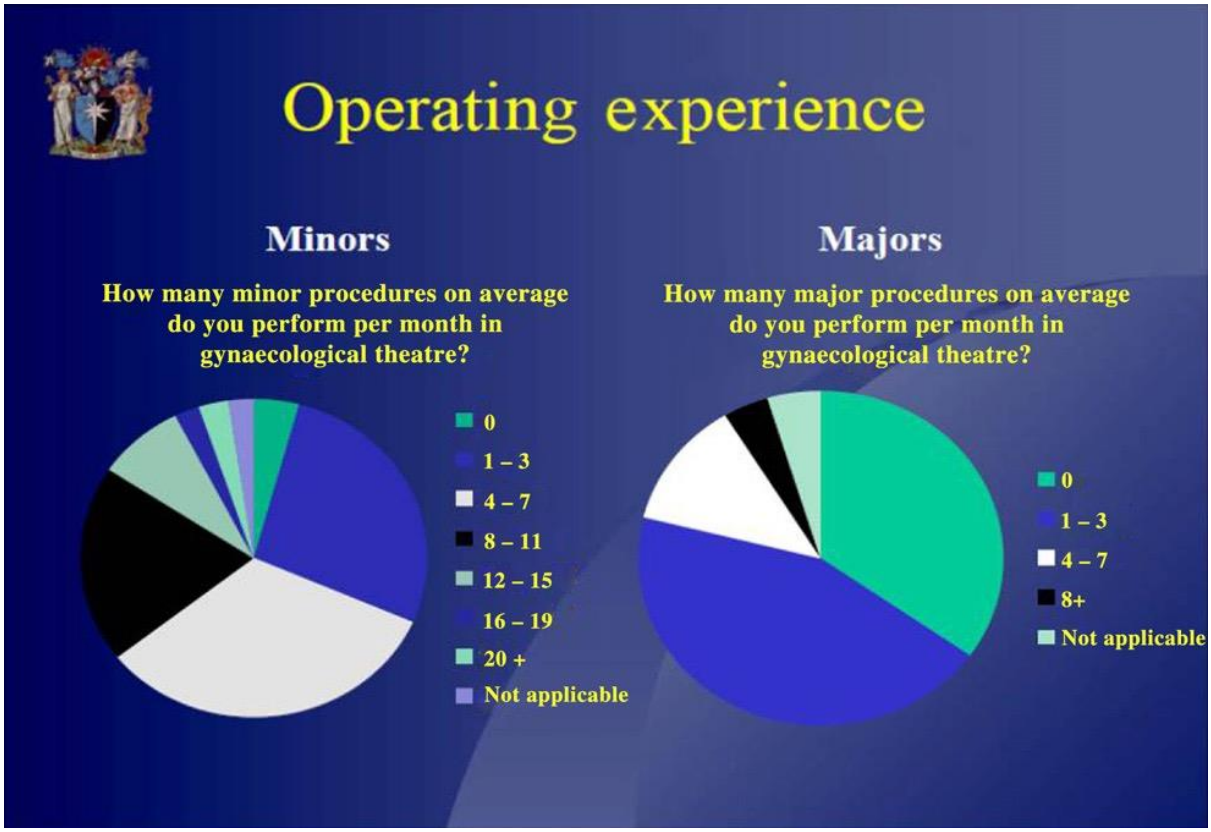


Figure 1.1 Graphical representation of reduced operating experience, from UK trainee survey in Obstetrics & Gynaecology 2010. Taken from (RCOG, 2017)

Surgical simulation has a role in the development and maintenance of both competency and proficiency of these skills and it also slows the learning decay. Simulation of surgical procedures has the potential to improve all three learning domains (cognitive, affective and psychomotor) (McGaghie et al., 2014).

There is some disparity in the evidence suggesting laparoscopic simulation benefits predominantly the novice learner for example Beyer et al (2011) review suggest that laparoscopic simulation has the most potential in training the novice, however other studies such as Ghaderi et al (2011) show that even experienced surgeons

can achieve higher standards of procedural skills using laparoscopic simulation as a learning tool (Ghaderi et al., 2011, Beyer et al., 2011).

There is evidence that laparoscopic simulation facilitates both procedural skill acquisition and retention with the potential of achieving automaticity.(Sroka et al., 2010) Automaticity is the ability to perform tasks without occupying thoughts consisting of basic details, thereby enabling the task to be performed more efficiently and successfully. An example of this would be a novice learner may think of the anatomical boundaries prior to performing the procedure whereas with previous simulation experience this may become second nature. Repetitive goal directed practice has been shown to facilitate achievement of procedural skill automaticity in laparoscopic surgery (Sroka et al., 2010).

Laparoscopic surgery has traditionally been learned using the master apprentice (Halstead) model(Banks et al., 2007). Development of these skills through this model has faced a challenge - balancing patient safety and achieving the desired learning goals. This is compounded with inexperience of procedural skills in surgery resulting in increased intraoperative patient complication rates (Birkmeyer et al., 2013). It has been accepted that the anachronism of this approach no longer meets the ethical responsibilities of the patient safety agenda (Burden et al., 2016).

Simulation provides a bridging solution for learning laparoscopic surgery by practicing in a safe learning environment prior to clinical practice. It is a well agreed consensus that surgical simulation is an effective intervention compared to the traditional master apprentice model or placebo in terms of reduced operative

time, improved technical and non-technical skills and potentially could result in a lower intraoperative complication rate (McGaghie et al., 2010, Purcell Jackson and Tarpley, 2009, Rashid, 2017).

Laparoscopic simulation can have the following applications in training postgraduate doctors in Obstetrics & Gynaecology:

1) Invention, innovation and subsequent trial of new surgical instruments. Intelligent energy devices such as the Harmonic Scalpel© are trialled in this manner.

2) Practice and develop non-technical skills associated with surgery such as communication, interpersonal and organisation skills (de Montbrun and Macrae, 2012).

3) Encounter rare or complex scenarios that can be practiced (Saad et al.), for example the management of large vessel injury can be rehearsed during a laparoscopic simulation activity, further promoting the patient safety agenda of rehearsing rare unexpected events.

4) The educational design of simulation can be modified to the experience of a learner (Mathews et al., 2017). The same laparoscopic simulator can be used to develop basic skills such as port entry for the novice whilst also allowing the advanced learner to practice suturing skills.

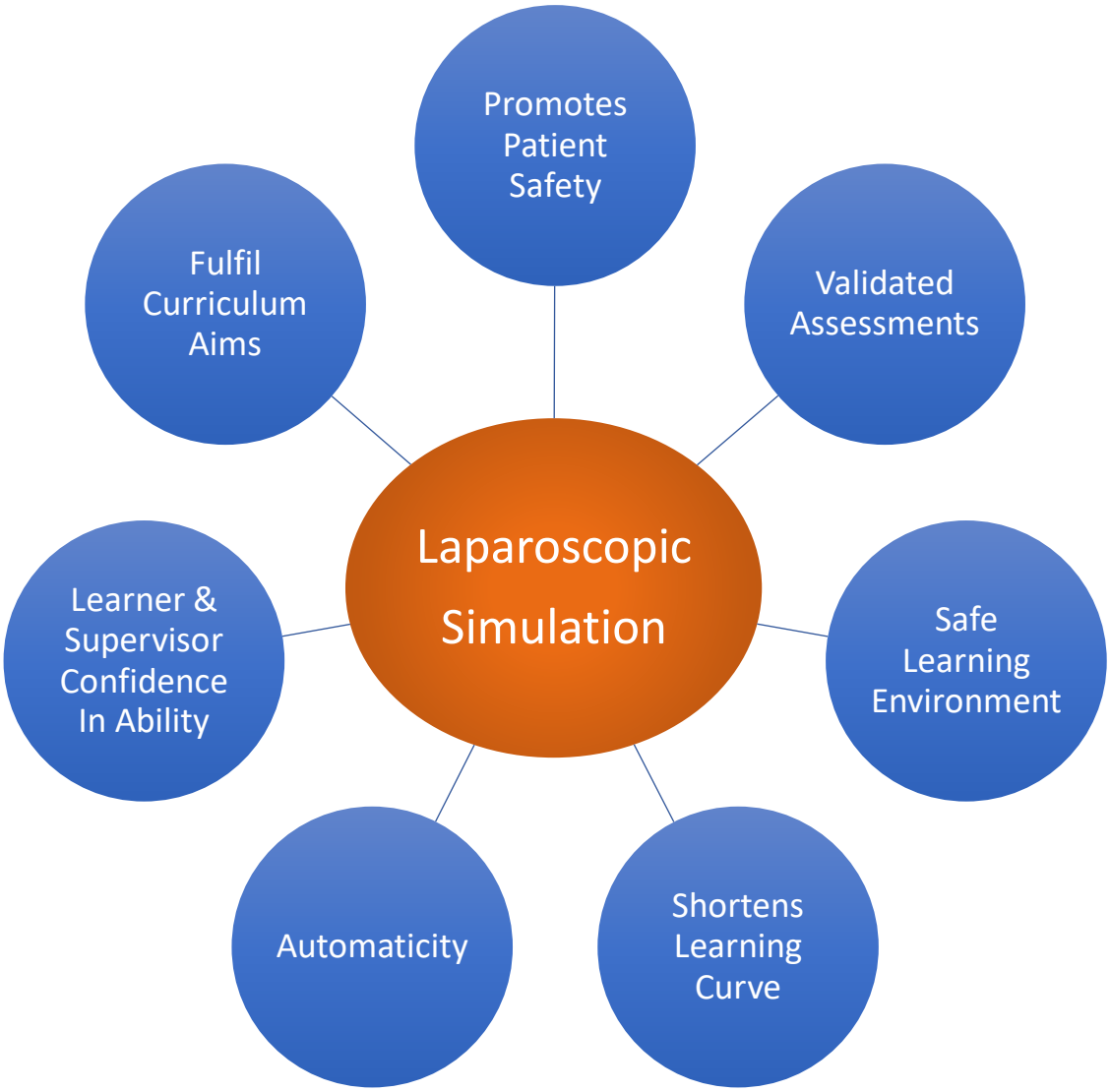


Figure 1.2 Positive attributes of laparoscopic simulation as an educational intervention

Chapter 2 - What Are The Educational Constructs Behind The Laparoscopic Simulation Learning Environment And What Are Its Limitations And Barriers To Effective Implementation?

This chapter will explore this question through the interactions of the laparoscopic simulation learning environment described in Figure 2.1. It will also highlight limitations of laparoscopic simulation as well as barriers to its effective implementation shown in Figure 2.2.

The following educational constructs will be discussed in this chapter:

1) The simulation learning curve
2) The role of the surgical teacher in simulation
3) Fidelity of the simulation experience
4) Sustained exposure and deliberate practice
5) Self-Efficacy in Simulation
6) Feedback and debrief

The role of reflection in simulation will be discussed separately in Chapter 3.

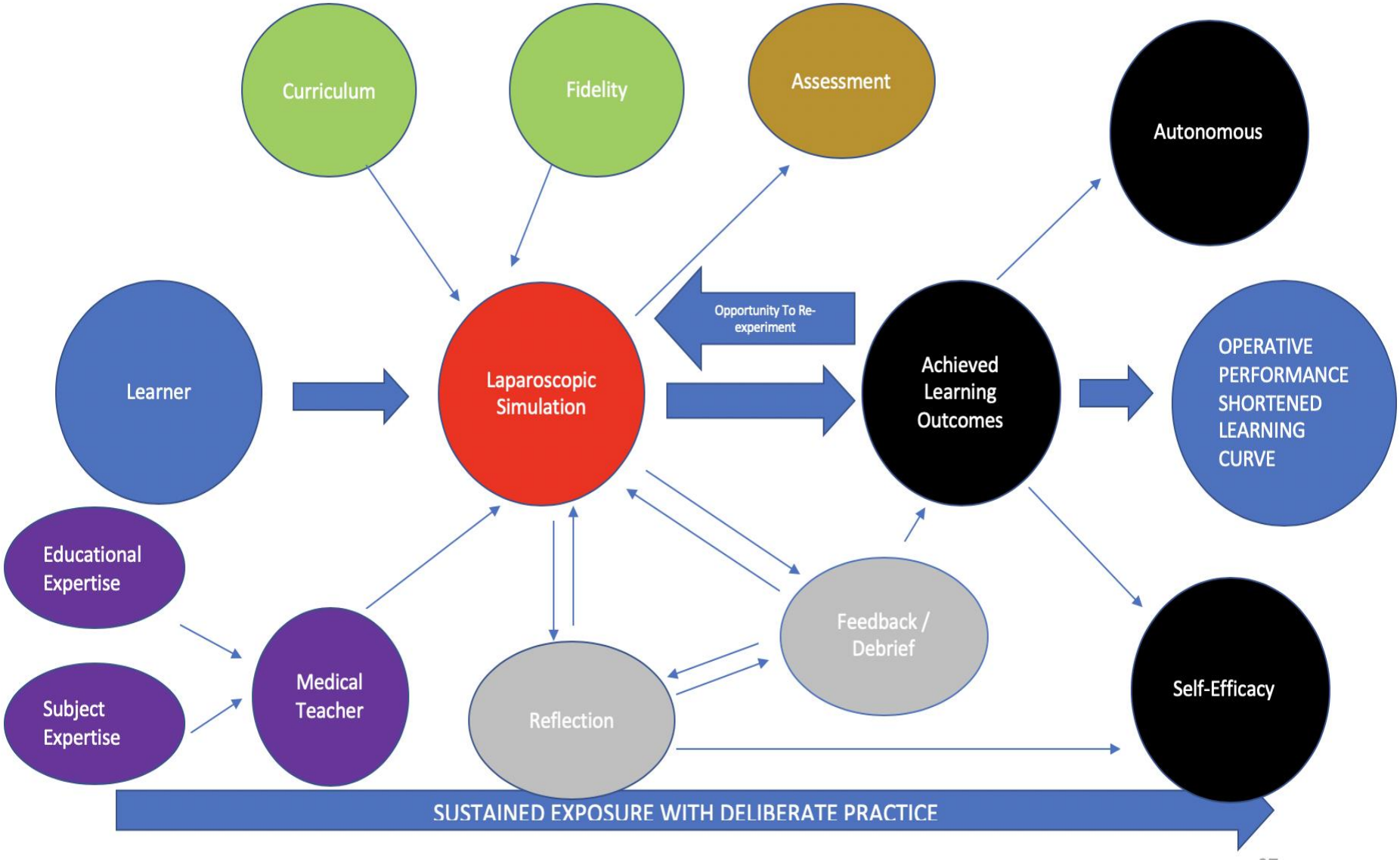

Curriculum
Fidelity
Assessment
Autonomous
Learner
Laparoscopic Simulation
Opportunity To Re-experiment
Achieved Learning Outcomes
OPERATIVE PERFORMANCE SHORTENED LEARNING CURVE
Educational Expertise
Subject Expertise
Medical Teacher
Reflection
Feedback / Debrief
Self-Efficacy
SUSTAINED EXPOSURE WITH DELIBERATE PRACTICE

Figure 2.1 A graphical representation of the laparoscopic simulation learning environment.

2.1 Learning Curve

The evidence supporting laparoscopic simulation shortening the learning curve for transference of technical skills into the operating theatre has been well documented in the literature (Larsen et al., 2012, Hyltander et al., 2002, Ghaderi et al., 2011, Sroka et al., 2010).

Benefits of shortening the learning curve using laparoscopic simulation include immediate primary outcomes such as fewer errors in skill, more precise economical movements and reduced intraoperative training time as well as longer term secondary outcomes such as cost savings from this reduce intraoperative training time, improved patient safety and greater learner and supervisor confidence in individual learner ability (Larsen et al., 2012, Larsen et al., 2009).

Fitts and Posner (1967) theoretical model describes three sequential stages of the learning curve associated with skill acquisition which can be applied to laparoscopic simulation (Fitts and Posner, 1967).

Stage 1: Cognitive
The theoretical knowledge needed to achieve a learning goal is constructed from existing knowledge. In laparoscopic simulation, the learner will recollect knowledge from previous experience and will synthesise and apply this knowledge into the simulation activity.

Stage 2: Associative

This stage requires refinement of strategy to achieve the desired goal. The learner may struggle with the simulation task and will need to reflect how to modify strategy to achieve the task.

Stage 3: Autonomous

This is the transition stage from sustained practice to automaticity which was described in the previous chapter. Invariably the evidence always suggest that this requires effective feedback from a surgical teacher (Taylor and Ivry, 2012). Stages 1 and 2 can be reinforced by the learner alone but the transition from the associative to autonomous phase requires feedback from a surgical teacher (Beyer et al., 2011).

2.2 Surgical Teacher

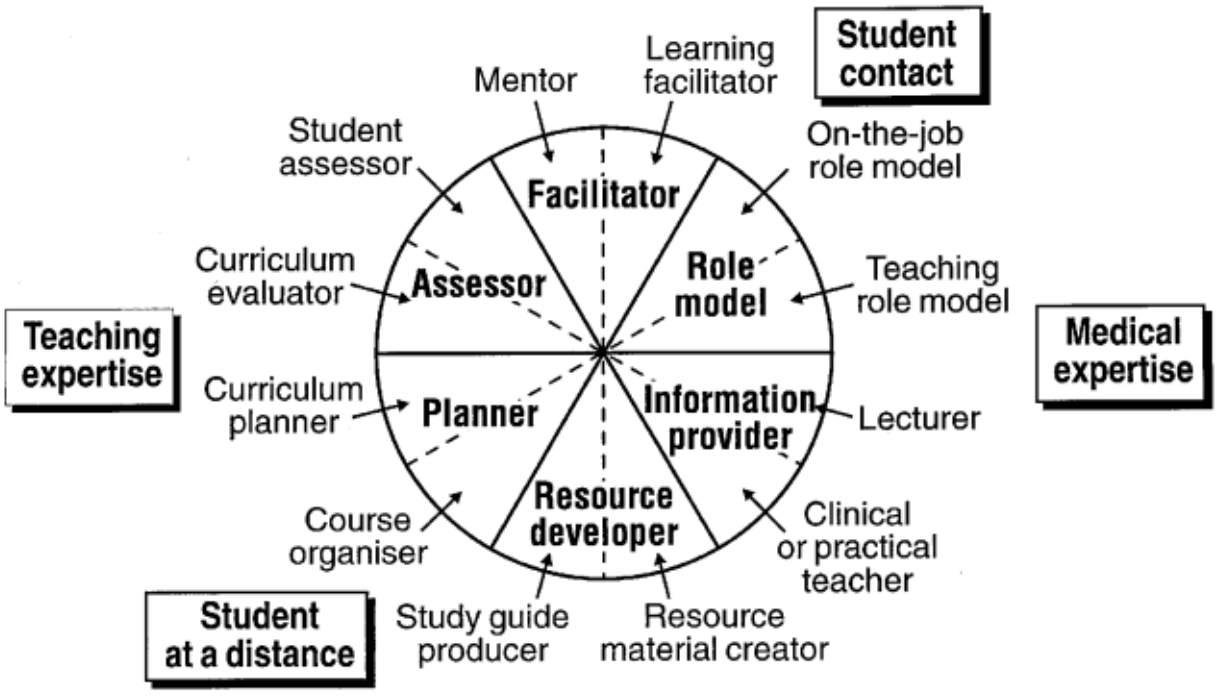


Figure 2.2 Twelve roles of a teacher taken from AMEE guide (Crosby, 2000)

In this thesis, a surgical teacher is defined as an individual that has both surgical (subject) and teaching (educational) expertise with a primary aim of engaging students in learning activities and facilitate achievement of learning goals. Due to the strong emphasis on this concept that runs throughout this thesis, the term **surgical teacher** will be used as opposed to other terms commonly used in the literature such as facilitator, educator, trainer or supervisor. Similarly instead of trainee, student or junior doctor which has also been used extensively and interchangeably in the literature the term **learner** will be used. Applying the nomenclature in this manner has been validated through its use in medical education literature (Harden et al., 2018, Hordijk et al., 2019, Riveros-Perez and Rodriguez-Diaz, 2017).

The conceptual roles of a teacher shown in Figure 2.2 are explained further in the context of the laparoscopic simulation learning environment.

2.2.1 Information Provider

The surgical teacher has two important roles in laparoscopic simulation as the information provider. They need to set the outcomes and expectations of the simulation experience based on the curriculum. The surgical teacher also needs to have subject expertise such as the ability to demonstrate correct procedural skill technique in a manner that the learner can comprehend (Crosby, 2000).

2.2.2 Role Model

The surgical teacher should be a role model that embodies the values of knowledge skills and attitudes suggest by the General Medical Council Good Medical Practice framework (2013). This means that during laparoscopic simulation, these three values should be demonstrated by the surgical teacher. For example, the surgical teacher will demonstrate a professional attitude when teaching skills on the simulator as would be done in clinical practice and it is expected the learner should replicate this behaviour. Furthermore many of the non-technical skills associated with surgery such as communication has shown to be reinforced with a positive role model (Piccinato et al., 2017).

2.2.3 Resource Developer

The surgical teacher has a role in developing and providing learning resources but this responsibility is more at an institutional level rather than by an individual or a faculty (Salas and Burke, 2002). Given that UK postgraduate curriculum mandates attendance at simulation experience, there is an onus by the governing bodies to facilitate accessibility to laparoscopic simulation. However, there are individual, institutional and cultural barriers to accessing and effectively using laparoscopic simulation which are summarised in Figure 2.3.

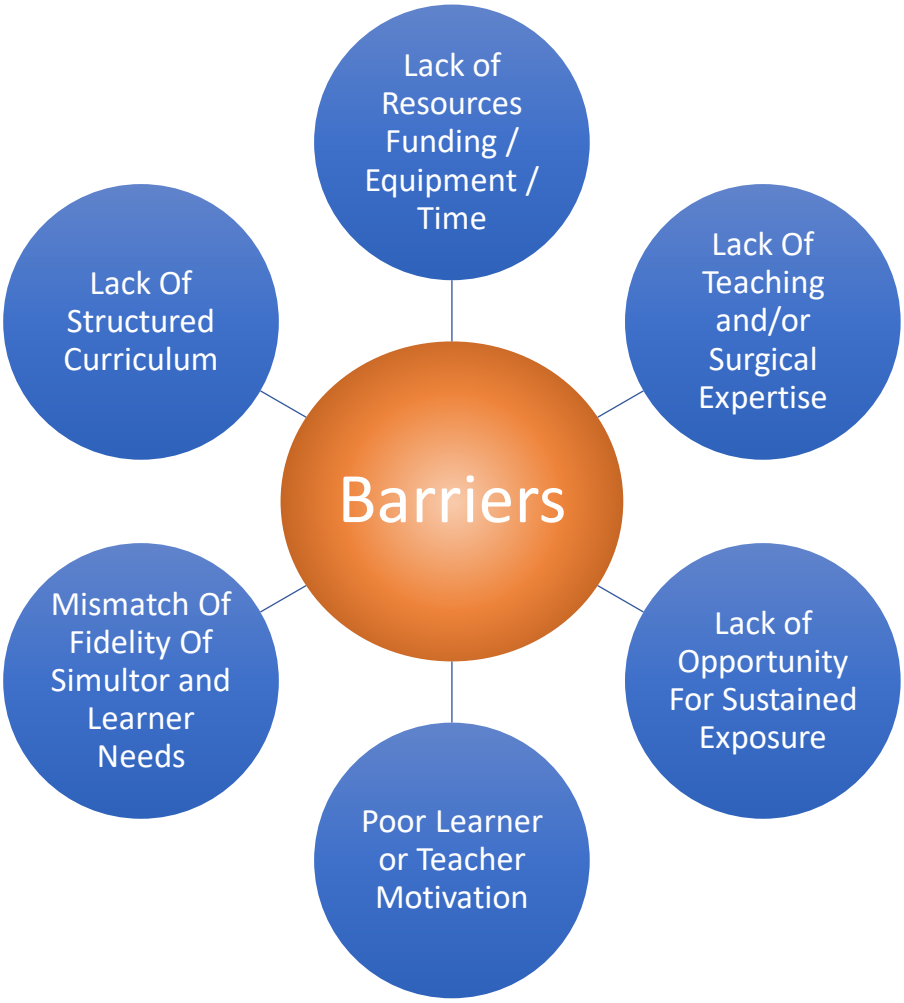


Figure 2.3 Individual, institutional and cultural barriers to effective implementation of laparoscopic simulation

2.2.4 Facilitator

Whilst the laparoscopic simulator may be a fixed entity, the facilitator role is to maximise the learning potential from the simulation activity by engaging with the different learners needs (Ahlborg et al., 2015). For example, in laparoscopic simulation the facilitator may need to identify learners experiencing greater difficulty due to reduced visuospatial awareness and therefore devote more individualise feedback to the specific learner. The

facilitator should empower the collaborative partnership between the learner and teacher as part of the learning process (Crosby, 2000).

2.2.5 Assessor And Assessment

Laparoscopic simulation can act as an assessment tool. The UK postgraduate training board for Obstetrics & Gynaecology, uses a practical skills test on a laparoscopic simulator, as part of a recruitment process for the advanced laparoscopic surgery training module. There is also evidence to support that as an assessment it may identify surgeons who need additional support with learning laparoscopic surgery (Mathews et al., 2017).

However, there is a growing consensus that summative assessment with simulation alone cannot equate to clinical competency as the skill itself risks becoming decontextualized from its purpose.(Paisley et al., 2001, Agha and Fowler, 2015). Simulation should complement rather than replace clinical assessment and/or experience and should be viewed as an adjunct to learning.

In laparoscopic simulation, the assessor can be the surgical teacher, the learner or the simulator itself. Some Virtual Reality laparoscopic simulators have the capability of generating task-based assessments. This is a useful formative exercise but is limited by the ability to provide feedback that can change future performance for the individual learner.(Gor et al., 2003)

There is often a widespread discrepancy in medical education between the learner’s self-assessment of ability and objective

assessment of ability. It is interesting to note that there is some evidence for laparoscopic simulation being a unique modality where learner self-assessment correlates well with objective assessment by an assessor (Mathews et al., 2017).

The commonest assessor in laparoscopic simulation is the surgical teacher though some laparoscopic simulators can also assess ability. It is important to differentiate between summative and formative assessment, as summative can be seen more exclusively in the assessment domain but formative assessments are a combination of capability assessment, as well as utilising teaching skills such as feedback and formulating learning strategies. It is important that the assessments conducted are validated against the curriculum learning outcomes (Crosby, 2000).

The predominant instrument of assessment for laparoscopic procedural skills in Gynaecology postgraduate training in the UK is the OSAT (Objective Structured Assessment of Technical Skills). This can be done as a formative or summative exercise and offers a structured validated assessment tool for surgical teachers. The reliability and validity of such instruments increases with number of assessors (Shaharan and Neary, 2014).

2.2.6 Curriculum And Planner

The outcomes expected from laparoscopic simulation should be structured logically from the curriculum which is necessary for an effective learning experience (De Win et al., 2016). Laparoscopic surgical training for UK postgraduate trainees in Obstetrics & Gynaecology is governed by the Royal College of Obstetricians & Gynaecologists (RCOG) and has specific learning outcomes.

Laparoscopic simulation that involves this population must incorporate these curriculum outcomes.

However, there is no agreed consensus on what the frameworks are for incorporating laparoscopic simulation into the curriculum. It is recognised that poorly structured laparoscopic simulation that does not integrate curriculum outcomes, leads to negative learning experience such as failure to address curriculum aims, reduced motivation for the surgical teacher and learner and lack of transference of skills from simulation to clinical practice (De Win et al., 2016). Many studies focus on specific simulators or tasks but more emphasis is needed on researching how to integrate laparoscopic simulation with the curriculum governing its use.

2.2.7 Fidelity Of Laparoscopic Simulation

Fidelity of simulation has commonly been conceptualised as the degree of realism during the experience (Ker and Bradley, 2013). However, a common misconception both in the literature and in simulation practice is the greater the fidelity of the simulation the greater the demonstrable learning (Kumar et al., 2014). Fidelity is an important construct, especially in laparoscopic simulation, but higher fidelity does not automatically equate to improved quality of the simulation or achievement of higher learning outcomes. This concept can be explored further by exploring the taxonomy of validity in laparoscopic simulation.

Face validity in laparoscopic simulation describes to what degree of realism does the laparoscopic simulation experience subjectively compare to the operating theatre. Face validity is important for learner acceptance and engagement in the simulation experience.

However, only the most beneficial elements of learning need to be replicated and there is no clear consensus or evidence to support which concepts must be translated into the simulation (Schreuder et al., 2011).

Construct validity in laparoscopic simulation refers to the degree to which the simulation experience measures outcomes as would be expected in the operating theatre e.g. manual dexterity (McDougall et al., 2006). The ability of a simulator to differentiate between novices and experts would support its construct validity (Schreuder et al., 2011).

Content validity in laparoscopic simulation ascertains whether laparoscopic simulation is the correct educational modality for the learning outcomes (Schreuder et al., 2011). If the learning outcome is to understand how endometriosis is managed with multidisciplinary input, then a laparoscopic simulator may not be necessary. Whereas if the outcome is to understand how endometriosis is managed surgically, then there could be a role for laparoscopic simulation.

It is interesting to note that in a study by Schreuder et al (2011) exploring different box simulators, the cost and fidelity of the simulator did not translate into superior learning outcomes (Schreuder et al., 2011). Haeziderah and Frapell (2013) review of laparoscopic simulation demonstrated that all simulators could demonstrate construct validity with varying degrees of face validity which supports the assertion that the degree of fidelity alone does not necessarily lead to a better educational experience (Haerizadeh and Frappell, 2013).

However, Nagendran et al (2013) Cochrane systematic review suggests that there is stronger evidence for virtual reality laparoscopic simulators than box trainers with regards to both operating time and operative performance (Nagendran et al., 2013). Virtual reality simulators have greater face, content and construct validity but can be prohibitively expensive (Hertz et al., 2018). It is therefore imperative that the fidelity of the simulator matches the desired education goal. For example a trainee learning dissection planes in severe endometriosis could enhance their learning through virtual reality laparoscopic simulation compared to a novice learner practicing how laparoscopic graspers work, where a box model might suffice.

2.2.8 Sustained Exposure And Deliberate Practice

The most common laparoscopic simulation experience for postgraduate gynaecology trainees in the UK has been a single isolated course in the curriculum lasting between half day to 6 weeks with often limited opportunity to practice after this.

Deliberate practice is an evidence based educational methodology for developing skill expertise consisting of four important principles: Well defined goals derived from the curriculum, motivated learners, specific effective feedback and the opportunity for repeat exposure to the simulation experience.(Causer et al., 2014). Application of this specific methodology has previously been validated in laparoscopic simulation with improvement in specific and objective targets of learner performance (Carrier, 2013).

Sustained exposure to laparoscopic simulation with deliberate practice has superior learning outcomes and this has been a

consistent theme identified in previous studies (Carrier, 2013, De Win et al., 2016). There is some thought that laparoscopic simulation exposure should not be early in curriculum and may be a wasted resource, this assertion has not been substantiated in the literature with educational value seen even with early simulation exposure (De Win et al., 2016).

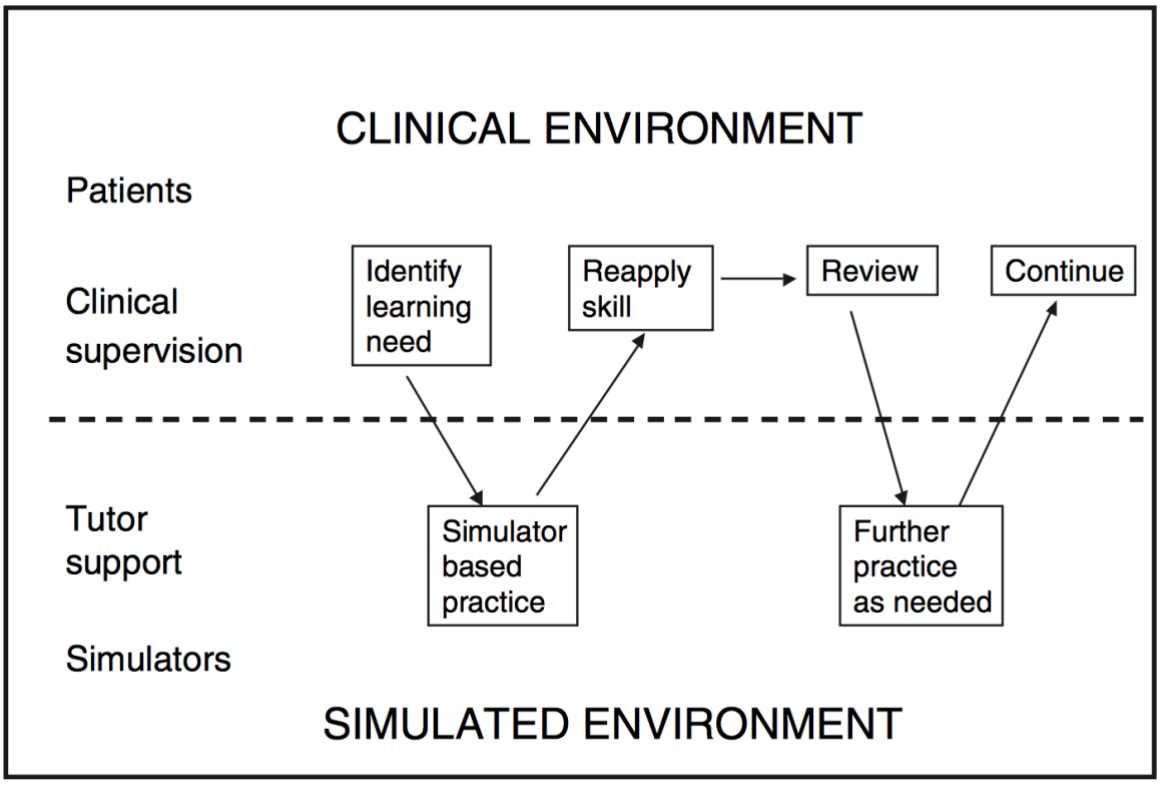


Figure 2.4 The interactive relationship shown is taken from Kneebone et al (2004). It demonstrates the iterative process of simulation so that skills are learned and constantly reinforced with sustained deliberate practice and results in transference of learning into the clinical environment (Kneebone et al., 2004).

2.2.9 Self-Efficacy In Simulation

Self-efficacy is the learner's belief in their own potential or ability to complete a task and enhanced self-efficacy is an important goal

of simulation (Sandars and Cleary, 2011). In surgery, self-efficacy is critical in determining a learners perceived ability to perform an operation. Surgical simulation uniquely enables learners the opportunity to develop confidence in ability but also within an environment does not compromise patient safety (Davies et al., 2013).

Being actively aware of metacognitive processes i.e. reflection in clinical simulation has been shown to improve self-efficacy amongst learners (Tutticci et al., 2016). Furthermore, Ahlborg et al (2015) found that critically reflecting on self-efficacy enables learners to determine individualised specific areas of improvements in laparoscopic simulation. As a result of this, the actual and perceived gaps of learner's self-efficacy is narrowed leading to safer surgical practice (Ahlborg et al., 2015).

2.2.10 Feedback And Debrief In Laparoscopic Simulation

There is no consensual definition of what feedback is in the literature. Clinicians often feel they have given effective feedback in contrast with learners who perceive they have received little feedback (Shrivasta et al., 2014). The disparity in the frequency and quality of feedback has been demonstrated in a surgical context by Sender et al (2005) showing a great discrepancy in perceptions of feedback between surgical educators and learners (Sender Liberman et al., 2005).

Van de Ridder et al (2008) review article provides a pragmatic definition of feedback that can be applied in a laparoscopic simulation context – "Specific information about the comparison between a trainee's observed performance and a standard, given

with the intent to improve the trainees performance."(van de Ridder et al., 2008).

The process of feedback and debrief are widely regarded in the literature as the single most important feature of simulation. Skill decay is slowed and it is during these processes that learners reflect on their perceptions of strengths and weaknesses and engage in the process of life-long learning (Issenberg et al., 2005).

Feedback and debrief are the processes that form the core of Schon's reflection and Kolb's experiential cycle (Burns, 2015). This concept is important and will be explained further in Chapter 3.

Ahlborg et al (2015) mixed methods study into individualised feedback with laparoscopic simulation highlights three important principles with respect to feedback in this context. Feedback should be constructive and not inappropriately critical, formally integrated into the educational design and should compare learner's performance against a standard with the aim of achieving learner improvement (Ahlborg et al., 2015). There is some translational evidence that feedback alone in surgical simulation improves technical skills and reduces the likelihood adverse surgical events (Johnston et al.).

Debriefing in simulation is conceptually defined by Fanning and Gaba (2007) as " facilitator-led participant discussion of events, reflection, and assimilation of activities into their cognitions produce long-lasting learning"(Fanning and Gaba, 2007). It is described as the period exclusively following simulation in which feedback and reflection on action occurs within an active learning environment (Coutinho et al., 2016). The debriefing process has

been described as the cornerstone of experiential learning in simulation (Abatzis and Littlewood, 2015).

The evolution of debrief in simulation to its current conceptual definition is thought to originate from four different fields. Firstly from the military, where actions are reviewed to develop subsequent strategies. Secondly in the context of critical incident stress where psychological concerns following experiences of trauma are addressed. Thirdly in psychology research, where learners undergo deception and the debrief examines the learner's experience of being deceived. Finally from the aviation industry, where the culture of simulation is embedded, with many debrief principles from aviation simulation translated across into clinical simulation (Fanning and Gaba, 2007, Gardner, 2013).

Feedback in contrast to debrief can occur during the debrief with reflection on action but it can also occur during the live simulation developing reflection in action. It can be driven by the surgical teacher, direct from the model or post experience with audio and/or video feedback. The concepts of reflection in action and on action are discussed further in Chapter 3.

Ahmed et al (2012) tri-continental study for developing best practice guidelines for debriefing in surgery provides another conceptual difference between feedback and debrief. Feedback aims to compare observed performance against a set standard with the intent of improvement. However, debrief is an exchange of dialogue where feedback may occur but also new insights are synthesised through facilitated reflection (Ahmed et al., 2012). The conceptual and theoretical premise of facilitated reflection will be explored further in this thesis.

However, despite this there remains significant gaps in understanding of feedback and debrief related to laparoscopic simulation –

What is the appropriate model for structuring feedback and debrief during laparoscopic simulation and how does this vary with the learner. How do we evaluate feedback and debrief for quality, relevance and learner outcomes in laparoscopic simulation; and what role does guided or facilitated reflection have when structuring feedback or debrief. (McGaghie et al., 2010)

Chapter 3 - Exploring The Role Of Reflection In Simulation.

Expertise development and skill automaticity does not come with repetition alone (Causer et al., 2014). It is clear there are other educational phenomena that have a crucial role in this. Arguably reflection is perhaps the most important of these and this reflection should be active and deliberate rather than passive and coincidental (Loughran, 2002). Formal recognition of reflection is now ingrained into undergraduate and postgraduate curriculums. The General Medical Council Good Medical Practice guidance states "You should regularly reflect on your own performance, your professional values and your contribution to any teams in which you work. You should ask for, and be prepared to act on, feedback from colleagues".(GMC)

Furthermore, reflection in simulation has been theorized to facilitate learners to achieve higher levels of Blooms cognitive taxonomy from comprehension to synthesis of knowledge (Chiang, 2014, Bloom, 1956).

This chapter will review the phenomenon of reflection in simulation. It will highlight current and existing theories of reflection and how these can be applied to simulation. The role of reflection in simulation is explored using Schon and Kolb's theoretical constructs of reflection which have previously been used extensively in simulation.

There are various models of reflection and the prevalent ones in the literature are summarized in Table 1.

Author/Year	Models of Reflection
Dewey 1938	"*active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it tends*"(Dewey, 1910).
Kolb 1984	Kolb described one stage of experiential learning as reflective observation. Reflective observation involves taking time out from the action to analyze the experience and what has been done (Kolb, 1984).
Boud et al 1985 + 2013	'*Reflection is an important human activity in which people recapture their experience, think about it, mull over & evaluate it. It is this working with experience that is important in learning'* (Boud et al., 2013).
Schon 1987	Schon described reflection in action and reflection on action, which explores how learners

	think during the experience and after the experience and how it affects outcomes (Schön, 1987).
Mezirow 1998	"*A critique on the presuppositions on which our beliefs have been built*" (Mezirow, 1998). This is further elaborated on in Chapter 12.
Moon 2004	"*Reflection is part of learning and thinking. We reflect in order to learn something, or we learn as a result of reflecting, and the term 'reflective learning' emphasises the intention to learn from current or prior experience*"(Moon, 2013)
Driscoll 2006	Driscoll adapted the experiential learning cycle to use reflection using three stem questions: What (Identify/Describe the experience); So What (Evaluate feelings and discuss consequences of actions); Now What (Synthesize and consider implications of actions).(Driscoll,

	2006)
Bandura 2008	"*…visualize futures that act on the present; construct, evaluate, and modify alternative courses of action to gain valued outcomes; and override environmental influences*"(Bandura, 2008)
Sandars 2009	"*Reflection is a metacognitive process that occurs before. during and after situations so that future actions can be informed by this previous understanding*". Metacognition is an awareness of ones thought processes – *"thinking about thinking".* (Sandars, 2009)

Table 1: Existing Models Of Reflection In The Literature

There are many different conceptual models of reflection but there is no consensus or evidence in the literature which model would be pragmatic, engage learners, achieve superior learning outcomes or could be applied in a laparoscopic simulation context.

3.1 Models Of Reflection And Learning Framework In Simulation

Learning frameworks integrate reflection with experience and have been explored both in theoretical and empirical simulation research.

The three most commonly identified models of reflection and corresponding learning framework in the literature that scaffold construction of reflection in simulation are reflective observation through Kolb's experiential cycle, Reflection in action and on action through Schon's reflective practicum and Mezirow's critical reflection in transformative learning (Page-Cutrara and Turk, 2017, Burns, 2015, Sadideen and Kneebone, 2012). This chapter will explore these models and frameworks further within the context of laparoscopic simulation.

3.1.1 Schon's Reflective Practicum

Schon described the term "reflective practicum" a safe environment where reflection is synthesized with this knowledge (Schön, 1987). Simulation can be described as an example of Schon's reflective practicum where learner safety is prioritized (Henderson, 1998). The meaning and importance of learner safety is further discussed in Chapter 5.
In this thesis the terms reflection in action refers to reflection during the actual laparoscopic simulation activity and reflection on action refers to reflection following the simulation, which is traditionally integrated into the debrief but can also be a separate step. This is consistent with other studies that explore the role of

reflection in simulation (Schön, 1987, Page-Cutrara and Turk, 2017).

3.1.2 Kolb's Experiential Cycle

The integration of Kolb's Experiential Cycle into simulation is depicted by Poore et al (2014) in Figure 3.1 and is elaborated further using examples in a laparoscopic simulation context.

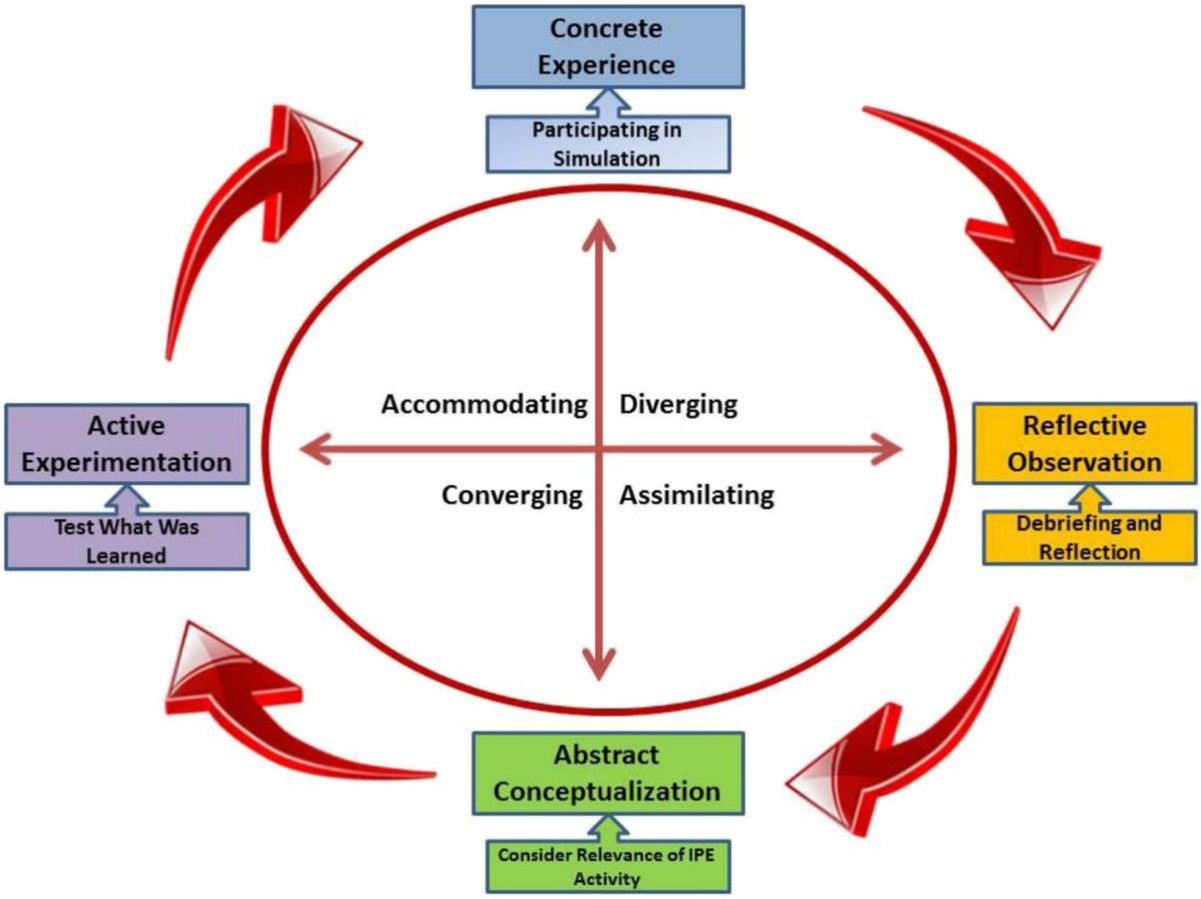


Figure 3.1 Kolb experiential learning cycle in simulation as illustrated by (Poore et al., 2014).

Concrete Experience: During this phase the learner actively participates in the laparoscopic simulation activity and is exposed to a new environment and experiences.

Reflective Observation: Reflection in action and on action occurs during reflective observation. The learner reflects during the simulation exercise and may adapt and modify their behavior accordingly. For example, during laparoscopic simulation, the learner may struggle with unfamiliar depth perception of the simulator but with reflection in action they will modify their procedural skills accordingly to overcome this. Following the simulation activity, the learner will reflect on action of the experience, often formally during the debrief.

Abstract Conceptualization: This is a constructivist learning theory whereby new theories synthesized from the simulation are built onto existing frameworks of knowledge during the abstract conceptualization phase (Coutinho et al., 2016). For example, the learner prior to the simulation activity may know that laparoscopic surgery requires depth perception skills, but they may not comprehend the importance of the skill or how they can achieve automaticity of the skill until after they have completed the simulation exercise.

Active Experimentation: This is where the learner demonstrates the knowledge synthesized and this could either be in the simulation setting or in clinical practice. Both abstract conceptualization and active experimentation rely on reflection to enable the learner to make sense of the experience with the goal of transferring this learning into the operating theatre.

Furthermore, simulation fulfils another key goal of engaging in new behaviors (Sadideen et al., 2012).

Kolb's experiential cycle highlights that repetitive experience in simulation is not alone sufficient for developing expertise in surgery. It must be reinforced with reflection that synthesizes new knowledge or drives new behaviours (Burns, 2015).

3.1.3 Transformative Learning And Simulation

Transformative learning as conceptualized by Mezirow can be described as "Reconfiguration of ideas knowledge and meaning stimulated by reflection. So, the experience or event changes their own ideas knowledge and thoughts by a process of critical reflection." (Mezirow, 1998).

This model of transformative learning by Mezirow has been used as a framework to assimilate experiential learning with critical reflection to foster a culture of lifelong learning from simulation (Pollard and Wild, 2014, Clapper, 2010). Simulation can foster opportunities for transformative learning in both learners and surgical teachers with opportunity for surgical teachers to develop skills such as leadership (Pollard and Wild, 2014).

Transformative learning has been suggested to be one of the principle goals of simulation. (Clapper, 2010). Figure 3.1, an adaption of Decker's model of reflection in simulation (Decker et al., 2007), illustrates how the goal of transformative learning is achieved through the synergistic effects of reflection in action and on action in laparoscopic simulation.

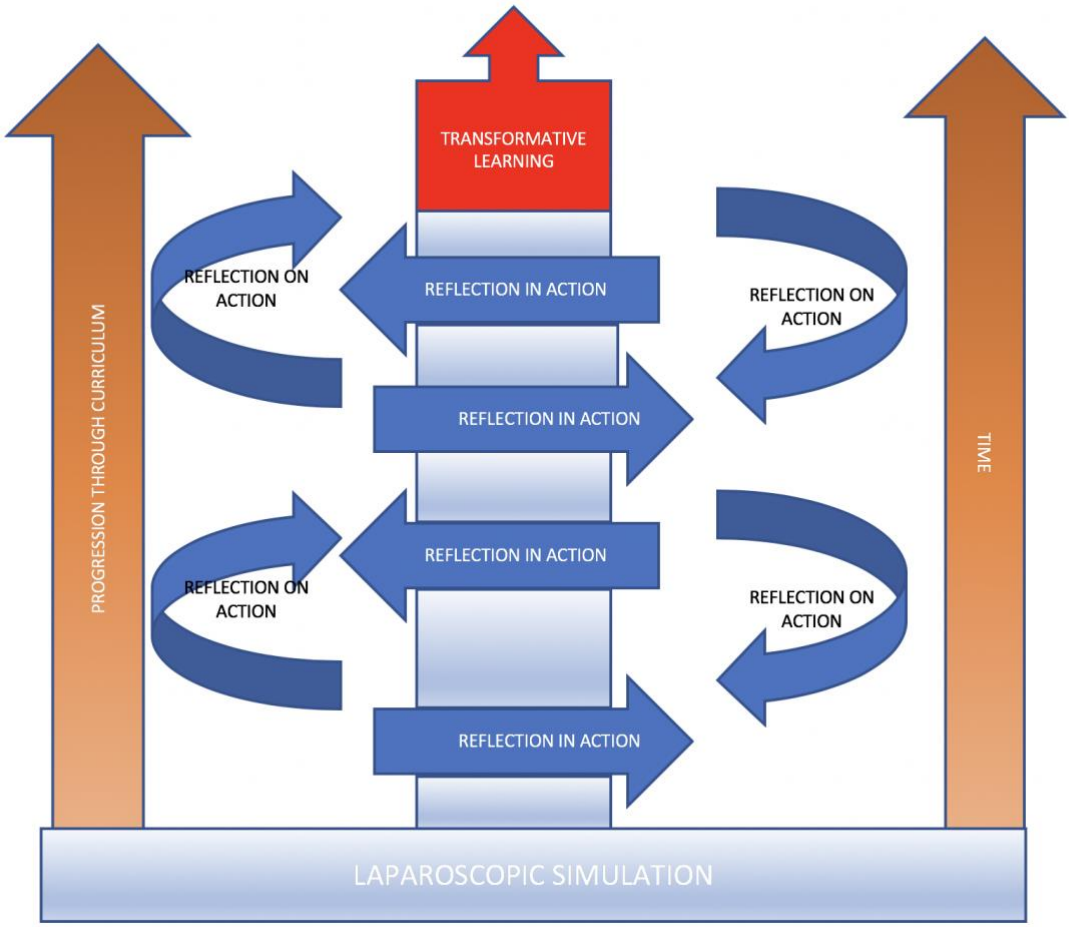


Figure 3.1 Adaptation of Decker's model showing reflection in laparoscopic simulation enabling transformative learning processes (Decker et al., 2007).

The theoretical framework of transformative learning and its relationship with critical reflection in simulation is further elaborated in Chapter 8.

Chapter 4 - In What Ways Do Existing Or Current Approaches Develop Reflection Following A Surgical Simulation. A Critical Review Of The Literature.

4.1 Introduction

Norman and Eva summarise that "*the literature review should provide the conceptual framework for the study to reside*" (Norman and Eva, 2013). In order to understand how the metacognitive processes of reflection can be facilitated in laparoscopic simulation, it is necessary to explore how reflection itself has been conceptually studied in surgical simulation.

The literature review question has been expanded to encompass surgical simulation as opposed to laparoscopic simulation alone. Surgical simulation is defined in this thesis as any simulation activity that focuses on developing procedural skills in surgery and is not restricted to laparoscopic surgery alone. This is because there were significantly limited number of studies identified in the literature during the search process. Furthermore, reflection in surgical simulation has comparable and translatable conceptual themes that can be applied within a laparoscopic simulation context.

This literature review has two aims: To explore the approaches for developing reflection in surgical simulation and to identify the individual, institutional and cultural barriers of reflection in surgical simulation that need to be taken into consideration when devising the methodology for a proposed intervention.

4.2 Methodology

The methodology chosen for this literature review is a critical review. The critical review approach has been used before in eliciting the educational mechanisms and translational outcomes of healthcare simulation (McGaghie et al., 2014).

4.2.1 Rationale And Justification For The Critical Review Methodology

The critical review methodology does not focus on rigid systematicity or an exhaustive search of the literature as may be found in a systematic review. It aims to provide a balanced representative view of the literature that conceptually synthesises different views to explore the phenomenon under investigation and offer new perspectives (Norman and Eva, 2013).

To answer the literature review question, the critical review methodology has been selected.

There are two main criticisms associated with a critical review. Firstly, author bias - the aim of the critical review is to develop new perspectives but consciously or unconsciously the researcher may selectively include or exclude literature that supports their underlying beliefs of the phenomenon under investigation.

Secondly the critical review unlike a systematic review is likely to explore different concepts and generally cannot give conclusive or definitive answers. For example a critical review is suitable for exploring the approaches and role of reflection in simulation but is unlikely to provide a definitive answer such as does reflection in

simulation reduce operative complications for patients, as might be expected with a more reductionist approach of a systematic review (Norman and Eva, 2013).

However, the use of the critical review methodology in other simulation reviews has been shown to specifically enable understanding of underlying mechanisms of why educational interventions work compared to exclusively focusing on outcomes of these interventions (McGaghie et al., 2014). This is crucial in understanding how reflection develops or is employed in surgical simulation.

A critical review does not aim to identify whether one educational intervention is better than none or compared to another. However it can explore what phenomena were involved, what are the essential elements to the intervention and how these achieved such an outcome, as Norman (2009) describes "what the real ingredients are that lead to a difference" (Norman, 2009). The literature review questions aims to explore how reflection has been developed in surgical simulation and does not intend to compare efficacy of different educational interventions but rather identify and synthesise emerging themes that are involved in the development of reflection.

Though a critical review does not follow a systematic approach to screening the literature, a critical review should still involve conducting a comprehensive and thorough analysis of the literature (Sawyer et al., 2016). With clear search terms, discrete inclusion and exclusion criteria and a rigorous process of searching the literature, this can be achieved (McGaghie et al., 2014).

The critical review methodology used, is adapted from McGaghie et al (2014) critical review of simulation-based mastery learning with translational outcomes. This provides a pragmatic clear structure for writing the critical review: Define the scope of the review, define search terms, extract and synthesise the emerging data, summarise findings qualitatively and highlight contradictory and confirmatory findings (McGaghie et al., 2014).

4.2.2 Inclusion And Exclusion Criteria

Articles that were included in the review had to fulfil three important criteria - 1) The population studied should include surgeons or gynaecologists in postgraduate training 2) The study or review had to include some form of surgical simulation that involved developing procedural skills 3) There should be an explicit exploration of reflection.

There was no restriction on time and all studies were included up until the time of the search. All studies must also have been published in English.

4.2.3 Search Terms & Databases

The following search terms were used: Surgical training, Simulation, Reflection along with their respective synonyms, broader terms, narrower terms, related terms and alternate spellings and variants. For full list of search terms please refer to Table 2.

The search was conducted on the following databases: PubMed, The Cochrane Library and Current Contents, Ovid Medline, Psych Articles, Google Scholar.

The quality of studies was appraised using guidance from Kuper et al (2008) "Critically appraising qualitative research" (Kuper et al., 2008).

4.2.4 Ethics & Reflexivity

The ethics and reflexivity was also reviewed for each study. Reflexivity is the researcher or observer acknowledging their influence on the study participants (Tavakol and Sandars, 2014). For example, a study reviewing reflection on learners behaviour, should acknowledge that the researcher observing the participant is likely to have some influence on the learners behaviour. Often this is unavoidable but a comprehensive study should acknowledge this.

	Population	Context	Outcomes
	Postgraduate Doctors in Surgical Training	Surgical Simulation	Reflection Procedural Skill
Synonyms	Surgical Trainees		
Broader Terms			Practical Clinical Skills Technical Skills Clinical Procedural Skills
Narrower Terms		Simulation Based Medical Education Laparoscopic Simulation	Surgical Procedural Skills Laparoscopic Skills Operative Skills
Related Terms		Surgical model Model training	Reflective Practice

Alternative Spellings & Variants	Simulation Simulate Simulator

Table 2 Search Terms

4.3 Results Of The Critical Review

A total of 2865 articles were identified from the search. The main reasons for article exclusion are summarised below. No quantitative data was identified from the search and hence only qualitative data is presented.

There were no studies identified focusing on the role of reflection in surgical simulation as a primary aim. The commonest reasons for exclusions of articles included reflection not being exclusively explored, there was no form of simulation or an inappropriate sample population.

The phenomenon of reflection not being exclusively identified or investigated but instead examination of other associated processes was the commonest reason for article exclusion. Many studies focused on feedback in laparoscopic simulation which as discussed earlier is inextricably interwoven with reflection but the exact role of reflection was not clearly determined. Though many of the studies subtly alluded to concepts of reflection it was not possible to clearly identify and interpret how reflection was employed in the study or any outcomes as a result of reflection during feedback.

Many studies were conducted in the live operating theatre and not in a simulation context. There were a few studies that discussed reflection in these contexts. Though these were not included in the results section as they did not meet the search criteria, important conceptual findings are analysed further in the discussion section. This is because whilst the development, the experience and outcomes of reflection may be different in simulation compared to the operating theatre, there is suggestion that reflective processes in simulation can be translatable and replicated in the live environment. Ultimately the primary goal of laparoscopic simulation is transferability of learning into the operating theatre.

Often the sample population being investigated did not include postgraduate doctors in training but focused only on undergraduate medical students. Again, though these were not formally included in the results, emerging themes are elaborated on in the discussion as there may be elements of transferability with a postgraduate population.

Other reasons for article exclusion that were much less frequent included abstract or conference only publications and articles not written in English.



Figure 4.1 PRISMA flow diagram for critical review.

Reference & Typology	Participants and Simulator	Study Aims	Relevant Conclusions/Concepts	Reflexivity & Ethics
(Ahlborg et al., 2013) Prospective Randomized Controlled Trial	Postgraduate Basic Surgical Trainees LapSim GYN VR simulator	1) To investigate how simulator training and non-technical factors affect laparoscopic performance with postgraduate gynaecology doctors in training	1) Flow and self-efficacy positively correlated with simulator performance.	Ethics approved. Reflexivity not stated.
(Sadideen et al., 2012) Review Article	N/A	1) Detailed exploration and critical appraisal of principles for effective simulation	1) Reflection may have an important role in the affective component of learning in simulation. The emotional need of the learner must be acknowledged with reflection as a potential tool for effective learning.	N/A
(van Empel et al., 2012) Prospective Controlled Trial	Surgical Residents Laparoscopic Box Trainer	1) Identify factors determining autonomous training on a laparoscopic box trainer at home.	1) Feedback is essential for skill acquisition. 2) Feedback may promote reflection	Not stated
(Johnston et al.) Review Delphi Systematic Process	N/A	1) Report on progress made in different research priorities of surgical simulation	1) Reflective practice can drive learning in low resource settings where no facilitator is present	N/A

(McKendy et al., 2017) Prospective Observational Study	US Postgraduate trainees (advanced trainees) Institution Own Simulator	1) Provide preliminary validity evidence for the creation a formative feedback tool (FFT) for advanced laparoscopic suturing skills.	1) Formalised structured tools for feedback may deliver improve the quality of the feedback and the way the feedback is received	Not Stated
(Ghaderi et al., 2015) Prospective Observational Single Subject Study	US postgraduate trainees. In live OR but potential to translate into simulation Live laparoscopic surgery	1) Assess cognitive and technical skills of advanced laparoscopy during fellowship	1) Schon's reflective model can be used as a core principle for curriculum design 2) Facilitated reflection can help deconstruct issues to develop pragmatic approaches for future development.	Not stated
(Agha and Fowler, 2015) Review Article	Postgraduate UK Surgical Training	1) Role of simulation in surgical training 2) Impact of simulation with reduced surgical training time	1) Simulation facilitates a safer environment perceived by learners developing surgical technical skills by giving the freedom of asking "what if questions"	N/A
(Uemura et al., 2014) Prospective Observational Study	LapSim Model Expert surgeon and medical students in Japan	1) Understand the role of metacognition in laparoscopic surgery 2) Integrate findings into curriculum	1) Metacognitive skills can be enhanced from some laparoscopic simulator models providing direct feedback e.g. suggesting change in strategy 2) Metacognitive skills should be integrated into an active well	Not Stated

				designed explicit curriculum for laparoscopic training programs.	
(Chen et al., 2013) Randomized Controlled Trial	Postgraduate US Surgical Trainees	1) Impact of immediate preoperative laparoscopic warm-up using a simulator on intraoperative laparoscopic performance	2) Warming up may stimulate cognitive arousal and short term familiarity		Not Stated
(Paige and Chauvin, 2008) Review Article	Postgraduate US Surgical Trainees Animal model simulators	1) To discuss potential of surgical simulation training on operative team dynamics	1) Video recorded simulation allows accurate recall during debrief greatly enhancing the reflective process		N/A
(Ahmed et al., 2012) Qualitative semi structured interviews	Postgraduate Surgical and Anaesthetic Trainees in US,UK and Australia Simulator model not stated	1) To identify best practices in debriefing in a surgical context	1) Guided reflection is an underlying critical step for the learning process during debriefing 2) The educational terminology of reflection may not explicitly be used but the process still occurs 3) Effective debrief (where guided reflection occurs) needs to challenge learners that this process does not exclusively occur when something goes wrong.		Ethics approved. Reflexivity not stated.

				4) The first stage of effective debriefing involves exploring the learners emotions immediately following the event.	
(Cook et al., 2016) Proof of concept study	Postgraduate US senior and junior trainees Inguinal hernia repair box trainer	1) To design a team based multi learner surgical simulation addressing needs of both novice and senior learners.		1) Surgical simulation has the opportunity to stimulate reflection bi-directionally between the learner and the medical teacher.	Not stated
(Raemer, 2009) Editorial	Postgraduate US Surgical Residents	1) To review cardiothoracic simulation as a paradigm, shift in educational policy		1) Describes how reflection fits in surgical simulation using Kolb's experiential model of learning	NA
(Abdelsattar et al., 2015) Simple observational study	Undergraduate US Medical Students, Postgraduate US surgical trainees, Postgraduate US senior surgeons Video recording of live laparoscopic surgery	1) To design a video tool to assess baseline knowledge prior to live surgery		1) Video as a simulation modality offers learners from novice to expert level the opportunity for deeper reflection to improve operative performance	Not Stated

(Papaspyros et al., 2009) Review	Trainee Surgeons Model not stated	1) To update and validate the PAR framework for surgical assessment in simulation.	1) Having an objective specific model for monitoring training progress can help with assessment and revalidation. 2) Reflection can be formally incorporated into this model as a specific objective.	NA
(Khan et al., 2017) Protocol For RCT/Pilot Study	Novice Endoscopists Virtual Reality Colonoscopy Simulator	1) To evaluate simulation with a non-technical skills curriculum on novice endoscopist performance of clinical endoscopy	1) Integration of non-technical skills (NTS) such as communication curriculum in the simulation enhances self-reflection in learners. 2) Incorporation of NTS can lead to superior operative performance	Ethics Approved Reflexivity Not Stated
(Nguyen et al., 2015) Pilot Single Blinded Observational Study	Postgraduate US Surgical Trainees Novice - Advance Simulated Operating Theatre with High Fidelity Simulated Laparoscopic Cholecystectomy	1) Examine the effect of laparoscopic simulation on NTS	1) Laparoscopic simulation follows Kolb's experiential learning cycle 2) Reflective observation of Kolb's cycle occurs predominantly during the debrief 3) Active experimentation requires the learner to have the opportunity	Not Stated

				to experiment again.	
(Coffey-Zern et al., 2015) Review Article	US Postgraduate Surgical Trainees No Specific Model	1)	To describe the Christiana Care Method for incorporating simulation into maxillofacial surgical training	1) Debriefing is predominantly where reflection on action occurs 2) It is a learner centered and safe environment. 3) A critical component of the debrief should be learner reflection	NA
(Sharma et al., 2011) Observational Study	Postgraduate US Surgical Trainees	1)	Evaluate interprofessional simulation crisis resource management training according to Kirkpatrick model	1) A significant challenge of the debrief can be participants reluctance to debrief in front of peers or seniors due to shyness or intimidation.	Not Stated
(Gardner and AbdelFattah, 2017) Observational Study Laparoscopic Cholecystectomy Simulator	Postgraduate US 1st Year Surgical Trainees	1)	Compare non-technical competencies in simulation compared to live theatre for general surgery residents	1) Video recording of performance can facilitate deeper learner reflection following simulation	Not Stated
(Vaughn et al., 2016) Observational Study Laparoscopic Knot tying simulator	Postgraduate US 1st Year Surgical Trainees	2)	Compare peer video feedback on surgical performance compared to faculty feedback	2) Peer feedback using video improves learner performance comparable to faculty feedback	Not Stated

(Sullivan et al., 2017) Review Article	Postgraduate Surgical Trainees	1) To answer can simulated procedures still play a role for more advanced learners to continue their professional development beyond the basics	1) Mentoring during reflection of cognitive simulation can support positive change in skill development 2) Surgical simulation can develop "reflection through action"	NA
(Colaço and Tennent, 2016) Review Article	Postgraduate UK Surgical Trainees	1) To review the need for simulation in shoulder surgery.	2) Reflective learning can be recorded using workplace based assessments.	NA
(Thomas, 2013) Review Article	Postgraduate US Surgical Residents Box Models, Human Cadavers, Virtual Reality, Animal Models, Robotics	1) To establish state of knowledge on development of technical competence during surgical simulation	1) Reflection in surgical simulation helps learners prepare for their next learning experience	NA

Table 3: Details of the studies included in the critical review.

4.3.1 Thematic Analysis Of Results

Thematic analysis is a commonly used methodology for identifying, analysing and reporting qualitative educational data. The methodology used for thematic analysis is adapted from Braun and Clarke (Braun and Clarke, 2006). This method is chosen because it has theoretical freedom, flexibility and can provide a rich detailed analysis of complicated phenomena such as reflection.

The thematic analysis looked for recurring themes identified from the data which are synthesised to draw new findings. Thematic analysis was done following three key steps. Firstly the data was extracted and coded into distinctive features and the data rechecked to ensure they were coded systematically. Themes were then drawn and data from the coding was correlated and analysed in the context of a theme. Finally the data in each theme was analysed and conclusions were drawn with corroboration from the initial data source (Braun and Clarke, 2006).

4.4 Discussion

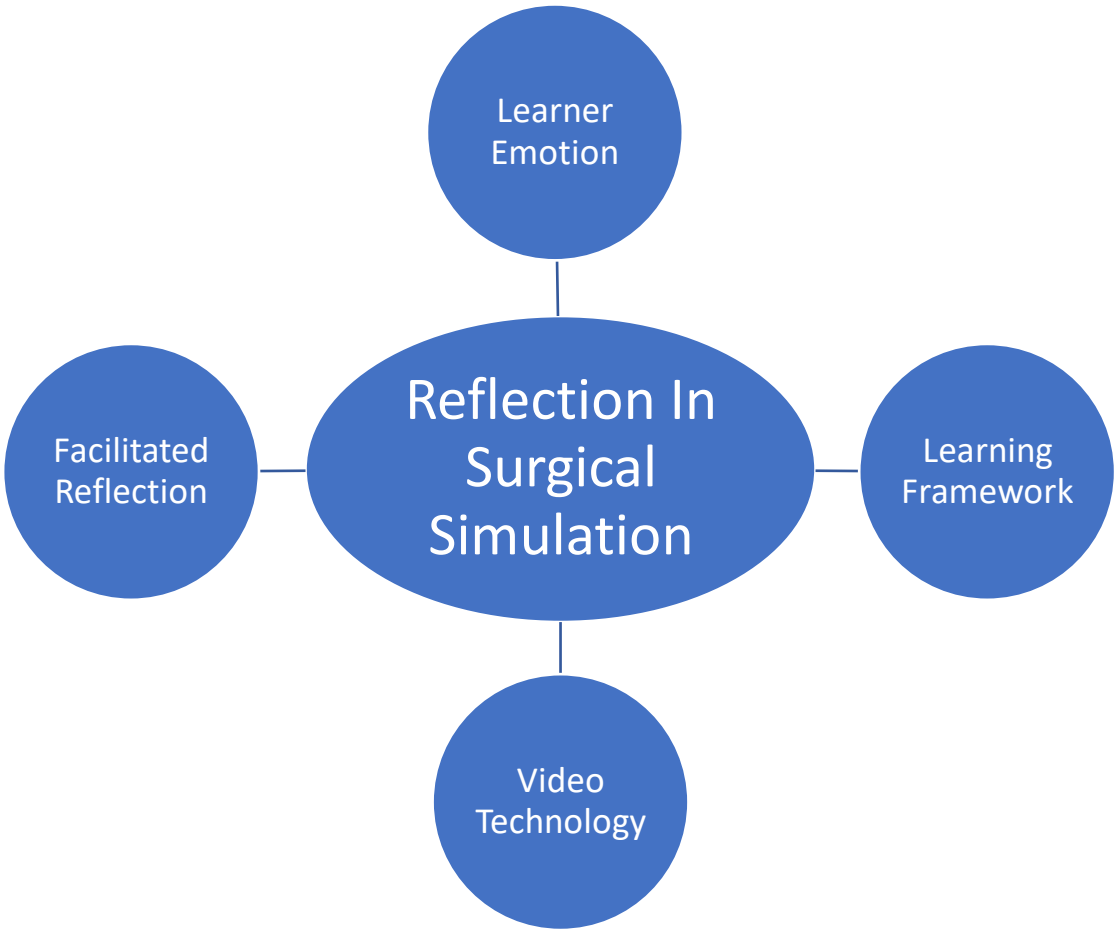


Figure 4.2 Thematic Map Showing Four Final Themes

Four important themes were synthesised: Learning frameworks that integrate reflection in surgical simulation; Learner emotion and reflection in surgical simulation; the role of facilitated reflection in surgical simulation and finally the role of video technology in surgical simulation.

Individual institutional and cultural barriers to reflection in surgical simulation were also identified and this will assist with the design

the facilitated reflection tool. Finally, studies that did not meet the inclusion criteria but the findings were considered to be of significant value for developing a facilitated reflection tool are discussed in this section. These studies did not meet the inclusion criteria as the sample population was with undergraduate medical students or the observations and outcomes of reflection were explored in the operating theatre as opposed to during simulation.

4.4.1 Learning Frameworks In Simulation And Reflection

The first theme identified supports that learning frameworks can help integrate and amplify reflection into the simulation. Frameworks can be based on traditional learning models such as Kolb's experiential learning cycle and Schon's reflective practicum or tools developed predominantly by medical educators that have reflection explicitly integrated as one of the components.

Sadideen and Kneebone (2012) suggests using learning frameworks in surgical simulation can predict how effective approaches to surgical education are, as well as using such a framework can ensure consistent learning (Sadideen et al., 2012).

Specific tools used as learning frameworks to develop reflection included workplace based assessments, where reflection can be standardized and formally recorded (Colaço and Tennent, 2016); tools specifically developed to deliver feedback in surgical simulation, that improve the quality of learner reflection through structure (McKendy et al., 2017); or tools designed to assess progress through the surgical simulation, which monitor extent and frequency of learner reflective activity (Papaspyros et al., 2009).

However, none of the tools identified from the results elaborated further how they achieved these effects on reflection.

Raemer et al (2009) review article and Nguyen et al (2015) pilot observational study discusses using learning frameworks based on existing theoretical learning frameworks, in this case Kolb's experiential learning cycle, for integrating reflection in surgical simulation. The simulation itself forms the experience, guided feedback develops reflection, abstract conceptualization occurs in a safe environment and the learner should have the opportunity to retry the simulation again during the active experimentation phase, thus completing the cycle (Nguyen et al., 2015, Raemer, 2009). Furthermore, the opportunity to repeat the simulation enhances transference of learning to the operating theatre through a repeat cycle of reflection (Thomas, 2013).

The concept of reflection in action and reflection on action in a safe but relevant environment such as simulation was discussed in Chapter 3. Sullivan et al (2016) reiterates Schon's concept of reflection in action and on action occurring within a safe environment but goes on to expand further and describes the notion of reflection "through action" that manifests during surgical simulation .

The review describes reflection in action as identifying what is the immediate next step in the procedural simulation and reflection on action as analyzing performance following the simulation. Reflection through action occurs when learners analyse what they are doing at that moment and how could this translate into the operating theatre at exactly the same time as doing the procedural simulation (Sullivan et al., 2017). However, it is arguable whether

this concept is pragmatic for learners to explicitly reflect in this way at the same time as undertaking procedural simulation. Furthermore, learners are likely to be task focused during that period of time.

4.4.2 Surgical Simulation And Learner Emotion

The second theme identified, explores the necessity to recognize the value and importance of learner emotion in surgical simulation and its effect on both reflection and learning. Negative learner emotions can inhibit cognitive development and arrest learning processes including reflection (Clark et al., 2016).

As is known from the conceptual definitions of reflection described in Chapter 3, learners exploring their initial reactions and emotions often forms the first step of reflection. This concept recurred in the context of surgical simulation, where during the debrief phase it is has also been strongly advocated that exploration of emotions and initial reactions should form the first step (Ahmed et al., 2012).

Simulation should aim to provide a learning environment with reduced stress. Stress is a limiting factor in learning, but simulation allows learners to reflect and engage in a dialogue with reduced fear and embarrassment of asking questions.(Sharma et al., 2011) The surgical teacher should try to support learners that human error is normal and forms an important component of experiential learning (Sharma et al., 2011, Ruoranen et al., 2017). For learners to feel free to discuss their own errors and mistakes, the environment should be learner centered and safe without fear of intimidation or reprisal (Agha and Fowler, 2015).

The findings extensively reiterate the important concept of a "safe" learning environment where the value, role and significance of learner emotion during surgical simulation is understood. However, there is some suggestion that learners feeling comfortable in this environment may focus on "retreating" to simulation as opposed to transferring their newly acquired knowledge into the clinical environment (Ker and Bradley, 2013).

4.4.3 Facilitated Reflection In Surgical Simulation

The dialogue between the learner and surgical teacher where processes of reflection, or reflection itself, are explicitly discussed in surgical simulation has been described as facilitated reflection or guided reflection (Ghaderi et al., 2015, Gagnon and Abbasi, 2017).

In this thesis the term facilitated is used rather than taught or guided. This is because the term facilitated when applied to reflection suggests from the literature a process that engages learners to construct and develop their own learning rather than allowing learners to fall into a passive role (Clapper, 2010).

Facilitated reflection has the potential to enhance the process of highlighting discrepancies between desired and actual performance in the learner that occurs during feedback.(Clark et al., 2016) Learners may be able to reflect and identify perceived strengths and weakness but a surgical teacher can help in this process to deconstruct and identify tangible changes that can be made (Ghaderi et al., 2015).

Reflection does not require a dialogue between the learner and the surgical teacher but requires the learner to be skilled and proficient

at reflective practice (Johnston et al.) However for the novice learner, a dialogue can lead to more sustained meaningful reflection, again reaffirming the value of facilitated reflection (Johnston et al., Yule et al., 2007).

Learners who try to examine their cognitive processes during decision making in surgical simulation are more likely to encounter a profound change in professional practices (Sinclair et al., 2016). This scrutinization and analysis of cognitive processes can be enhanced with a surgical teacher (Sullivan et al., 2017).

Developing non-technical skills in surgical simulation such as communication improves the learners ability to reflect but also the promotes opportunity to engage in dialogue with a surgical teacher who can further enhance this reflection (Khan et al., 2017). Awareness of the role and value of non-technical skills in laparoscopic simulation is greatly lacking (Agha and Fowler, 2015).

Reflection in surgical simulation enables learners to identify new perspectives on an existing dilemma (Sullivan et al., 2017). Surgical teachers should scaffold reflective questions to the learner to explore the rationale behind decision making and how this contrasts with the learners previous experience (Sullivan et al., 2017). This concept follows principles of transformative learning as conceptualized by Mezirow. Furthermore, they should emphasize to learners what the importance and role of reflection is in the context and what can be achieved through reflection (Sandars, 2009, Sullivan et al., 2017).

Cognitive simulation encourages mental rehearsal of the key steps of a procedure. Cognitive simulation in surgical simulation enables

advanced learners to consider hypothetical scenarios of complications or difficult procedures through reflection in the context of the current simulation activity (Sullivan et al., 2017).

This assertion is supported by findings from randomised controlled trial using a laparoscopic simulator concluding that cognitive simulation when combined with surgical simulation can shorten the learning curve and improve learner performance (Immenroth et al., 2007). A surgical teacher could enhance this cognitive simulation process by structuring a framework for the learner to rehearse (Windsor, 2009, Gagnon and Abbasi, 2017).

There is some suggestion that learner engagement with reflection appears to decline with experience of the learner. Developing frameworks to integrate reflection in surgical simulation can empower learners of all experiences to engage in reflection actively (Sullivan et al., 2017).

Cook et al (2016) proof of concept study suggests both the surgical teacher and the learner have the opportunity to develop knowledge and skills through reflection in surgical simulation. For example, the learner may improve technical skills through a process of reflection, but the surgical teacher has the opportunity to iteratively develop their own teaching skills and as a consequence their skills in facilitating reflection. This highlights a unique concept that facilitated reflection can enhance the quality of reflection that occurs in both the learner and the surgical teacher (Cook et al., 2016).

For facilitated reflection to occur dedicated time is needed. It is anticipated that the time needed will vary significantly between

learners and will be limited by resources. (Nickel et al., 2014, Ahmed et al., 2012)

4.4.4 Video Technology And Learner Reflection

Several studies and reviews concluded that using video technology to record the simulation may enrich the debrief process and provide a framework to structure facilitated reflection.(Abdelsattar et al., 2015, Paige et al., 2014, Gardner and AbdelFattah, 2017, Vaughn et al., 2016, Paige and Chauvin, 2008)

Paige et al (2008) review of surgical simulation suggests the use of video technology, allows accurate recall of information from the simulation and can provide an objective framework for structuring the debrief following surgical simulation. This enhances reflective activity in learners and crucially results in positive behavioural changes (Paige and Chauvin, 2008).

Video recording the surgical simulation has been shown to stimulate critical reflection in the learner by developing cognitive understanding of the task (Vaughn et al., 2016). This also has been shown to increase propensity of the learner to engage further in deliberate practice (Vaughn et al., 2016, Paige and Chauvin, 2008).

When using video technology, a safe environment to learn from is needed. Vaughn et al (2016) study explored peer video feedback of surgical simulation in the learners own home. The fact that the task took place at the learners home, with peers instead of assessors supported a learner centric environment which was described as a "stress-free" zone (Vaughn et al., 2016).

4.5 Individual, Institutional and Cultural Barriers To Developing Reflection In Laparoscopic Simulation

It is necessary to understand the perceived barriers to reflection in laparoscopic simulation to highlight some of the challenges that may be encountered with developing a facilitated reflection tool.

4.5.1 Individual barriers

Learners sometimes perceive that feedback or debrief when done formally is only given in the context "*when something wrong has happened*". Ahmed et al (2012) suggests that the debrief process, when facilitated reflection occurs, needs to be strategically planned to reinforce reflection with a positive value approach.(Ahmed et al., 2012)

Combining active involvement of the surgical teacher in the simulation experience, as well as observing the learner, can impair objectivity in providing meaningful feedback (Yule et al., 2007). This is a well-known paradigm in other modalities of learning and though video technology can record learner behavior objectively, it may not change the surgical teachers perceptions of the learner, having interacted with them.

4.5.2 Institutional barriers

Any reason that extends the time of the simulation experience increases costs and reduces time for service provision by staff. There is no clear data on time needed for reflection in surgical simulation (Smith et al., 2013, 2016).

The evidence for the use of video technology to structure the debrief and for the enrichment of learner reflection has been discussed. However use of video technology requires learner and faculty consent, availability and expertise of using the technology, following of the data protection legislation and sufficient time allocation for using the technology (Paige and Chauvin, 2008).

There is a great disparity between subject expertise and educational expertise leading to a lack of understanding of the role of reflection among surgical teachers. This is further exacerbated with a lack of time dedicated towards faculty development and training in gaining educational expertise (Yule et al., 2007).

One study reported resistance among faculty to using reflective tools e.g. *"this is not the way it's done here",* this again links into the fact that there is often limited resources to support development of educational expertise amongst faculty (Yule et al., 2008).

The laparoscopic simulation experience has been described as a "Postcode Lottery" for learners in terms of the simulation experience gained. This could be due to either the surgical teacher, the specific model, or the program of the simulation activity despite identical curriculum and learning goals (Agha and Fowler, 2015). Furthermore, some studies have also highlighted there is a mismatch of learning goals and expectations between the learner and the institution (Agha and Fowler, 2015, Uemura et al., 2014, Kneebone, 2010).

Despite many of the institutional barriers being financial, it is interesting to note that reflection in simulation has already been

hypothesized to reduce institutional costs (Haerizadeh and Frappell, 2013). Training time in the operating theatre is a significant financial burden and if the learning curve can be reduced by facilitating the reflection in simulation, then this has potential cost saving benefits.

4.5.3 Cultural Barriers

There is sometimes a perceived belief of reflection as a tick box exercise and therefore not taken seriously by either surgical teachers or learners or both (Yule et al., 2007). This has been highlighted earlier and appears to be a recurring theme with reflection in simulation.

Simulation can become decontextualized and reflection in simulation may not represent reflection in the operating theatre. However, there is some evidence that reflection in simulation is translatable into the operating theatre and this is discussed further in this chapter (Agha and Fowler, 2015).

4.6 Studies Or Reviews With Medical Students As The Sample Population

In North America, several studies used undergraduate medical students as the sample population during laparoscopic simulation interventions. The undergraduate curriculum and subsequent postgraduate training is vastly different compared to the UK, for example US and Canadian medical school is graduate only entry (Marsden, 2006). Medical students in their later years must start developing skills such as surgical technical skills for their chosen

speciality which they will embark upon post-graduation, unlike the United Kingdom (Bjerrum et al., 2015).

Therefore, the learners as a population are very different and may be more akin to postgraduate doctors in training in the UK at early stages of their career. Some studies have correlated that surgical technical skills among medical students have comparable standards to postgraduate surgeons in training in their early stages of career (Bennett et al., 2011).

It is therefore worthwhile reviewing how reflection is developed in this population and the relevant studies are summarised here.

Nickel et al (2014) reiterates an important concept that dedicated time is needed in the laparoscopic simulation activity to develop reflection (Nickel et al., 2014). It is anticipated that the time needed to develop reflection in laparoscopic simulation will vary significantly between learners and will also be restricted by costs and resources.

Dempsey and Kauffman (2017) study explores self-efficacy and coping models in a laparoscopic simulation context with a medical student population. As part of these models they used specific questions such as *"what is the probability you can tie this knot laparoscopically"* that stimulate reflection in the learner and make a judgement on their self-efficacy. This model of feedback had a positive impact on self-efficacy on medical students but also enhances the efficiency of learning (Dempsey and Kauffman, 2017).

Ahlborg et al (2015) mixed methods study looked at individualised feedback during laparoscopic simulation among 5th year Swedish medical students. Four outcomes were measured: simulator performance, self-efficacy, flow and learner's perception. Flow was defined as *"to move or progress smoothly (in the simulation) with unbroken continuity"* (Ahlborg et al., 2015).

The study showed that if there is feedback that is tailored to the individual learner, self-efficacy and flow are greater. It is interesting to note that individualised feedback also increased anxiety in some students and this phenomenon has been termed as the mentor effect (Ahlborg et al., 2015). Mentor effect is where the learner may feel pressurised when observed and strives in congruence with the feedback to achieve the perceived expectations and high standards of the mentor (Paskins and Peile, 2010).

4.7 Studies Or Reviews Of Reflection In The Live Operating theatre

During the search process, studies were extracted that discussed reflection but in the operating theatre as opposed to in surgical simulation. Three articles are highlighted as they provide some conceptual insight into the phenomenon of reflection in the operating theatre. These studies are discussed because ultimately as reiterated, the goal of surgical simulation is for transference of knowledge, skills and behaviours into the operating theatre. Analysing reflective processes in the operating theatre provides a unique insight into understanding how reflection should be embodied in surgical simulation.

Gagnon et al (2017) systematic review of all randomized controlled trials looking at coaching in surgery explored what are the effects of surgical coaching to improve learner outcomes. Guided or facilitated reflection, as part of the coaching process, in conjunction with experiential learning, can elucidate the discrepancy between desired and actual performance as well as acting as a tool for behavior modelling (Gagnon and Abbasi, 2017). This concept interlinks with surgical simulation, in that one goal of reflection in surgical simulation should be to facilitate the transition between desired and actual performances (Scherer et al., 2003).

Ruoranen et al (2017) observational study explored how operative risks or potential errors are explained to novices, learning from experienced surgeons, who are teaching them during live surgery. The study identified that reflection through transformative learning processes, has the potential to enable surgeons to learn from such errors. Reflection not only enhances problem solving of errors, it can identify root causes of errors and steps to avoid them form happening in future (Ruoranen et al., 2017).

Yule et al (2007) pilot usability trial demonstrated that non-technical skills tools such as cognitive task analysis can act as a learning framework similar to the other tools described earlier (Yule et al., 2007). However, not only can these tools scaffold reflection in surgical simulation but also ensure that learners engage in deliberate reflection as part of the tool (Yule et al., 2008).

4.8 Limitations of this review

The greatest limitation was the paucity of evidence available to address the literature review question. The few primary studies undertaken were further limited by quality of design and robustness of methodology and none of the literature addressed reflexivity with very few explicitly stating ethics.

All the literature identified discusses reflection in action or on action i.e. during the simulation experience or after. No studies discussed reflection pre action – reflection before the simulation experience. There is a scarcity in the medical literature exploring pre action reflection in surgical simulation but there is some evidence highlighting the value and significance of this (Page-Cutrara and Turk, 2017, Burns, 2015, Chamberlain, 2016). Reflection pre-action is discussed further in Chapter 22.

There was no literature identified discussing Kirkpatrick Level 4 - patient outcomes. However, it has been established that this area of research is still in its infancy, learner perceptions and Kirkpatrick level 2/3 outcomes may be more valid and fruitful to investigate initially. Lack of translational patient outcomes should not automatically quantify a study as poor quality in this context.

4.9 Conclusion

Though the critical review was limited due to the number of studies identified through the search process, the role of facilitated reflection has been validated in surgical simulation and the theoretical justification for developing a facilitated reflection tool has been demonstrated from the learner outcomes of these

studies. Furthermore, none of the studies suggested a specific type or model of simulator was superior in developing reflection, supporting the validity for a wider application of the facilitated reflection tool in different types of laparoscopic simulation activity.

Perhaps one of the most pertinent findings from the critical review is that video recording the simulation and using it during debrief appears to support learner engagement in reflection and amplify transformative learning processes associated with reflection.

Learner recall, engagement in reflection and an increased propensity to engage with deliberate practice are all cited as benefits of video technology and it can create a framework for structuring facilitated reflection. The powerful dynamic integration of video technology and facilitated reflection is discussed further in Chapter 16.

Though the phenomenon of facilitated reflection has been shown from the critical review to result in enhanced learner outcomes, a greater propensity for learners to engage with reflection and the opportunity for reciprocal reflection; The need for a clear instructional framework for facilitated reflection with corresponding theoretical justification is essential for the construction of such an educational tool (Tooley and Darby, 1998, Ker and Bradley, 2013).

Chapter 5 - What Other Conceptual Understandings Are Known Regarding Facilitated Reflection In Simulation

This chapter explores if there are any other translatable concepts that can be applied from other forms of healthcare simulation, besides surgical, when designing the facilitated reflection tool as well as identify any limitations or barriers that were not synthesised from the literature review.

Three themes were identified in the literature with regards to the role of a facilitated reflection in simulation as illustrated in Figure 5.1.

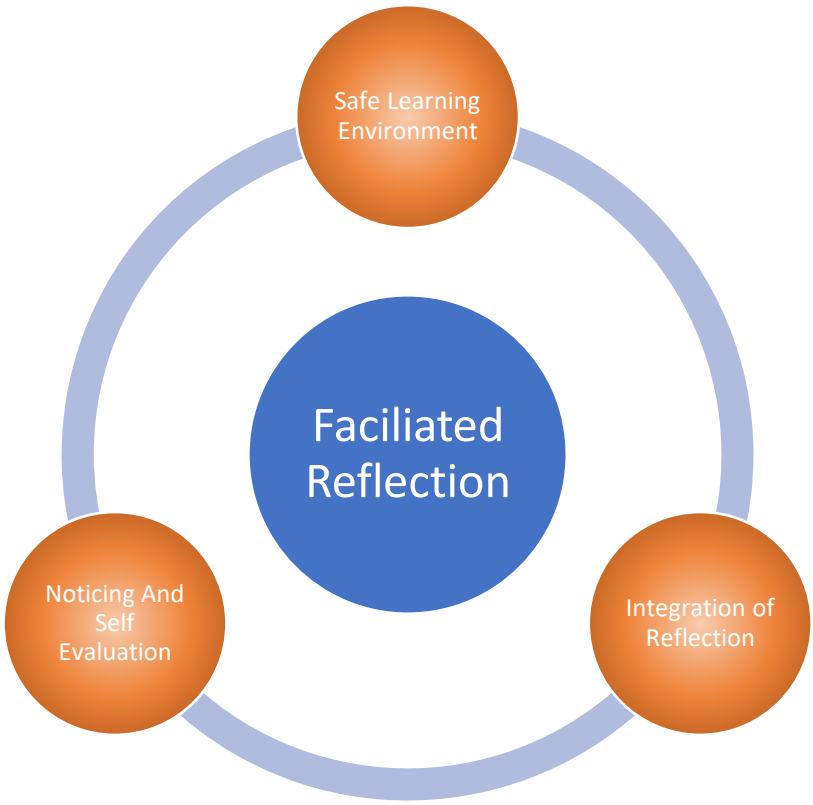


Figure 5.1 Facilitated reflection in non-surgical simulation.

5.1 Integration Of Reflection Into Simulation

As discussed in Chapter 4, the integration of simulation and reflection are central to learning. Reflective thinking can be developed and scaffolded to make the integration with simulation more conducive to learning (Decker et al., 2007).

Reflection is frequently discussed in the literature as being isolated from the overall educational process and hence decontextualized from simulation (Sullivan et al., 2017). Reflection in postgraduate medical training is sometimes perceived as a tick box exercise as already discussed in Chapter 4, and the evidence in non-surgical

simulation suggests the educational value of reflection is significantly reduced (Curtis et al., 2017). A surgical teacher is exclusively placed as having the ability to promote the value of reflection and effectively integrate it into the simulation (Sandars, 2009).

There is evidence that reflection in undergraduate medical students enhances their perceptions of their strengths and weakness in clinical skill acquisition (Paul et al., 1998). This valuable perception is further enhanced through facilitated reflection with a surgical teacher by stimulating critical interactive reflection through dialogue (Paul et al., 1998). The surgical teacher is able to inculcate the value of reflection in the simulation experience so the role and necessity of reflection is embedded in the learner. (Jones and Alinier, 2006).

Virtual patient simulation is a unique simulation modality that can foster practices of facilitated reflection without a surgical teacher (Kleinheksel, 2014). Virtual patient simulation offers the opportunity for learners to not only identify simple clinical features such as symptoms and signs of disease but explore the virtual patient holistically including personality, character and wellbeing. In doing so they engage in higher reflective activity (Kleinheksel, 2014, GUISE et al., 2012). Currently no laparoscopic simulators were identified in the literature that incorporated features of a virtual patient as well but this could be a promising avenue to explore in the future.

5.2 Noticing And Self Evaluation

Learners may consciously or unconsciously block noticing of an important experience. A surgical teacher can empower the learner to notice this experience and try to make sense of it. Even if learner consciously acknowledges the experiences they may not be able to translate this into how it can inform future action (Sandars, 2009). A surgical teacher can facilitate this translation from the experience, to learning and understanding that informs future practice (Sandars, 2009).

Self-evaluation drives reflection. However not all learners are able to be self-aware and critical of their performance. Poor ability to self-evaluate in simulation is less likely to achieve lifelong learning (MacDonald et al., 2003). This is where the role of facilitated reflection has another potential, a surgical teacher can guide the reflective process so that the learner is able to introspect deeper, self-evaluate more critically and inform future actions through richer and more meaningful understandings (Burns, 2015).

5.3 Promoting A Safe Learning Environment

Facilitating reflection in simulation is thought to enable learners to achieve higher order cognitive skills as a result of learners feeling they are in a safe environment (Thackray and Roberts, 2017).

A safe learning environment in surgical simulation, has features such as learning that avoids fearing certain complexities of the clinical environment, for example risks towards real patients from the learners action, as well as the confidence to ask questions

without fearing embarrassment or reprisal from either peers or the faculty (Kneebone, 2009).

A safe learning environment ensures the guardianship of psychological safety for all learners. Psychological safety in simulation as defined by Rudolph (2006) is *"a person's sense that the immediate environment is safe for interpersonal risk taking; that trying out new ways of talking or acting will not be ridiculed; that mistakes will be worked on together as a source of learning instead of being treated as a crime to be punished or covered up"*(Rudolph et al., 2007).

Palaganas (2016) and Rudolph (2014) discuss core features that establish psychological safety in simulation (Palaganas et al., 2016, Rudolph et al., 2014).

Declaration Towards Ensuring Psychological Wellbeing Of Learners - Facilitators are aware of the importance of psychological safety of the learners and are committed to good practice with this.

Logistical Preparation -The simulation experience should be pilot tested focusing on how the learners experience may be perceived. This would try and identify any potential adverse outcomes prior to learners attending. Furthermore, learners should be orientated to what to expect and the simulation should also occur in an environment conducive to learning.

Clarification - Expectations should be clarified. Adult learning theory hinges on the belief that learners should know what, how and why they are learning. This would be covered before the

simulation discussing expected learning objectives. Issues surrounding confidentiality should also be discussed as part of this.

Contract - An agreement between the learner and the facilitator should clearly be stipulated explaining the expectations and responsibilities of each other. It should also be explained that though the simulation is not a replacement for surgical experience, it would be envisaged that transferable skills and behaviours are developed through it (Palaganas et al., 2016, Rudolph et al., 2014).

Additional Support - Often the initial exploration of emotions in the debrief is not enough and participants may still have persistent negative feelings. Facilitators should be aware of support services available and contact details provided should the learner require extra support following the simulation experience.

A safe learning environment enhances the learner's ability to cope with the process of accommodation (Sandars, 2009). Accommodation is where a learner experiences an unexpected event – a cognitive conflict and this in turn reveals inadequacy of existing frameworks of knowledge (Turner and Harder, 2018). This could lead to learner embarrassment but by engaging in reflection with a surgical teacher, within a safe learning environment, new conceptual frameworks can be scaffolded and the learner feels empowered. However, it is important to note that with cognitive conflict, this can result in learner disengagement and dismissal of the experience. Here again facilitated reflection has a role in challenging the learner's negative perceptions and this challenge is more likely to be well received through a safe learning environment (Sandars, 2009, Kneebone, 2009).

From the literature review and this chapter's six key concepts were synthesized with regards to facilitated reflection in laparoscopic simulation.

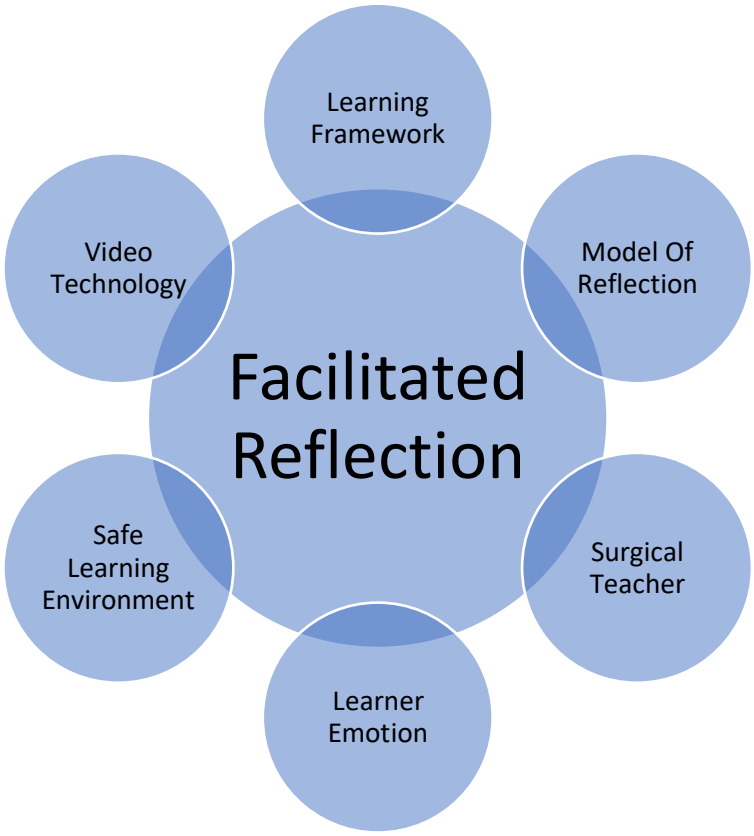


Figure 5.2 Concepts underpinning facilitated reflection in simulation

These concepts will be further discussed in Objectives 2 & 3 of this thesis.

Chapter 6 - An Issue Worthy Of Research?

From the literature review and preceding discussion, there is a clear theoretical justification for developing a facilitated reflection tool in laparoscopic simulation.

Several studies have already demonstrated that skills gained from a laparoscopic simulation activity can be transferred to the operating theatre with potentially improved patient safety. This study's purpose is to explore if this educational experience can be further enhanced through development of a facilitated reflection tool. With Courses averaging from five hours to six weeks with costs of up to £800 per trainee, it is vital that this significant investment of time and money provides the best learning opportunities for Gynaecologists in training.

Norman and Eva (2013) provide a framework for selecting and justifying *"an issue worthy of research"* and suggest five themes, shown in Figure 6.1. The theoretical justification for this research is summarised through these five themes.

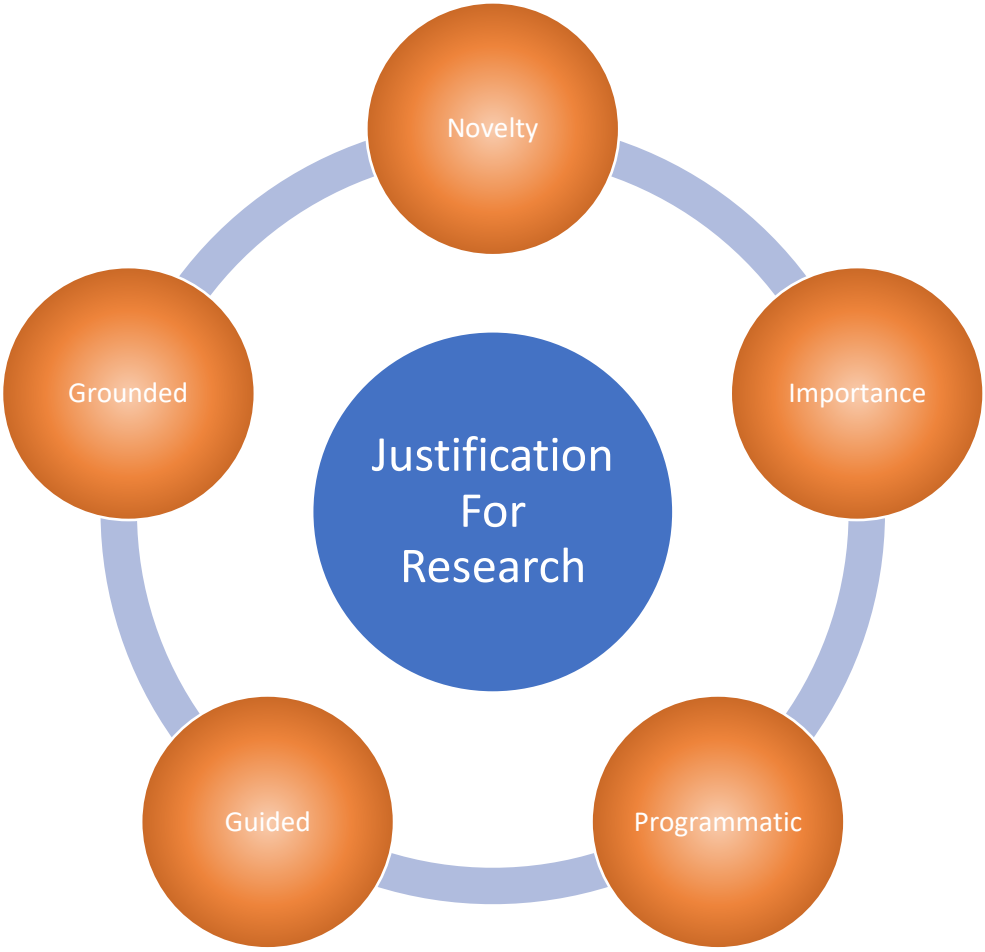


Figure 6.1 Five themes for justifying an area of research adapted from (Norman and Eva 2013)

Novelty: This theme answers whether the research has ever been conducted previously. Up till the date of the literature search, no studies or protocols were identified for either the development of or use of a facilitated reflection tool in laparoscopic simulation.

Importance: This theme explores whether the phenomenon is worthy of investigation. Reflection in simulation has been theorized repeatedly in the literature as one of the most crucial phenomenon for achieving lifelong learning (Clapper, 2010, Decker et al., 2007, Pollard and Wild, 2014). The surgical teacher has a critical role in

the promotion and facilitation of both reflective and higher order thinking (Clapper, 2010, Tutticci et al., 2017).

If learner outcomes can be improved as a result of effective laparoscopic simulation, then potentially there is a transformational benefit towards patient safety if this learning can be replicated in the operating theatre.

Programmatic: Medical education research is criticized for researching projects than developing a programme. The latter ensures follow through, systematic and rigorous testing of the research conducted whilst avoiding research waste (Norman and Eva, 2013, Glasziou and Chalmers, 2018).

The aim of this research is not designed for immediate conclusions regarding learning outcomes, but it is envisaged that it will form the foundation for the future study to reside in – the validation of the facilitated reflection tool through exploration of learner outcomes.

Guided: This theme uncovers what is the conceptual framework that the research lies within. This conceptual framework will be discussed under Objective 3 of this thesis.

Grounded: Grounded refers to the research being an extension to what is already know. The literature review has discussed this concept and supports the research direction chosen.

Having explored the research justification for developing a facilitated reflection tool, the next section of this thesis will explore

the selection and justification of a theoretical orientation for the facilitated reflection tool to reside in.

Objective 2

To Select And Justify The Theoretical Orientation For the Facilitated Reflection Tool To Reside In.

Chapter 7 - Introduction To Objective 2

The term theoretical orientation in medical education is described as identifying the roots of a phenomenon or intervention based on existing educational theory (Ng et al., 2015).

The theoretical orientation of facilitated reflection resides in the model of reflection and the learning framework. One of the key findings from the literature review was that there were no studies identified exploring reflection in surgical simulation, with a clear definition of what encompassed reflection. However, the integral role of a learning framework to develop and structure this reflection was validated in surgical simulation. This section of the thesis will select and justify a learning framework and corresponding model of reflection that will form the theoretical orientation for the facilitated reflection tool to reside in.

There are several learning frameworks that have been suggested to develop and structure reflection in simulation. From the literature review predominantly Kolb's experiential learning cycle and instructional tools that were not grounded in educational theory were used to develop and structure reflection in surgical simulation.

Using a simplified instructional tool for facilitated reflection, that has not been constructed through educational theory or academic scrutiny, risks over-simplifying a complex process. Over-simplifying complex processes in surgical simulation affects the learners ability to engage in deep understanding (Kneebone, 2009). Furthermore, designing simulation interventions grounded in educational theory helps to affirm its credibility (Ker and Bradley, 2013).

Though the use of Kolb's experiential learning cycle to develop reflection in surgical simulation was identified from the literature review it has been criticised for its oversimplification of the many learning processes in simulation compounded with a weak theoretical foundation (Ker and Bradley, 2013). Experiential learning is at the core of simulation, however a learning framework that supports this in a simulation context needs to develop lifelong learners, incorporate the role of communicative learning and encourage deep introspection (Kear, 2013, Clapper, 2010).

In this thesis transformative learning as conceptualised by Jack Mezirow has been selected as the learning framework. Mezirow (1991) defines learning as *"the process of making a new or revised interpretation of the meaning of an experience, which guides subsequent understanding, appreciation and action"* (Bork, 1991). Transformative learning incorporates three foundation principles consisting of centrality of experience, discourse and critical reflection to guide this understanding, appreciation and action as shown in Figure 7.1 (Neill, 2016, Mezirow, 1991). Transformative learning has been explored in the literature to design and structure simulation through these principles (Chen and Martin, 2014, Parker and Myrick, 2010, Mitchell et al., 2012).

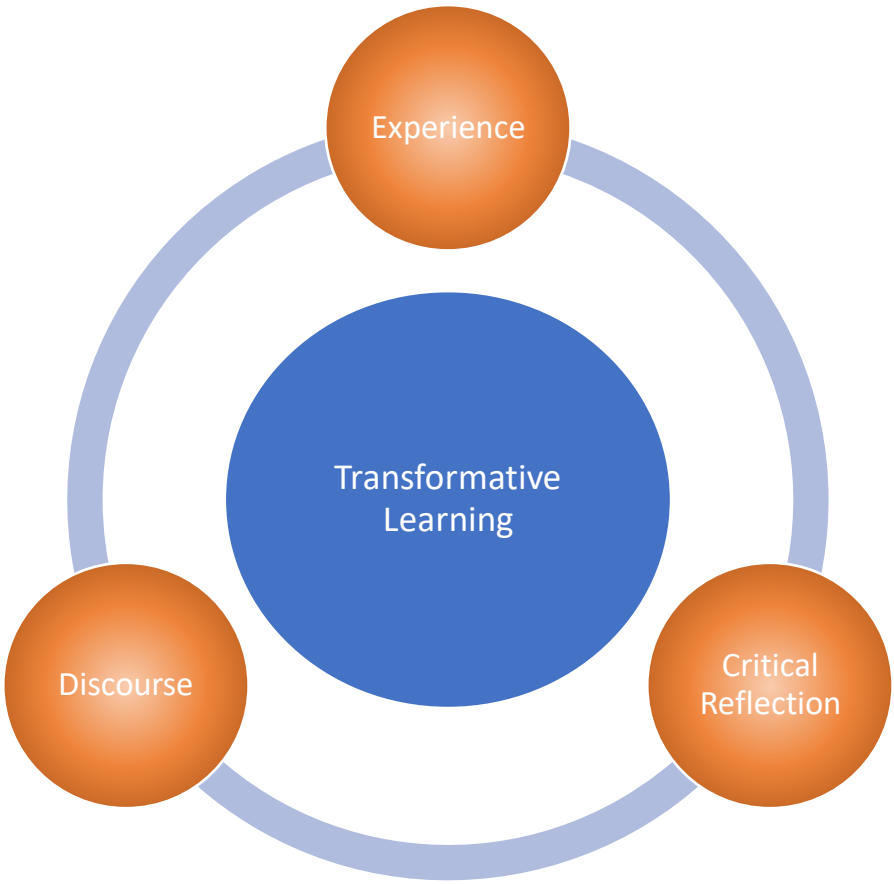


Figure 7.1 The three foundation facets of transformative learning.

This section of the thesis will explore transformative learning and critical reflection further, with a specific focus on the works of Jack Mezirow, in the context of laparoscopic simulation.

Chapter 8 - Transformative Learning And Surgical Simulation

Integrating transformative learning into surgical simulation, gives direction to learners and surgical teachers, keeping learner autonomy central (Rashid, 2017). Rashid goes on to postulate that in surgical education "*Adult learners embrace transformation if they feel that the goals are worth attaining and they have control over the learning process*".(Rashid, 2017)

Though the phenomenon of transformative learning and reflection itself has not yet been explored in surgical simulation, there are studies exploring the role of transformative learning in surgical simulation and these are summarised below.

Mitchell et al (2012) prospective observational study explored postgraduate doctors comprehension of anatomical structures using cadaveric simulation as part of their training in vascular surgery. This study found that using this modality of surgical simulation achieves perspective transformation through understanding of threshold concepts (Mitchell et al., 2012)(A threshold concept as described by Meyer and Land (2003) "can be considered as akin to a portal, opening up a new and previously inaccessible way of thinking about something.") (Meyer and Land, 2003).

Surgical simulation with transformative learning helps learners understand and navigate through complex processes synergistically and rapidly (Kneebone, 2009). For example, a novice learner through transformative learning can understand surgical paradoxes such as how laparoscopic surgery can be used

to treat surgical adhesions even though the learner has always been taught that surgery is a cause of adhesions. Following on from this they can expand even further by understanding how treatment of adhesions in itself can result in further adhesions (Menzies and Parker, 2004).

8.1 Cultivating Lifelong Learners Through Transformative Learning In Surgical Simulation

Lifelong learning is "*a continuation of medical education with an ongoing process of professional development along with self-assessment, which enables physicians to maintain the requisite knowledge, skills, and professional standards*."(Madewell, 2004) The General Medical Council has published guidance to support doctors foster a habit of lifelong learning through continuing professional development (GMC, 2012). Life-long learning is at the core of surgical education and bridges the gap between novice and expert surgeon (Gramlich, 1976).

Simulation is uniquely placed in its ability to cultivate lifelong learning practices in healthcare through transformative learning (Kear, 2013, Clapper, 2010). Learners who undergo perspective transformation as a result of simulation, where there is a paradigmatic shift in learners beliefs and values through critical reflection, are more likely to embrace lifelong learning (Kear, 2013). Perspective transformation and critical reflection are both discussed further in Chapters 9 and 12.

Van den Eertwegh et al(2014) goes on to suggest Mezirow's model of transformative learning promotes lifelong learning practices through three dimensions shown in Figure 8.1 (van Den Eertwegh et al., 2014).

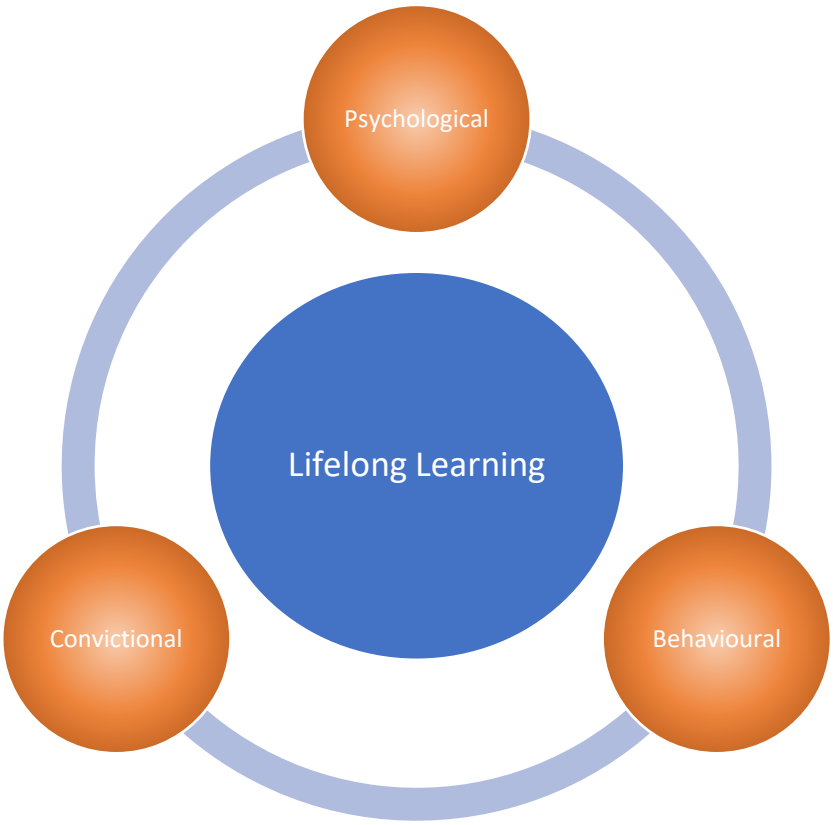


Figure 8.1 Dimensions of transformative learning that promotes lifelong learning practices as conceptualised by (van Den Eertwegh et al., 2014).

The psychological change entails the learner reviewing and critiquing their identity, convictional where beliefs and values are scrutinized and behavioural where actions are evaluated and either refuted or justified.(van Den Eertwegh et al., 2014)

Parker (2010) review on transformative learning and simulation asserts "*Transformative learning with a foundation of critical reflection…(creates) powerful learning experiences that can transform student assumptions, values, and beliefs about the world*" (Parker and Myrick, 2010).

Transformative learning helps learners achieve triple loop learning in simulation (Tutticci et al., 2018). Single loop learning identifies an immediate solution to a problem whilst double loop aims to identify why the problem was encountered in the first place. Triple loop learning looks and challenges underlying beliefs, ideas, perceptions and presuppositions. It promotes critical thinking and engages learners to reason why it is done this way in the first place (Schwartz, 2011). Both single loop and double loop learning are often done effectively by the learner alone, however triple loop learning often requires the expertise of a surgical teacher in simulation (Tutticci et al., 2018). Achieving triple loop learning leads to lifelong learning from simulation with a sustained translatable improvement in clinical practice (van Den Eertwegh et al., 2014, Tutticci et al., 2018).

Chapter 9 - Understanding Mezirow's Transformative Learning

This chapter explores the origins and conceptualization of Mezirow's transformative learning theory and its integration and application within a laparoscopic simulation context

9.1 Influences On Mezirow's Works On Transformative Learning

Jack Mezirow was a sociologist and Emeritus Professor of Adult Education in Columbia, USA. He first conceptualized transformative learning theory in 1978 in a qualitative study exploring individual, social and cultural factors that affect women's re-entry into higher education or employment following a period of time out (Mezirow and Marsick, 1978).

He summarized his rationale for developing transformative learning theory in four themes - developing a foundation for adult education that encompasses defined learning goals, construction of an educational programme, a framework for instruction and a concept that can be objectively researched (Mezirow, 1978).

Mezirow model of transformative learning is one of the most sophisticated learning frameworks for adult learning with an underlying premise based on critical reflection (Mälkki, 2010). This chapter explores the significant influences on Mezirow's theories in order to understand this complex and multifaceted learning framework.

Mezirow's model of transformative learning was primarily influenced through the works of Kuhn (1962) Freire (1970) and Habermas (1971) (Calleja, 2014, Kuhn, 1962, Freire, 1970, Habermas, 1971) illustrated in Figure 9.1.

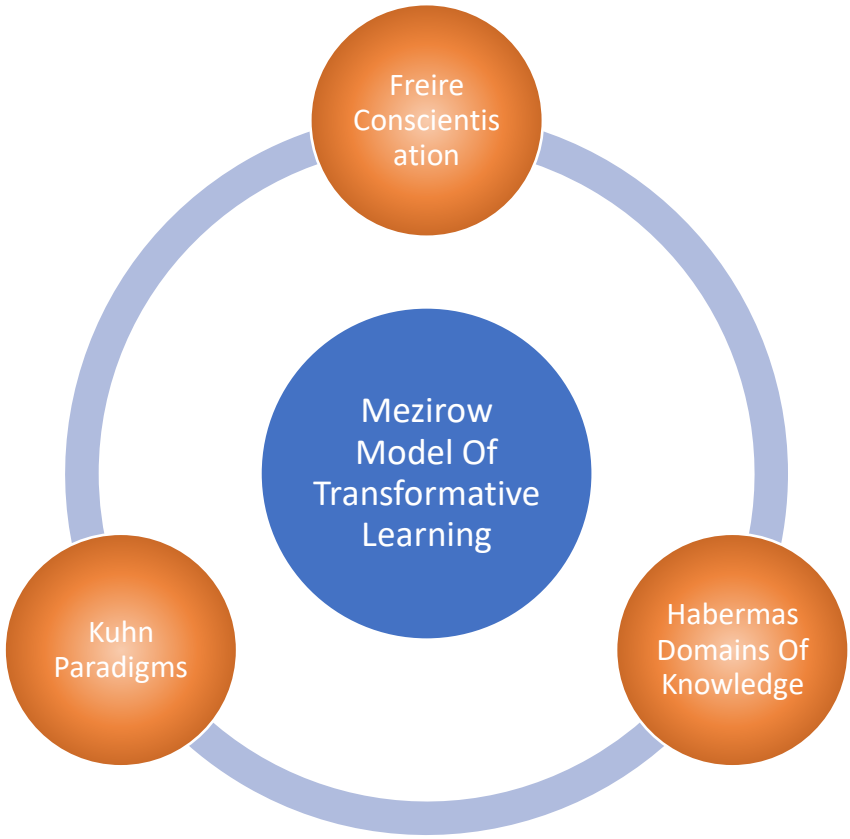


Figure 9.1 Key works that influenced Mezirow's conceptualization of transformative learning

Kuhn's (1962) book on the structure of scientific revolutions was a landmark publication on the philosophy and sociology of knowledge. Kuhn described the concept of paradigms and paradigmatic shift. Paradigms as described by Kuhn are a set of beliefs or views that determined scientific practice in that specific period of time (Kuhn, 1962). Mezirow expanded on this and described such paradigms as similar to frames of reference i.e.

beliefs or views through which the world is viewed through and a paradigmatic shift akin to perspective transformation. The concept of frames of reference and perspective transformation is discussed further in Chapter 9 (Kuhn, 1962, Mezirow, 1991).

Freire developed the concept of conscientisation under the pretext of social movement. The concept describes critical consciousness of deep world views with a perception of the social, political and economic contradictions that exist (Freire, 1970). This consciousness results in the development of critical awareness in the individual to take action against oppressive social structures present in their life. This concept of conscientisation was conceptualised as a vehicle for emancipation for oppressed populations (Calleja, 2014). Meizrow used this concept of conscientisation to construct his idea on the role of the teacher in adult education. The teacher must conscientize learners and evoke critical awareness (Mezirow, 1978). However Mezirow, changes direction in his views in that he believed conscientisation of learners is achieved through democratic, learner centric dialogue rather than being politically motivated or emancipatory (Freire, 1970, Mezirow, 1978).

Habermas work on social theory had arguably the most significance on Mezirow's work (Calleja, 2014). One of Habermas seminal works that laid the foundation for Mezirow's work on transformative learning is Habermas concept of the three domains of knowledge (Habermas, 1971, Habermas, 1984)

Habermas described three domains of knowledge: the technical, the practical and the emancipatory. Technical learning describes learning that is based on memorization that is specific to a task.

Practical learning describes how to conduct oneself in a social context and emancipatory learning conceptualises learning through deep introspection of self (Habermas, 1971). Mezirow (1985) adapted and revised these three domains as – instrumental, dialogic and self-reflective respectively (Calleja, 2014, Habermas, 1971, Mezirow, 1985). Instrumental learning refers to the ability with solving task oriented problems, dialogic is the process of understanding social normalities, and self-reflective is an awareness of our character and individuality (Mezirow, 1985).

In the context of laparoscopic simulation, instrumental task learning could be developing a specific procedural skill such as the learner trying a new method of excising a fallopian tube and developing technical proficiency in this; in dialogic learning the learner would understand why this excision was done in this manner and the reason this method is accepted as the normality, the learner achieves this understanding through observation and dialogue with a surgical teacher ; self-reflective learning involves the learner introspecting and questioning underlying beliefs, values and assumptions. In this scenario the learner would question why they personally had not been exposed to this technique before and what they could change in future so they could gain greater exposure to this method. It is self-reflective learning built on Habermas work that forms the foundation for critical reflection in transformative learning (Jarvis, 1995, Mezirow, 1985).

9.2 Key Concepts Of Mezirow's Works On Transformative Learning That Can Be Applied In A Laparoscopic Simulation Context

This chapter will summarise the theoretical orientation of Mezirow's transformative learning theory that will be used to scaffold the instructional framework for the facilitated reflection tool. The foundation of Mezirow's transformative learning theory is formulated from his works on the ten steps of transformative learning

9.2.1 Mezirow's Ten Steps of Transformative Learning

Mezirow (1978) influential seminal study exploring women's re-entry into higher education culminated in a ten phase algorithm defining "transformative learning" depicted in Figure 9.2 (Mezirow and Marsick, 1978). From the findings of this initial study he summarised transformative learning as "(… *the process of using a prior interpretation to construe a new or revised interpretation of the meaning of one's experience in order to guide future action*"(Mezirow and Marsick, 1978).

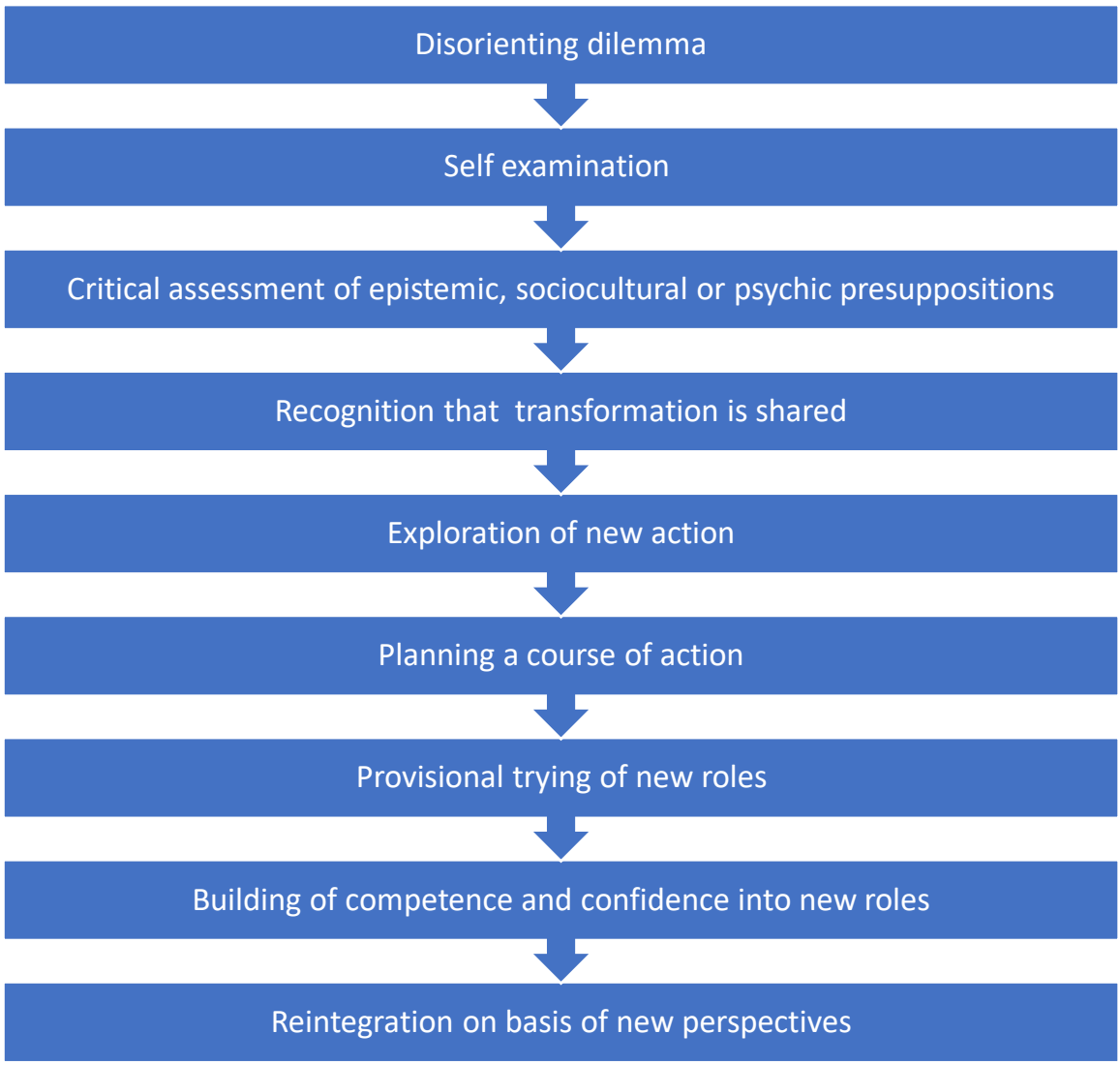


Figure 9.2 Mezirow 10 steps of transformative learning adapted from (Mezirow and Marsick, 1978).

These ten steps form the building blocks that structure transformative learning in simulation (Gum et al., 2011, Parker and Myrick, 2010). Key epistemological concepts and definitions that form these ten steps are discussed further except for critical reflection which is discussed separately in Chapter 12 due to its complexity and integral role in transformative learning.

9.2.2 The Disorienting Dilemma

The first phase of transformative learning – "the disorienting dilemma has been repeatedly asserted in simulation literature as being the "trigger" for initiating transformative learning.(Parker and Myrick, 2010)

The disorienting dilemma is an emotive and intense experience that triggers learners to reconsider their underlying views and beliefs and acts as a both a catalyst and trigger for transformative learning (Taylor, 2000).

Mezirow (1978) suggests that these disorienting dilemmas can be due to a crisis that exists externally or internally within metacognition. In education it serves to identify borders of learners knowledge and to validate, critique or justify underlying presuppositions (Mezirow, 1978).

The effect of these disorienting dilemmas on learners can vary depending on age, personality type, current emotion, self-efficacy, preferred style of learning and level of experience (Roberts, 2013).

Laparoscopic simulation can act as a medium for evoking disorienting dilemmas that trigger transformative learning. For example in laparoscopic simulation, a learner who is challenged on the method of their existing procedural skill, that they have established over a long period of time, with an alternate method demonstrated by the surgical teacher, may result in transformative learning as a result of this disorienting dilemma.

9.2.3 Presuppositions

The terms assumption, beliefs, perceptions, presumptions, presuppositions and views are often used interchangeably in

transformative learning literature to describe the change that occurs in transformative learning. In this thesis presupposition is distinctly used as a presupposition is an implicit existing belief, perception, value or view that is either challenged or validated through transformative learning compared to the other terms which may imply meanings that are fleeting or circumstantial (Andrew, 2008).

Mezirow suggested these presuppositions can be built on "*epistemological, logical, ethical, psychological, ideological, social, cultural, economic, political, ecological, scientific, spiritual*" grounds (Mezirow, 1998).

Examples of possible learner presuppositions in laparoscopic simulation include that their procedural skill technique is the norm of practice; laparoscopic simulation is a curriculum tick box exercise with limited potential for transferability to the live operating theatre or the belief that learning only occurs through high fidelity simulation such as virtual reality.

9.2.4 Frame Of Reference

Critical assessment through critical reflection of these presuppositions results in a revision or validation of a frame of reference. Critical reflection is a complex multidimensional phenomenon, with several models conceptualised in the literature and is discussed separately in Chapter 12.

Mezirow (1997) defined a frame of reference as "a mind-set or worldview of orienting presuppositions and expectations involving values, beliefs, and concepts by assessing its epistemic presuppositions"(Mezirow, 1997). Frames of reference are schemes

of interlinking presuppositions through which experiences are viewed through and made sense of (Mezirow, 1997).

Frames of reference are synthesised from two components described as "habits of mind" and "points of view"(Mezirow, 1997). Habits of mind are broad presuppositions that act as a filter for experiences. For example a laparoscopic surgeon with advanced skill and expertise feel they are unlikely to learn new skills. Habits of mind construct and delineate the path for a point of view – a specific belief value or judgement (Mezirow, 1997). Using the same analogy the laparoscopic surgeon translates this into a point of view that laparoscopic simulation is only for novice learners.

9.2.5 Perspective Transformation

Perspective transformation is rooted in self-reflective learning described earlier. If a frame of reference is revised in the context of a new experience through critical reflection, this can occasionally result in a whole paradigmatic shift of learners beliefs - perspective transformation (Mezirow, 1978) . Transformative learning must be differentiated from perspective transformation. Perspective transformation is a major change in a learners deep seated beliefs and whilst this arguably has the greatest impact on learning, it occurs infrequently. It is only through extensive critical reflection that perspective transformation can be achieved (Taylor, 2008) (Lundgren and Poell, 2016).

Perspective transformation is thought to occur less frequently since such frames of reference are bonded so intimately with emotion (Hoggan et al., 2016). Either a disorienting dilemma that is extraordinary or a learner who engages extensively with critical reflection is likely to achieve revision of such frames of reference.

As Mezirow (2000) states *"Our values and sense of self are anchored in our frames of reference. They provide us with a sense of stability, coherence, community and identity. Consequently they are often emotionally charged and strongly defended"* (Mezirow, 2000).

9.2.6 Reflective Discourse

Mezirow was a principle instigator in educational research for highlighting the importance of dialogue and how this is at heart of transformative learning. The role and importance of dialogue and facilitated reflection in surgical simulation has been repeatedly validated in Chapter 4. Mezirow (2003) expanded on dialogue and conceptualised the term reflective discourse. He defines discourse as *"dialogue involving the assessment of beliefs, feelings, and values* (presuppositions)*"* and reflective discourse as discourse that leads to reflective judgement (Mezirow, 2003).

Reflective discourse in simulation has been conceptualized in the literature through processes of feedback and debrief (Thompson et al., 2018). Mezirow's model of transformative learning is arguably the one which emphasises the most on the social dimension of learning through discourse. The role of reflective discourse is to develop willpower for the learner to engage in rational and active learning (Mezirow, 2003, Calleja, 2014).

Reflective discourse in a laparoscopic simulation context can be between the surgical teacher and learner or between the learner and other peers attending the simulation. However, crucially at the end of the discourse Mezirow (1990) suggests it is the learners onus as whether to take on this agreed justified idea. This has led to some criticisms that the learning is dissipated if the justified

idea is not taken on board, however, Mezirow (1990) argues it is a necessity for learner freedom and the role of the teacher is to facilitate learning not dictate. Learner freedom is essential to preserve learner autonomy (Calleja, 2014, Mezirow, 1990).

Mezirow (1997) describes five features that represent the ideal environment for effective reflective discourse as shown in Figure 9.3. He suggests enhancement of these factors by a teacher results in greater levels of critical reflection. However, it is worth noting for this enhancement to occur, he suggests it is crucial that the teacher has both educational expertise as well as subject expertise (Mezirow, 1997). These five features are expanded further here.

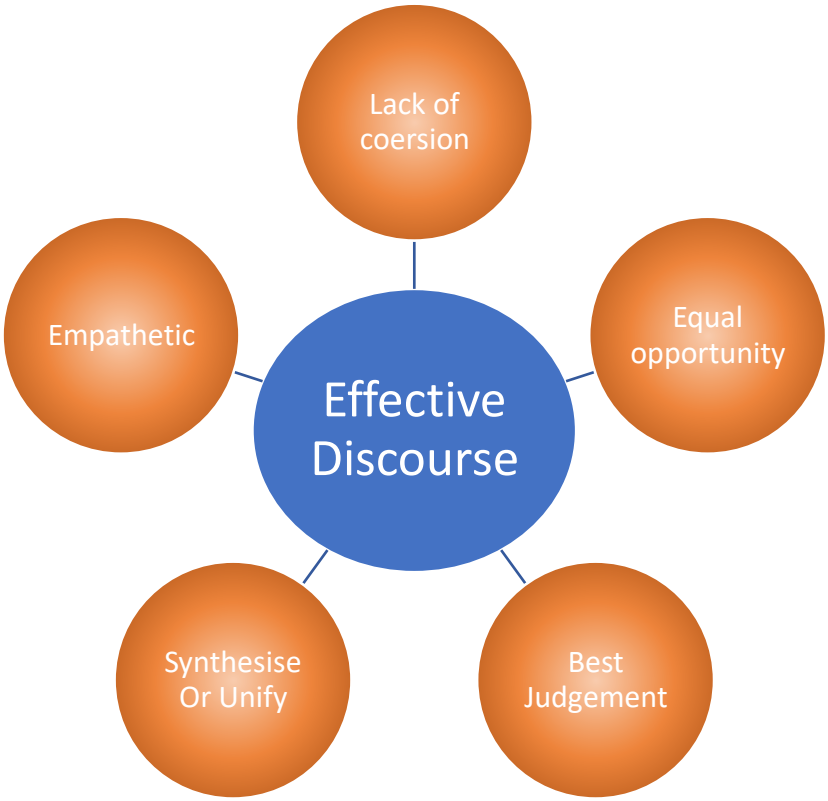


Figure 9.3 Five features for effective discourse as suggested by (Mezirow, 1997)

Empathetic: The learner and teacher should be empathetic to one another respecting each-others views and characters.

Lack of coercion: It is essential not only for effective discourse but also laparoscopic simulation that there is a non-coercive environment and the simulation is both learner centric and learner safe. Paradigms of power and authority restrict learners from sharing their beliefs and views (Langan et al., 2009).

Equal Opportunity: There should be equal opportunity for the learner and teacher to engage in discourse. Whilst varying levels of facilitation during simulation will be needed depending on the learner, both the teacher and learner should have opportunities to be able to share mutual understanding and respect. (Dismukes and Smith, 2017).

Synthesise or Unify: The teacher and learner should synthesise shared common views and beliefs regarding the experience or find a path to unify different views.

Best Judgement: In partnership the learner and teacher agree on a strategy or action plan following this unification or synthesis of views (Mezirow, 1997).

9.3 Criticisms Of Mezirow's Transformative Learning Theory

Mezirow (2000) wanted to rationalise the need for transformative learning at a basic level. He describes this as "*A defining condition of being human is our urgent need to understand and order the meaning of our experience, to integrate it with what we know to avoid the threat of chaos*" (Mezirow, 2000). However this rationalisation has led to criticism that the theory is too rigid excluding variables such as learner emotion and the impact of cultural, social and societal influences on the learner (Cranton, 2017). This chapter discusses these criticisms further. Criticisms that are related specifically to his conceptualization of critical reflection are discussed in Chapter 12.

Mezirow (2003) argues that the transformative learning occurs through reflective reasoning and that reasoning is a rational structured process of justifying or negating existing presuppositions, which does not involve emotion.(Mälkki, 2010, Mezirow, 2003).

Mezirow (2000) also suggests that learners should have a degree of "emotional maturity" to manage events that may be perceived as distressing for the learner during transformative learning - "As challenging one's cherished beliefs (a leap into the unknown) often invokes a threatening emotional experience, the qualities that constitute emotional intelligence are essential conditions of transformative learning." (Mezirow, 2000). He conceptualises emotional maturity as the learner having awareness of emotions and the ability to control them.

However, Mezirow's works do not delve into how this emotion originates in learning, what is the role of these emotions and how should learners and teachers adapt to strong emotions (Mälkki, 2010).

Newman (2010) asserts that Transformative learning has been perceived as being aggrandized in educational theory and may not necessarily represent the most important learning for an individual (Newman, 2010). This likely to be in at least partly attributable to the vast array of literature on transformative learning leading to loosely connected terms and methodologies (Dirkx, 2012).

There is some suggestion that transformative learning theory by Mezirow, whilst having an elaborate theoretical framework, does not have practical application real life and that transformative learning just represents shared characteristics of everyday effective learning (Newman, 2010). In this thesis Mezirow's conceptualization of transformative learning has been adopted in a pragmatic manner and used to structure a framework for an educational tool based on facilitated reflection. It is not intended for critical deliberation by as Dirkx (2012) describes *"serious scholars of transformative learning"* (Dirkx, 2012).

Perspective transformation has been criticised in that it cannot be either reliably detected or measured (Newman, 2010). However Taylor's (1997) critical review on empirical studies conducted in transformative learning did identify that learners did have a sustained paradigmatic shift after the initial disorienting dilemma (Taylor, 1997). A learner asserting that they have undergone transformation cannot reliably infer that higher order thinking or a dramatic change in beliefs has occurred. However, it is arguable that in the context of laparoscopic simulation, if a learner

demonstrates a changed improvement in practice the live operating theatre, then this is definitely evidence for perspective transformation.

The ethical creed of transformative learning has not been explicitly explored in Mezirow's works (Ettling, 2006). Ethical learning is elemental to learning that occurs in a laparoscopic simulation activity. In laparoscopic simulation, surgical teachers have an ethical duty to educate themselves on both subject and educational expertise; learners have an ethical duty to respect views and perspectives of others as well as adhering to the principles and code of conduct of the simulation and peers have an ethical duty to respect the confidentiality of what they have observed and discussed regarding other learners performance.

As a result of these criticisms many view Meizrow's work as incomplete. However, Mezirow himself postulated that his theory and work will always be progressive and evolving (Mezirow, 1997). Taylor (2000) goes on to support this assertion that Mezirow's work has many nuances and complexities that are still being discovered – "*a picture of transformative learning theory that is much more complex and multifaceted than originally understood*".(Taylor, 2000)

Chapter 10 - What Other Models Of Transformative Learning Are There?

Transformative learning has often ubiquitously been assumed to be a singular theory based on Mesirow's works (Taylor, 2008). There is in fact a large diversity in the conceptual models of transformative learning with a wide variation on different perspectives. Taylor (2008) suggests that an inclusion of these different perspectives is likely to impact a greater understanding of transformative learning with a wider application of the theory to practice (Taylor, 2008).

This chapter will summarise the common conceptual models of transformative learning in the literature besides Mezirow as summarised in Table 4. Relevant concepts that have not been covered through Mezirow's works can support designing the learning framework for the facilitated reflection tool and these will be discussed as well.

Year	Author	Transformative Learning Spectrum
1986	Daloz	Developmental
1993	Freire	Emancipatory
1999	O'Sullivan	Planetary
1999	Bradshaw	Community
1997	Dirkx	Spiritual
2001	Tisdell	Spiritual
2003	Williams	Race-Centric
2004	Berger	Knowing Edge
2005 / 2007	Janik	Neurobiological

Table 4: Alternative models of transformative learning to Mezirow's

10.1 Developmental Transformative Learning

Daloz (1986) transformative learning is based on a change in learner consciousness facilitated through a mentor (Daloz, 1986). The learning is progressive and achieved through coaching from a mentor to make sense of experiences (Taylor, 2008). Daloz described the mentorship as dependent on the context and that learners do not separate from mentors following a learning experience, rather their relationships evolve and transform with varying degrees of dependence (Daloz, 1986) (Cranton and Carusetta, 2004a). Through these relationships learner identity cyclically reforms and there is a mutually agreed responsibility for learning (Poutiatine and Conners, 2012).

Daloz theory validates two concepts of facilitated reflection in laparoscopic simulation. Firstly as identified from the literature review as well, the surgical teacher has a pivotal role in enabling learners to achieve higher learning outcomes. Secondly the relationship between the learner and the surgical teacher is complex and evolving and can affect learner outcomes (Lei et al., 2018, Budden et al., 2017). The relationship between the learner and the surgical teacher is discussed further in Chapter 15.

10.2 Emancipatory Transformative Learning

Emancipatory learning developed by Friere (1970) was discussed in Chapter 9 as being one of the most prominent works that influenced Mezirow's theory of transformative learning. This type of

transformation is a societal transformation rather than transformation of the individual as with Mezirow (Freire, 1970).

10.3 Planetary Transformative Learning

O'Sullivan (1999) described the concept of planetary transformative learning, where the focus of learning should originate through profound critical analysis of the content of what is taught and that this content should form an educational programme that leads to sustainable learning vision at all levels of society (O'sullivan, 1999). It is reorganisation of existing ontological, epistemological, institutional and cultural beliefs to develop new learning, that benefits society overall as opposed to focusing on the individual (Taylor, 2008).

If the facilitated reflection tool is piloted and shows enhancement of learner outcomes then principles from the theory of planetary transformative learning could be used as an educational bridge for integrating the tool into a laparoscopic simulation curriculum.

10.4 Community Transformative Learning

Community transformative learning is a conceptual framework that was originally designed for key stake holders in curriculum planning, in order to develop outcomes for higher education (Bradshaw, 1999). It is based on four underlying values - **multiplicity** which describes the interlinking connections between the diversity and complexity that exists in the educational environment; **connectedness** which is the relationship between different disciplines and the interlinking of different discourses in education, **critical intelligence** where knowledge is continuously evolving and being restructured and **transformation** where

learner agency is promoted within and outside an educational context (Bradshaw, 1999).

This framework of transformative learning has also been used to structure simulation. Multiplicity relates to the complex multifaceted environment of simulation; connectedness describes the relationships between learners, their peers and the faculty with exploration of different views; critical intelligence relates to where underlying values are questioned such as what is expected to be achieved from the simulation; and transformation is when learners fully immerse themselves in the simulation experience and feel empowered to translate newly acquired behaviours outside of the simulation into the real world (Smith-Stoner and Hand, 2008).

10.5 Spiritual Transformative Learning

Spiritual transformative learning described by Dirkx (1997) involves a journey where spiritual and soul beliefs in the learner evolve gradually with time through a series of experiences similar to the disorienting dilemma (Dirkx, 2000, Dirkx, 1997).

This does not follow a rational process and involves the learner critically analysing and reconstructing underlying organizational structures of their minds. Furthermore, Dirkx suggests that the disorienting dilemma that leads to such changes, do not need to be a life changing event but can in fact be everyday ordinary occurrences (Cranton, 2017, Dirkx, 2000).

Tisdell (2001) goes onto elaborate spiritual transformative learning by describing a phenomenon called “life-force” transformative learning that reaches to God (Tisdell and Tolliver, 2001). These conceptual frameworks of spiritual transformative learning have in

fact been explored for pedagogal and theological clarity in religion (Tisdell and Tolliver, 2001, Meneely, 2015) .

There has been much criticism regarding bringing the concept of spirituality into transformative learning and especially with the connotations of theological phenomena such as life-forces (Newman, 2010). This is because transformative learning was developed primarily to be employed in an educational arena and bringing theological and religious dimensions may alienate learners who do not share such beliefs (Newman, 2010).

However, one pragmatic concept that can be extrapolated from spiritual transformative learning is that the disorienting dilemma does not need to be an extraordinary rare experience to achieve what is in essence perspective transformation (Dirkx, 2000). Therefore surgical teachers do not need seek out rare or extreme phenomena in laparoscopic simulation to try and invoke a disorienting dilemma for the learner.

10.6 Race – Centric Transformative Learning

Williams (2009) embodied transformative learning in a paradigm he termed “Black Mama Sauce”. It is an idea based on alternative education that focuses on social justice and cross-cultural learning, especially in oppressed populations. This paradigm views that race, in this case African affects transformative learning processes (Taylor, 2008, Williams, 2009).

The effect of culture and background of the learner on the application and outcomes of the facilitated reflection tool is discussed further in Chapter 15.

10.7 Knowing Edge Transformative Learning

Berger (2004) describes the concept of "the knowing edge"(Berger, 2004). The knowing edge describes learners when facing a new situation that is unfamiliar, they may arrive at the edge of their knowledge. Learners may be unable to have the vantage point to see how to cross this metaphorical knowledge edge (Berger, 2004). Learners reaching the knowing edge risk retreating to safety zones such as the simulation itself as described in Chapter 4 (Ker and Bradley, 2013).

A teacher has a unique role of supporting learners during this phase by identifying the edge, supporting them during this time and help scaffold new territories in their knowledge (Berger, 2004). This concept embodies the core values of facilitated reflection in laparoscopic simulation – supporting learners cross the knowing edge.

This model of transformative learning also discusses another important concept. Not only do learners transform as a result of crossing the knowing edge, the relationship between themselves and the teacher may also transform (Berger, 2004).

This concept is important in the laparoscopic simulation, as the relationship between the learner and teacher may evolve as a result of transformative learning. However, how this relationship changes or its effects on the learner is not known .

Gum et al (2011) provides another insight into the knowing edge model of transformative learning - surgical teachers themselves may also experience the knowing edge in clinical simulation. This can result in unexpected dilemmas for the surgical teacher with a fear that they will lose learner credibility (Gum et al., 2011).

10.8 Neurobiological Transformative Learning

Neurobiological transformative learning focuses on the concept that learning is developed from innate curiosity which originates in the brain and learners through curiosity select their own agendas and outcomes (Janik et al., 2005, JANIK, 2007). Innate curiosity leads to learner discomfort and this triggers transformative learning processes (Cheng, 2014). Neurobiological transformative learning suggests that all these actual process of learning occurs through changes in brain anatomy and function rather than through traditional learning models such as constructivism (Janik et al., 2005).

Though the facilitated reflection tool is rooted in philosophies of social constructivism, the concept relating to learner curiosity and autonomy in neurobiological transformative learning must be embraced in laparoscopic simulation. Encouraging learner curiosity cultivates habits of self-directed learning and the centrality of learner autonomy to the facilitated reflection tool is discussed further in Chapter 15 (Edmondson et al., 2012).

Chapter 11 - Understanding Critical Reflection

Reflection is integral to learning in laparoscopic simulation. The differences between the conceptual definitions of reflection and critical reflection vary tremendously in the literature. However, generally critical reflection is viewed as a more holistic, deeper and richer process of metacognition than reflection (Decker et al., 2013).

Critical reflection has translational evidence suggesting improved patient care through extensive evaluation and deliberation of individual actions and decisions (Kim et al., 2018). It has been cited in the literature as "an ethically and professionally good thing to do" in the context of healthcare practice (Kim et al., 2018).

Critical reflection on culture and socioeconomic policy can lead to changes in healthcare at an institutional and societal level through the emancipatory transformative learning which Friere had alluded to (Greenhill et al., 2017, Freire, 1970). It encourages learner self-awareness, through engagement in deep perspective changes and enhancement of both personal and professional development (Smith, 2011).

Critical reflection has been researched in healthcare simulation (Kleinheksel, 2014, Gum et al., 2011, Beyer, 2012, Tutticci et al., 2016). It has been shown to enhance critical thinking (Tutticci et al., 2016), create meaningful learning (Gum et al., 2011), develop self-awareness and communication skills (Kim et al., 2018) and also acts as a learning outcome metric in healthcare curriculums (Tutticci et al., 2016).

Facilitation of critical reflection has been postulated to be achievable in surgical simulation (Sullivan et al., 2017, Mitchell et al., 2012) . Surgical curriculums recommend implementation of critical reflection, into learning, to encourage learner responsibility to engage in practices of self-directed learning (Chauvin, 2015).

However, there is widespread variation in the literature in the conceptual model and application of critical reflection in simulation with a mixture of common ground as well as subtle but critical variations in the definition. Furthermore there appears to be a disparity in the literature between the academic theory of critical reflection and its practical application by learners.

Given that Mezirow's learning framework of transformative learning has been used to develop the facilitated reflection tool, Mezirow's conceptualization of critical reflection should be the logical choice as the model of reflection. Assimilating a mixture of educational theories and concepts without due theoretical process could lead to uncharted territory and bring the educational credibility of the research into question (Tooley and Darby, 1998).

However, some empirical studies exploring Mezirow's transformative learning ,including in a healthcare setting, have acknowledged several different conceptualizations of critical reflection have been employed besides Mezirow's, such as the ones shown in Table 5. This has led to criticism on the validity and quality of these studies. (Lundgren and Poell, 2016, Taylor, 2007).

Author	Definition
(Mezirow, 1991)	*"challenging the validity of presuppositions in prior learning"*
(Reynolds, 1998)	*"critical reflection is the cornerstone of emancipatory education (whereas) reflection is a management concepts primarily as a key element of problem solving"*
(Brookfield, 2000)	*"An act of learning can be called transformative only if it involves a fundamental questioning and reordering of how one thinks or acts"*
(Fook, 2002)	*Involves "power analysis" of "hegemonic assumptions"* *"subjecting our practice to a more critical gaze, at the same time allowing us to integrate our theory and practice in creative and complex ways."*
(Howard, 2003)	*"reflection within moral, political, and ethical contexts of teaching"*

(King, 2004)	*"Theorizing about it (past experience) in the sense of considering problematic questions associated with power, history and agency"*
(Ziegahn, 2005)	*"To sensitize students to move beyond typical habits of mind to incorporate multiple frames of reference, develop greater empathy, and take new, more inclusive perspectives to the level of action"*
(Gray, 2007)	*"a route to collective action and a component of organizational learning and change"*
(Shih-Hsien, 2009)	*"How teachers learn to challenge their own teaching beliefs in a critical self-analysis and become responsible for their actions".*
(Tutticci et al., 2016)	*"a meta-cognitive skill, or the awareness of one's own cognitive functioning and is a key mechanism in the process of critical thinking"*

(Sullivan et al., 2017)	*Describes three types of reflectors:* *Non reflectors do not critically appraise their thinking and reflectors show some appraisal of metacognitive activities working towards a deeper understanding.* *Critical reflection "…learners actively work to adopt a new perspective or way of doing something based on the results of their reflection and their current state of knowledge or practice."*

Table 5 Common conceptualisations of critical reflection

Chapter 12 - Mezirow's Theory Of Critical Reflection

This chapter aims to discuss the theoretical stance and justification for choosing Mezirow's model of critical reflection for the facilitated reflection tool.

It order to understand the conceptual definition of critical reflection as defined by Mezirow it is necessary to delve deeper into the theoretical nuances between the different types of reflection.

12.1 Mezirow's Types Of Reflection

Mezirow defined three types of reflection in a hierarchical model: content reflection, process reflection and premise reflection. Using examples from laparoscopic simulation, these tree types of reflection are explained further.(Mezirow, 1998)

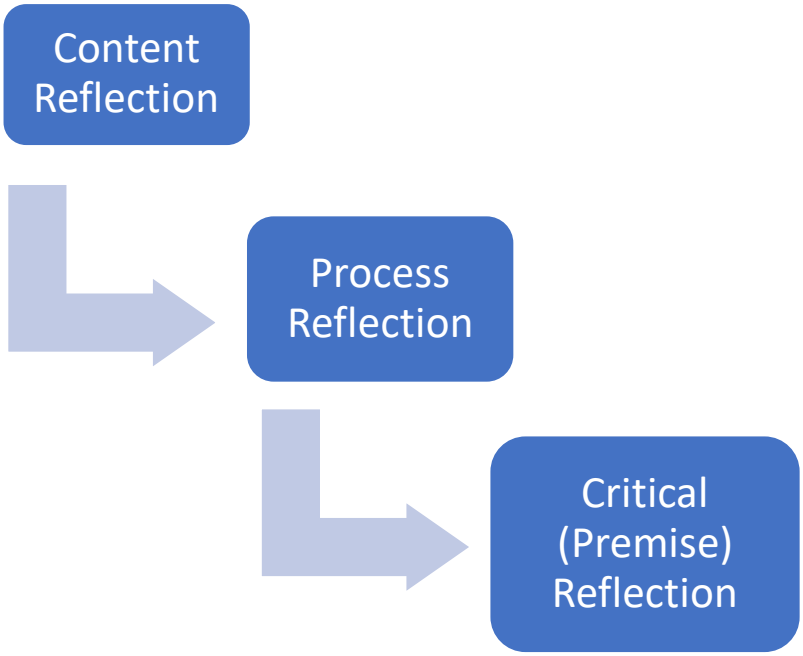


Figure 12.1 Mezirow's hierarchical model of reflection (Mezirow, 1998)

Content reflection involves intentionally examining the experience and identifying an immediate solution. A learner finds during laparoscopic simulation that they are not able to able to clearly visualise an object. They ask a surgical teacher who suggests increasing the zoom on the camera to gain better visualisation.

Process reflection examines why this experience occurred and what other factors may be implicated leading to the experience. The learner had never been told to use the zoom function on the camera even though he or she knows it is there. Furthermore the learner realises that the surgeon supervising them in the operating theatre had always done this and they had never consciously noticed this till now.

Premise reflection is a deeper and more complex reflection exploring the larger perspective and scrutinizing existing presuppositions in the current context. It is premise reflection that Mezirow renamed as critical reflection and is one of the key phases of transformative learning that can result in a global re-evaluation of practice (Kitchenham, 2008, Calleja, 2014). The learner realises that experienced surgeons demonstrate automaticity with procedural skill and that many processes of automaticity may not be consciously noticed. They realise in future they should actively inquire and observe these processes to advance their own expertise. By doing this the learner reformulates their internal values with an overall change not just in demonstrable skill but underlying attitudes as well.

12.2 Critical Reflection And Presuppositions

A key step in critical reflection is reviewing what caused these presuppositions. Kitchenam (2008) explored Mezirow view of critical reflection and defined the causes of these presuppositions in four paradigms as illustrated in Figure 12.2. Each paradigm is illustrated with an example from laparoscopic simulation. (Mezirow, 1998, Kitchenham, 2008)

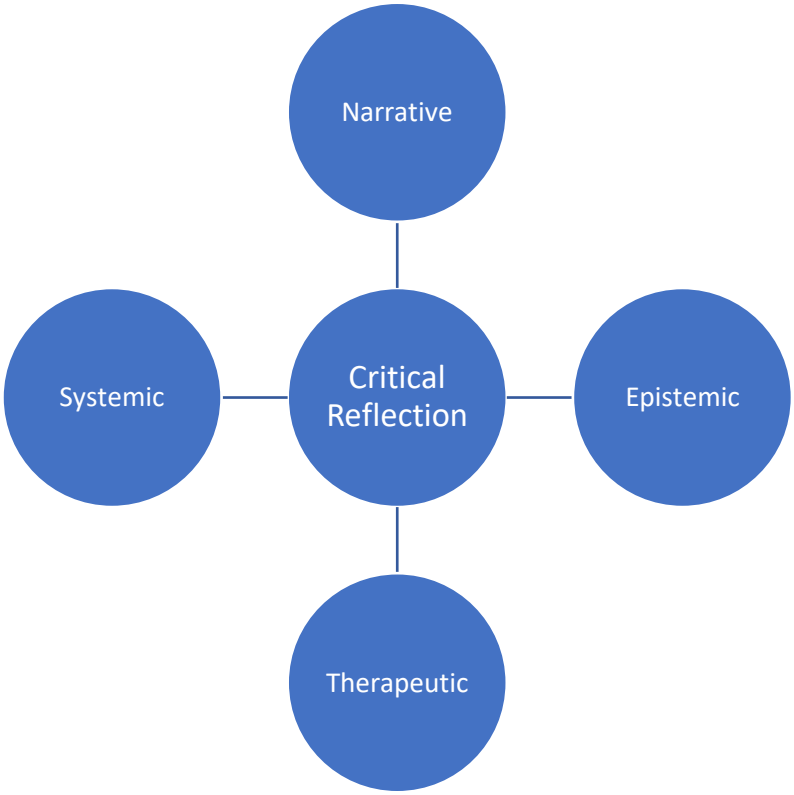


Figure 12.2 Four paradigms of critical reflection adapted from Kitchenam (2008).

Narrative - The learner considers and analyses a narrative episode and applies it in their own context to determine a solution: A learner listens to a colleague's view that laparoscopic simulation has limited potential for transferability of skills into the operating theatre. The learner analyses this through their own existing presuppositions about simulation and identifies previous objective benefits such as reduced task time in the operating theatre with greater flow. They come to a conclusion that in their own view, time spent in laparoscopic simulation shortens the learning curve for developing procedural skill in the operating theatre.

Epistemic - The learner tries to identify why they are predisposed to learn in a specific way and what are the limitations of this

learning: The learner perceives their own performance to be inferior compared to peer performance, they therefore may be less willing to engage with the simulation tasks with low self-efficacy and a view that their learning curve is much greater than their peers.

Systemic - The learner examines their presuppositions in the context of institutional and cultural barriers: The learner feels that they should spend more time in the operating theatre and less time attending laparoscopic simulation. The learner acknowledges that they may have other roles outside of being a learner such as being an on call doctor and this limitation of time means they prioritise learning that they view as most valuable for them and this may not necessarily be simulation.

Therapeutic - The learner tries explores the impact of affect on presuppositions and learning: The learner believes that they are likely to never be competent in laparoscopic surgery following repeated failure in achieving a specific task. The learner analyses why they feel this way and identified that the repeated failure has caused low self-efficacy with a negative affect and this is likely to perpetuate their feeling that they are unlikely to ever be competent or proficient in laparoscopic surgery.

12.3 Critical Reflection And Transformative Learning

Mezirow (2003) describes the relationship between critical reflection and transformative learning as: "*Critical reflection requires understanding the nature of reasons and their methods, logic, and justification. Transformative learning is metacognitive reasoning involving these same understandings but, in addition,*

emphasizes insight into the source, structure, and history of a frame of reference, as well as judging its relevance, appropriateness, and consequences."(Mezirow, 2003).

Furthermore, transformative learning is rooted in the centrality of experience resulting in critical reflection and its subsequent discourse (Taylor, 2002).

Critical reflection does not always lead to transformative learning but when it does, it analyses, critiques, validates or justifies a frame of reference leading to perspective transformation. Cranton & Carusetta (2004) go on to suggest that perspective transformation can only be achieved through critical reflection (Cranton and Carusetta, 2004a).

12.4 Criticisms Of Mezirow's Critical Reflection

There are several criticisms of Mezirow's critical reflection, both in relation to the conceptual theory but also in its application in simulation. This chapter discusses relevant criticisms and significance in a laparoscopic simulation context.

Critical reflection as described by Mezirow is based on the premise that learners want to change (Mezirow, 2003). However this inherent motivation cannot be automatically assumed for all learners and without it, critical reflection cannot ignite (Taylor and Cranton, 2013). However, learner motivation in surgery is not just essential for critical reflection, it is necessary for mastery of procedural skills and expertise development as a surgeon (Sachdeva, 2005).

Mezirow's critical reflection focuses on processes on experience that can be confusing i.e. the disorienting dilemma (Mezirow, 1990). Confusing experiences can perpetuate a negative self-regulatory function (Smith, 2011). Though experiences that demonstrate positive behaviours can be critically reflected on and may achieve transformative learning through iterative simulation exposure, this is less likely to lead to perspective transformation (Parker and Myrick, 2010). The facilitated reflection tool must incorporate strategies that counteract negative self-regulatory behaviour.

Although Mezirow alludes to principles of empathy in critical reflection. as well as transformative learning, such as when describing emotional maturity , it is never explicitly forms a prerequisite, phase or process in his works (Mezirow, 2000, Taylor and Cranton, 2013). Empathy is the cognitive ability to understand an alternate perspective view or belief as well as the ability to communicate this (Weng et al., 2011). Empathy in medicine has been repeatedly cited in the literature as "arguably the most important psychosocial characteristic of a physician engaged in patient care" (Colliver et al., 2010). It has been acknowledged as an integral component in other models of critical reflection (Ziegahn, 2005).

Empathy is necessary for being able to have an open mind to critique presuppositions and to take on board alternate perspectives during reflective discourse (Mezirow, 2003, Taylor and Cranton, 2013). The explicit explanation for the rational and need for empathy in simulation should occur before the actual laparoscopic simulation such as during the pre-brief stage.

Critical reflection can be perceived as a tick box exercise in the same manner as reflection as discussed in Chapter 5 (Macaulay and Winyard, 2012). However it is envisaged that the use of video technology recording a single learners behaviour, in combination with individualised reflective feedback through the facilitated reflection tool, will dampen the effects of these perceptions and instead inspire learners to engage in critical reflection (Ahlborg et al., 2015).

Critical reflection is context specific and it cannot be assumed that processes that enhance critical reflection will be automatically transferred into the live operating theatre (Mezirow, 1998). However the primary goal of laparoscopic simulation is not to achieve transference of ability to critically reflect into the operating theatre but instead of procedural skill development. Nevertheless an enhanced ability to critically reflect is likely to nurture development of procedural skills as identified from the literature review.

The actual process of developing critical reflection can become decontextualized from its purpose where the focus is on the technique rather than the goal (Smith, 2011). This is especially relevant when the focus of the simulation is for the learner to develop laparoscopic surgical skills and investment of time in critical reflection may be perceived in itself as a distraction or isolate learners from the actual simulation (Smith, 2011). However, the facilitated reflection tool will be designed that it focuses on reflection on action and hence should not divert the learners attention from the procedural tasks in laparoscopic simulation.

Objective 3

To Construct The Conceptual Framework For The Facilitated Reflection Tool Using Video Technology In A Laparoscopic Simulation Context

Chapter 13 - Introduction To Objective 3

Having explored the theoretical orientation for the facilitated reflection tool, this section of the thesis will now focus on the conceptual framework for the facilitated reflection tool.

A conceptual framework as defined by Miles et al(1994) *"explains, either graphically or in narrative form, the main things to be studied—the key factors, concepts, or variables—and the presumed relationships among them*."(Miles et al., 1994)

Guattari et al (1994) goes on to suggest conceptual frameworks should have the following features: "(be) *relative to its own components, to other concepts, to the plane on which it is defined, and to the problem it is supposed to resolve"* (Guattari, 1994).

The following chapters in Objective 3 of this thesis will isolate key variables relevant to the research aim identified from the theoretical orientation and elaborate on these further to construct the conceptual framework of the facilitated reflection tool. The conceptual framework will subsequently inform the instructional design of the facilitated reflection tool.

The conceptual framework has been synthesized from presumed tentative relationships inferred from the literature. The final conceptual framework is shown in Figure 13.1 and this framework, including the synthesis of conceptual relationships within the framework, is discussed in this section of the thesis.

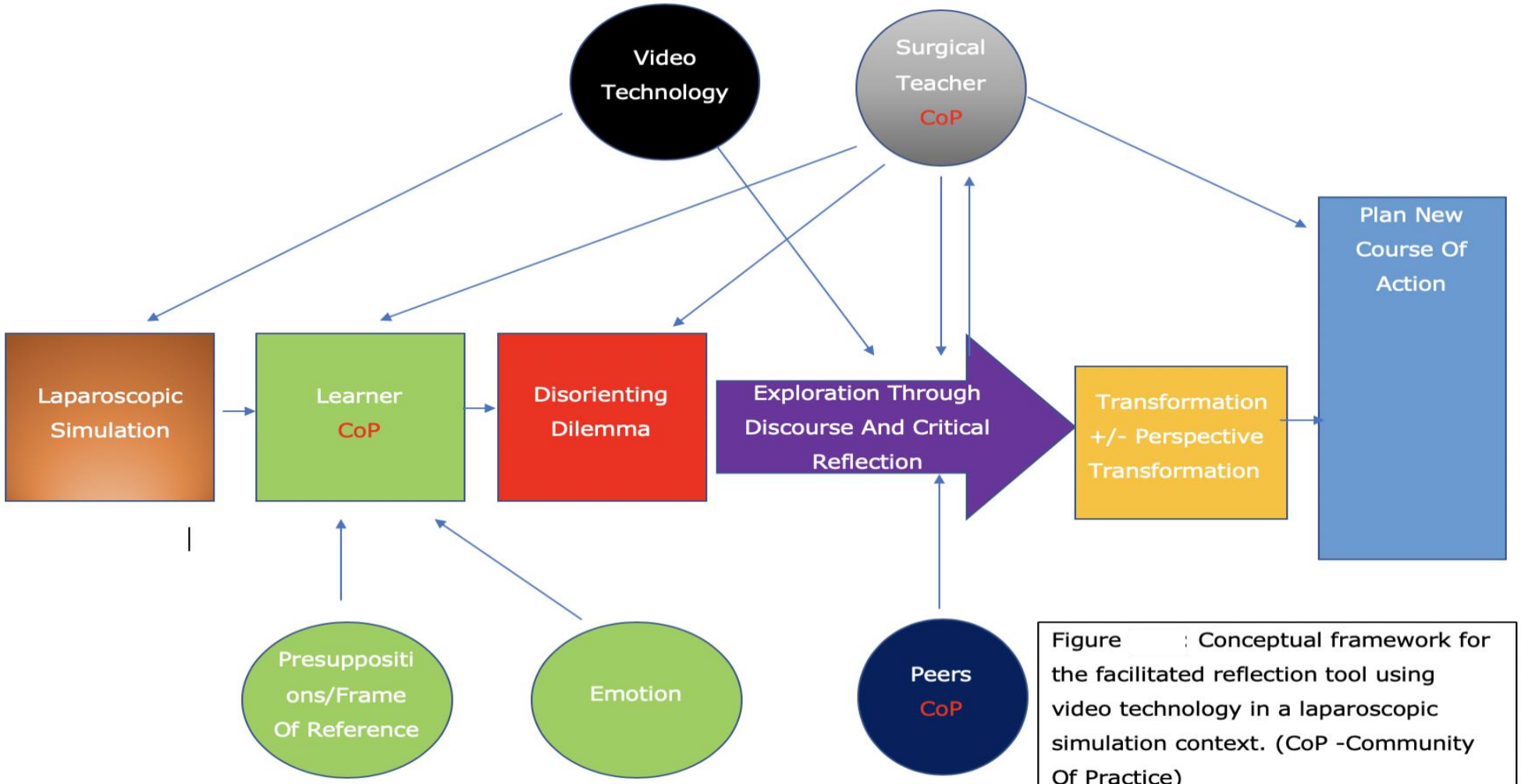


Figure : Conceptual framework for the facilitated reflection tool using video technology in a laparoscopic simulation context. (CoP -Community Of Practice)

Figure 13.1 Conceptual framework for the facilitated reflection tool using video technology in a laparoscopic simulation of context. (CoP – Community of Practice)

Chapter 14 – The Disorienting Dilemma And Discourse Within A Community Of Practice

This chapter explores the disorienting dilemma – the igniting step for the facilitated reflection tool that stimulates critical reflection and transformative learning as well as an exploration of the key conceptual understandings of reflective discourse within a community of practice, which forms the foundational premises underpinning the facilitated reflection tool.

14.1 The Disorienting Dilemma And The Facilitated Reflection Tool

The disorienting dilemma is the trigger and catalyst for the transformative learning pathway and critical reflection. Specific experiences from the simulation, acting as the mechanism for triggering the disorienting dilemma and exposing a range of emotions has been extensively conceptualised in the simulation literature (Smith et al., 2012, Gum et al., 2011, BROWN, 2008, Kear, 2013). The disorienting dilemma is critical to learning from simulation, as if there is no disorienting dilemma then a need to learn may not be recognised (Gum et al., 2011).

In contrast to other populations such as undergraduate students, laparoscopic simulation involves adults with well-established presuppositions and a change in these presuppositions is likely to lead to perspective transformation(Parker and Myrick, 2010).

This concept is reiterated in the literature, supporting that simulation can lead to perspective transformation through

debriefing integrated with facilitated reflection, with the simulation itself acting as a disorienting dilemma (Fanning and Gaba, 2007).

In order for the facilitated reflection tool to be a fertile environment for transformative learning, this necessitates acknowledging that learners may be faced with uncertainty with their existing knowledge when faced with a disorienting dilemma (Gum et al., 2011). The facilitator needs to recognise and support this uncertainty and help the learner construct new territory with respect to their knowledge or perspectives.

The disorienting dilemma can also be explored or ignored by the learner (Berger, 2004). It is likely to be missed if the learner is in a state of significant confusion over what they have observed. This may precipitate negative emotions resulting in learner disengagement and withdrawal from the scenario (Hamilton and Morris, 2012).

However if the disorienting dilemma is missed by the learner, the surgical teacher should be able to support identification of it through the facilitated reflection tool. The surgical teacher needs to help scaffold this confusion and enable the learner to gain a vantage point to explicitly identify what is the disorienting dilemma. This should be done with positive reinforcement, addressing any learner performance anxiety, whilst ensuring any valuable learning opportunities are not missed (Sandars, 2009, Hamilton and Morris, 2012).

14.2 Types Of Discourse In A Community Of Practice

The foundation for the facilitated reflection tool is based on the premise of reflective discourse occurring within a community of

practice. This section elaborates on the different types of learner/teacher reflective discourse within a laparoscopic simulation community of practice. First the different types of discourses are described and subsequently the meaning and application of community of practice with regards to laparoscopic simulation is elaborated on.

Exploring underlying presuppositions with the backing of surgical teacher is integral to transformative learning in simulation(Rashid, 2017, Clapper, 2010). By doing this learners are goal driven, willing to take responsibility for their learning and "elevate to a new point of contextual self-appreciation" (Rashid, 2017). New knowledge, new beliefs and ultimately establishment of new presuppositions are established through reflective discourse (Cranton, 2017).

As discussed in chapter 8, reflective discourse has been shown to facilitate the transition through threshold concepts in surgical simulation (Mitchell et al., 2012). For example, a learner believes laparoscopic simulation lacks fidelity and therefore they are not able to conceptualise in their mind how any learning developed in this simulation can be translated into the live operating theatre. The facilitated reflection tool should create an opportunity for the surgical teacher to explore underlying presuppositions and offering an alternate point of view of what can be achieved through laparoscopic simulation. This could lead to a major revision of the learners frame of reference and ultimately result in perspective transformation (Mitchell et al., 2012, Mezirow, 1978).

There are three different types of reflective discourse depending on who is involved and they are described here.

14.2.1 Individual, Peer and Group Discourse

This discourse in laparoscopic simulation can be between the learner and their peers (**peer reflective discourse**), the learner and the surgical teacher (**individual reflective discourse**) or a combination of both (**group reflective discourse**) (Mezirow, 2003). However, the aim of reflective discourse should always be to achieve a mindset that analyses, changes, reinforces or validates presuppositions through critical reflection so that a new action can be justified and validated (Piercy, 2013).

A group reflective discourse has been advocated as the optimum environment that fosters transformative learning and critical reflection. Furthermore, a social group setting stimulates critical reflection leading to transformation (Taylor, 2000).

This concept is reinforced in simulation where group reflective discourse has been shown to enhance transformative learning processes by greatly expanding the opportunity for reflective discourse. However for this to happen, this requires learner to be equally willing to take responsibility to cultivate such a community.(Parker and Myrick, 2010)

Group rather than individual reflective discourse during the debrief phase of simulation has been shown to promote vicarious learning (O'Regan et al., 2016). There is greater shared empathy between learners and less fear of reprisal during simulation with an environment fostering peer collaboration (Secomb, 2008).

14.2.2 Individual Reflective Discourse

However, there are limitations and challenges with group learning. Firstly and perhaps most notably as identified from the studies in the literature review the need for individualised feedback in surgical simulation including laparoscopic simulation (Ahlborg et al., 2015).

Thomas (2013) literature review on developing technical competence discusses the necessity of individualised feedback in surgical procedural skill development - Surgical simulation must be "tailored to individual learning needs in individual specialities" (Thomas, 2013). This is because the route and time to achieve competency or proficiency in surgical simulation will vary greatly between learners (Thomas, 2013). Similarly Ahlborg (2015) highlighted the importance and value of individualised feedback in laparoscopic simulation with shortening of the learning curve and learners having greater self-efficacy and flow (Ahlborg et al., 2015).

Group reflective discourse can be challenging with dissonance of potential inter-learner conflict especially for a novice teacher (Taylor, 2000). Similarly large variations in group dynamics are likely be challenging for a surgical teacher to engage in facilitated reflection (Taylor, 2000, Gum et al., 2011). Furthermore, models of debriefing are likely to be suited according to different learning styles, however establishing a group with very similar learning styles is unlikely to be feasible in laparoscopic simulation (Gum et al., 2011, Fanning and Gaba, 2007).

14.2.3 Peer Reflective Discourse

There have been few empirical studies exploring peer reflective discourse in surgical simulation.

Peer reflective discourse through peer assessment or feedback is gaining increasing popularity in medical education (Hekelman et al., 1996, Byock et al., 2006). The evidence for peer feedback in laparoscopic simulation shows mixed findings. Peer feedback in laparoscopic simulation has been shown to reduce the demand for resources such as faculty, time, cost with more effective feedback and in some cases better learning outcomes in terms of procedural skill development (Vaughn et al., 2016, Lehmann et al., 2018, Van Bruwaene et al., 2009).

However other empirical studies conducted in laparoscopic simulation found the need for either or both subject and educational expertise to be present - a surgical teacher. The need for surgical teachers includes to provide tuition on the actual procedural skill (Dehabadi et al., 2014), skills in delivering effective individualised feedback (Ahlborg et al., 2015) and the ability to formulate an objective, valid and reliable assessment of learner performance (Choy et al., 2013).

One suggestion to meet the balance has been to use a faculty consisting of near-peers in surgical simulation (Chauvin, 2015). Near peer teaching is teaching that is delivered by students or trainee doctors who have subject expertise just beyond the learners capability, usually less than two years ahead in experience than the learner (Musbahi et al., 2019). Findings from near peer research in surgical simulation suggest increased learner self-

efficacy and enhanced competence in surgical simulation (Preece et al., 2015). It is thought near - peer reflective discourse in surgical simulation, helps the transition for learners across their independent capability and what they can achieve through guidance (Chauvin, 2015).

However, near peer faculty and peer feedback have been criticised for oversimplification of explanations, lacking vital subject and educational expertise and not delivering current best practice or evidence based theory to learners (Kalsi, 2018). Furthermore the critical review did not identify any evidence for near peer faculty or peer feedback for developing reflection in surgical simulation. The essential mandate for a surgical teacher who can deliver both subject and educational expertise for this tool has been discussed extensively and the facilitated reflection tool is built on this concept.

14.2.4 Group And Individual Reflective Discourse

Given the strong arguments for both individual and group reflective discourse the facilitated reflection tool will need to be effective at integrating both at different stages of the tool. However the group should be a small size, with a suggestion of no more than eight participants. This number of participants was extrapolated from research findings exploring the value of individualised feedback in laparoscopic simulation (Ahlborg et al., 2015).

Though this is likely to have implications with regards to time, costs and resources, the overwhelming learning profit of combining both opportunities has been demonstrated in the literature. Furthermore, The benefits of the facilitated reflection tool are also

likely to be diluted with large groups. It is conceivable that if small groups gain proficiency of laparoscopic procedural skills much more rapidly than they would in a large group setting, this may be a long term justifiable premise for stakeholders to invest in individualised or small group learning (Endacott et al., 2019).

Despite the facilitated reflection tool being targeted for the small group setting, it is envisaged that all learners who participate in the simulation will have an opportunity to network and discuss the experience. The value of large group learning has been validated previously in simulation literature with peer support, collaborative analysis of meaning schemes and the opportunity to reframe references with exposure to a wide variety of learners views (Parker and Myrick, 2010).

The opportunity to do this could be formally during the simulation closure or informally at the end of all programmed activities. However, confidentiality of the simulation experience, which is essential to foster an a safe learning environment built on a foundation trust, must not be compromised (Clapper, 2010).

14.3 Communities Of Practice - Creating A Learning Environment For Both Individual And Group Reflective Discourse

Communities of practice described by Lave and Wenger (1991) is ""*groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly.*" They argue that experiential learning occurs through social contexts rather than through a process of internalization (Lave and Wenger, 1991).

This concept has been translated across into surgical education including laparoscopic simulation (Costa et al., 2018). Benefits cited in the literature include shortening the learning curve through sharing of practices, development of new surgical skills and a greater propensity for transformative learning processes as learners become more active. Learners are much more likely to be enthusiastic about surgical education when they are part of a cohesive community of practice (Gandamihardja, 2014, Kumar et al., 2014, Debra and Annette, 2014).

A cohesive community of practice must have three principles as defined by Lave and Wenger (1991). – joint enterprise, mutual engagement and a shared repertoire (Lave and Wenger, 1991).

Joint enterprise is what binds the group together. An effective joint enterprise in laparoscopic simulation brings learners at similar stages of training, experiences of laparoscopic surgery and educational cultures with a desire to achieve a common goal. In laparoscopic simulation this would likely be procedural skill mastery. (Lave and Wenger, 1991, Debra and Annette, 2014, Costa et al., 2018).

Mutual engagement refers to the dialogue and interactions between the group as well as the surgical teacher. In laparoscopic simulation this primarily occurs through reflective discourse which would be encapsulated in the facilitated reflection tool (Lave and Wenger, 1991, Debra and Annette, 2014).

A shared repertoire is the synthesis of new knowledge and expertise developed by the community. Laparoscopic learners

develop a bank of newly acquired knowledge and skills as part of being the community of practice (Thoma et al., 2018, Lave and Wenger, 1991).

A robust and cohesive community of practice in laparoscopic simulation should have learners from similar stages of training, experience and educational backgrounds with similar learning needs (Kitto et al., 2018, Debra and Annette, 2014, Lave and Wenger, 1991)

For example participants attending a virtual reality simulation for laparoscopic radical hysterectomy are likely to be of experienced surgeons at consultant level or equivalent with a career in gynae-oncology. A novice learner in the first few years of their training may feel uncomfortable and vulnerable in such an environment. Similarly basic laparoscopic simulation, where the aim is to stack sugar cubes on top of each other using a laparoscopic box set, would be targeted at novice learners in their first year of speciality training. An experienced surgeon attending this would feel frustrated and out of place. Both groups of learners are likely to have different philosophies, vocabularies and behaviours (Debra and Annette, 2014).

Learner autonomy and empowerment is protected in communities of practice and paradigms of authority and power are challenged. In a community of surgical simulation Sadideen & Kneebone (2012) suggest *"(The) mastery does not reside in the master, but in the community of practice's organization, of which the master is a part."* Furthermore, a surgical community of practice acknowledges that everybody in the community is learning

including the surgical teacher (Sadideen et al., 2012, Debra and Annette, 2014).

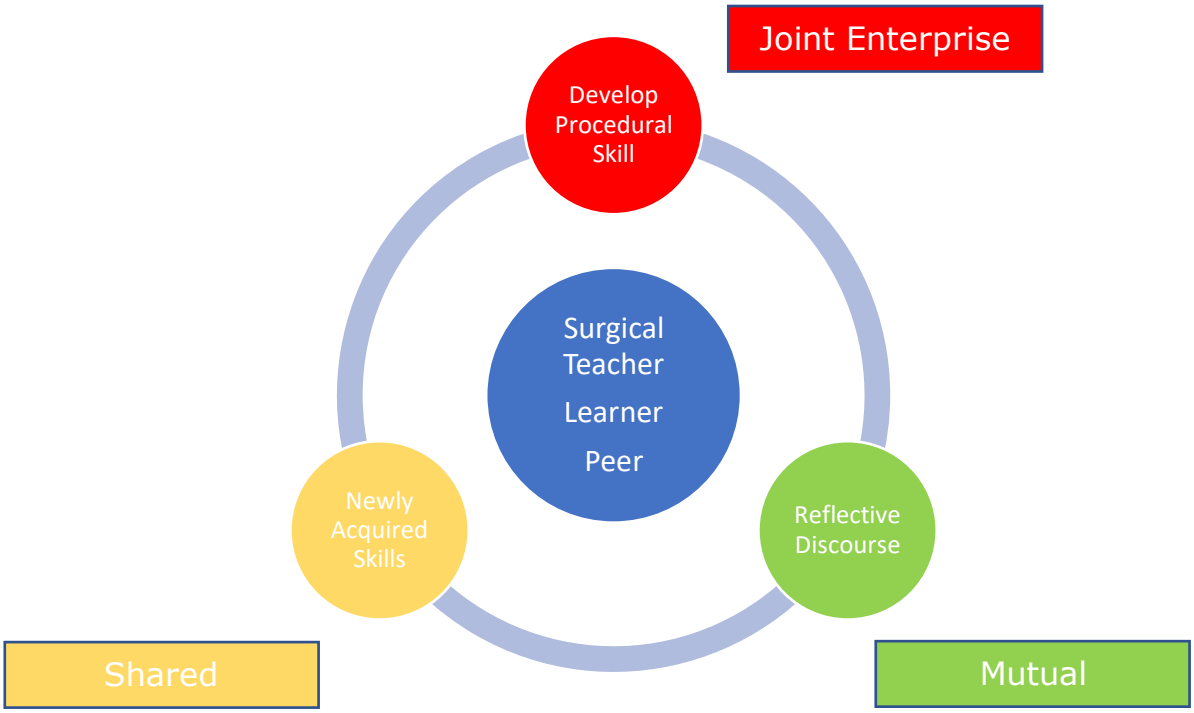


Figure 14.1 Community of practice in laparoscopic simulation

One concern of learners being a member to only one community of practice in laparoscopic simulation is competitiveness. Learner competitiveness is well known in medical education and especially in surgical specialities and this can lead to conflict and tension (Gandamihardja, 2014). The facilitated reflection tool has a role in the guardianship of a safe learning environment as described in Chapter 5. The surgical teacher should challenge competitiveness and encourage camaraderie and peer support.

Though there are significant differences between novice and expert learning, the conceptual framework of the facilitated reflection is based on the theoretical underpinnings of critical reflection and transformative learning which can be applied with both types of learners. With different learner populations forming different communities of practice there are likely to be different joint enterprises, mutual engagements shared repertoires. However, the overall conceptual framework and premise of facilitated reflection tool should enable it to be used in all communities of practice in laparoscopic simulation.

Chapter 15 - The Surgical Teacher And The Learner

This chapter explores the roles and attributes of the surgical teacher and learner and the effect of their relationship with regards to implementing the conceptual framework for the facilitated reflection tool.

15.1 The Surgical Teacher

The quality of the facilitated reflection is dependent on the skills of the surgical teacher. Palagas et al (2016) describe three key skills needed by the teacher for facilitated reflection: The teacher must understand the principles and educational value of reflection, understand principles of experiential learning and be motivated to promote reflection proactively (Palaganas et al., 2016).

Reed and Koliba's (1995) manual for facilitated reflection aimed at educators in undergraduate studies reiterates a critical concept of facilitated reflection that facilitation is a different phenomenon from leading and tries to move away from the paradigms of power and authoritarianism commonly associated with leading. A surgical teacher should act as a catalyst for dialogue exchange between the learner and the surgical teacher without diminishing the value of the learners opinions or agenda. (Reed and Koliba, 1995)

The surgical teacher should provide support but appropriately withdraw to promote independence. This allows not only the opportunity for the learner to participate in triple loop learning but it results in new deeper levels of critical reflection with the learner now trying to identify frameworks themselves for developing self-efficacy (Bradley and Postlethwaite, 2003, Sandars, 2009).

15.2 Learner

For learners to truly engage in transformative learning with a surgical teacher, they must be willing to practice mindfulness. Mindfulness in this context is when a learner explicitly reflects that laparoscopic simulation can change their existing knowledge, values and beliefs through transformative learning. The learner needs to understand the value and importance of laparoscopic simulation to become an agent of transformative learning (Glowacki-Dudka et al., 2012).

Self-efficacy can have both a positive and negative self-regulatory function on critically reflection in laparoscopic simulation (Ahlborg et al., 2015). Tuttuci et al (2016) pilot study showed an increased sense of learner self-efficacy correlated with the ability to critically reflect in nursing simulation (Tutticci et al., 2016). Variations in learner self-efficacy will impact the ability of individual learners to critically reflect. The facilitated reflection tool should try to encourage learner self-efficacy through clear strategies and action plans.

Critical reflection focuses on introspection with analysis and evaluation of the learners actions; however this can lead to the learner becoming disengaged or isolated from other important learning experiences during the simulation. Baker (1990) described this as rhetorical sensitivity where a learners over sensitivity to self-evaluation of practices results in a failure to achieve a difference in the live context (Baker, 1990). The facilitated reflection tool should encourage learner introspection but at the same time avoid a cycle of negative self-regulation by bring learners back to the live context.

Learners receptivity towards the facilitated reflection tool is likely to vary according to their motivation for attending laparoscopic simulation. Whether the laparoscopic simulation is necessary for medical revalidation, curriculum progression or as part of self-directed learning are all likely to influence learners attitudes towards opportunities for learning and reflection (Fanning and Gaba, 2007). It is important for surgical teachers to be aware of the learners agenda to help understand learners responses when the facilitated reflection tool is utilised.

15.2.1 Learner Emotion

As one of the themes identified from the literature review that has an essential role in reflection, an understanding of learner emotion and its effects are essential for effective learning in laparoscopic simulation. However, as discussed in Chapter 9 Mezirow work is often criticised for understating the impact of the emotional dimension in adult learning.

This is compounded with a general lack of acknowledgement in the literature regarding the importance of learner emotion in surgical simulation and its effect on learning and memory. This chapter explores the role of emotion and transformative learning in laparoscopic simulation.

The affective component of learners in laparoscopic simulation learning environment has been shown to be powerful and critical for development of procedural skills in laparoscopic simulation (Costa et al., 2018, Ahlborg et al., 2015). Furthermore, as has been emphasized in the literature review, a learning environment which actively focuses on learner emotions reduces the learners

perception of reflection being decontextualized from simulation, promotes learner introspection and sustains life-long learning.(Schön, 1987, Reed and Koliba, 1995, Clapper, 2010)

Learner emotion has the power to stimulate, regress, prime, anticipate and structure learning (Lundgren and Poell, 2016, Dreifuerst, 2009). Surgical teachers must understand the significance and role of the emotional dimension and how this can greatly alter learning potential both positively and negatively (Piercy, 2013). Active participation in simulation in conjunction with intense emotions are more likely to lead to sustained rapid learning (Fanning and Gaba, 2007, Clapper, 2010). Attending to the learners emotions needs is critical when evaluating an intervention such as facilitated reflection Furthermore, the surgical teacher should be try to match the emotional experience of the simulation with meaning (Clapper, 2010).

There is some suggestion that highly intense emotions in simulation can enhance the effect of the disorienting dilemma and give the faculty an impression "an enduring lesson has been learned" (Smith et al., 2012). However, it has to be remembered that the brain is very susceptible to emotion and a persistent negative affect can limit both memory and higher levels of learning (Dolan, 2002).

It has been suggested that transformative learning in simulation requires the collaboration and cooperation of cognition with emotion through a theoretical connectivity between limbic and cortical systems (Janik et al., 2005, Clapper, 2010). Both positive and negative emotions are likely to be drawn out during laparoscopic simulation and an effective debrief is crucial in

translating the emotion and experience into effective learning outcomes (Fannon, 2004).

For example in laparoscopic simulation a learner appears very reluctant to discuss why they were unable to complete a specific laparoscopic task. The surgical teacher explores this with the learner and the learner reveals that they were previously openly criticised on their performance in a previous simulation in front of peers. This experience has resulted in negative emotions and values associated with the simulation and hence the reluctance of the learner to engage with the reflective discourse. The surgical teacher empathises with the impact of this negative reaction and tries to reassure the learner through strategies to succeed in this task with positive reinforcement as well as declaring openly a commitment to leaner psychological safety as discussed in Chapter 5.

The surgical teacher demonstrates two crucial roles in the above scenario – restoring homeostasis to the learners negative reactions from potentially intense emotions as well as establishing new strategies to manage the specific difficulty.

15.3 A Reciprocally Rewarding Relationship

Transformative learning is more likely to occur in the context of a reciprocally rewarding relationship between the surgical teacher and learner during simulation.

Transformative learning literature suggests that a safe learning environment occurs primarily through relationships - the relationships between the learner and the teacher but also between

learners and their peers (Mezirow, 2003). Learners are more likely to have greater flow, freedom to analyse their thoughts and have a greater sense of self efficacy if they feel they are in a safe environment based on these relationships (Piercy, 2013).

Learners must be willing to share their existing presuppositions as well as construct new ones for transformative learning in simulation (Mezirow, 2003, Gum et al., 2011). Not all learners may have such an open mind or be willing to engage in new perspectives. This is more likely to occur when there are excessively formal relationships between the surgical teacher and learner with perceived barriers of power and authority (Langan et al., 2009). As a result of this harnessing the potential of the facilitated reflection tool can be challenging. However, authentic relationships between the learner and surgical teacher can challenge these boundaries.

15.3.1 Authentic Relationships

Authentic relationships between learners and surgical teachers are more likely to sustain a climate of transformative learning in simulation (Gum et al., 2011). Cranton and Carusetta (2004) describes the authenticity of a relationship between the teacher and learner as having five dimensions shown in figure 15.1(Cranton and Carusetta, 2004b).

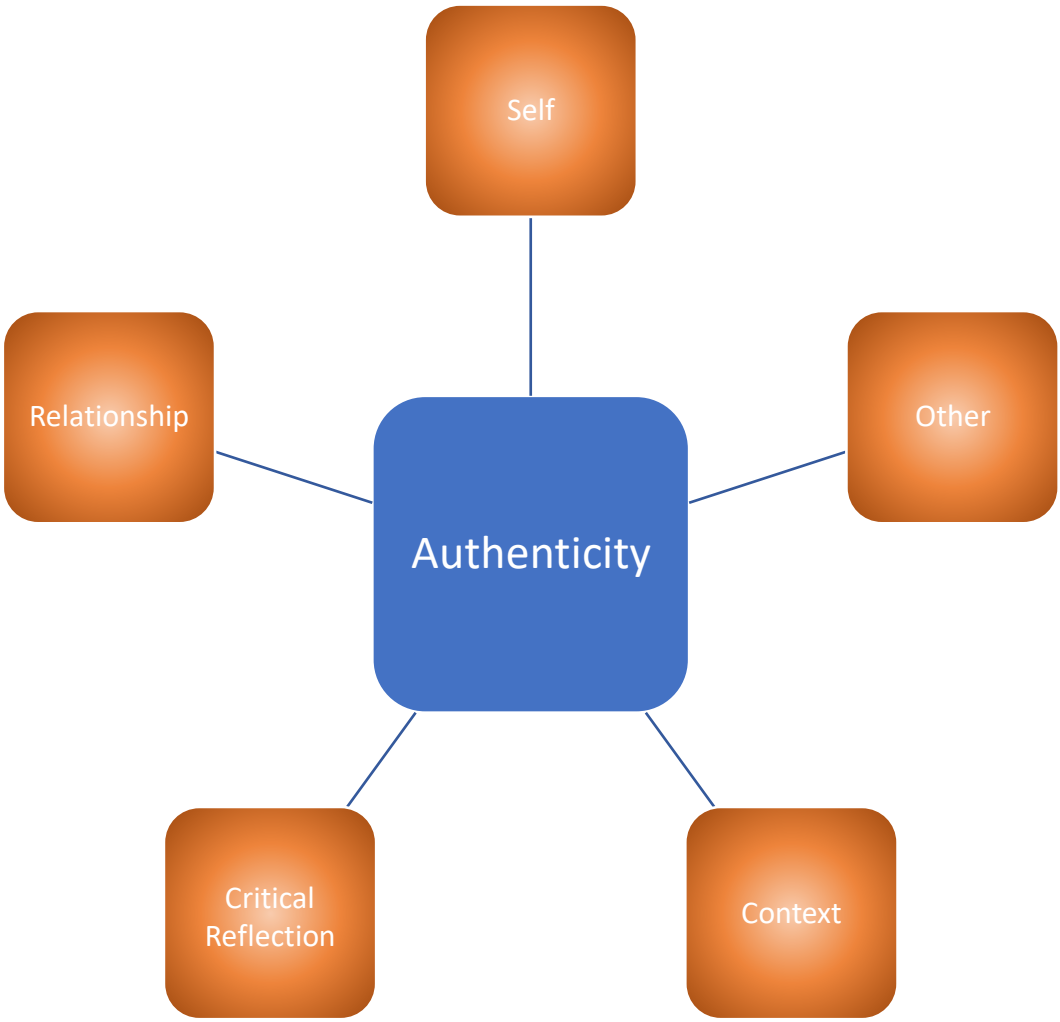


Figure 15.1 Authenticity in transformative learning as conceptualised by Cranton & Carusetta (2004).(Cranton and Carusetta, 2004b)

Each of these dimensions is explored further in a laparoscopic simulation context.

Self: An understanding of identity as a surgical teacher and an individual with both generic and unique characteristics. The surgical teacher may have skills of a teacher described in chapter 2 but also may have other internalised values through being an experienced surgeon such as promotion of leadership.

Other: An awareness and genuine interest of individuals from all disciplines, such as the learner, other surgical teachers, simulation assistants, learning technologists and their respective roles in contributing to the simulation learning environment. The surgical teacher should be aware of the skill set and resources available. Simulation assistants and learning technologists can be invaluable in designing an effective laparoscopic simulation learning environment through being agents of educational innovation (Davis and Fill, 2007, Finnis, 2004).

Relationship: A well-defined relationship between the surgical teacher and learner, that is intimate enough for the learner to be genuine and open but with learner boundaries respecting the agency of the surgical teacher. The surgical teacher should be approachable for the learner to divulge what potentially may be deep-seated views such as the learner does not believe that simulation is an effective learning medium. This may be challenging if the surgical teacher is an experienced surgeon and the learner is reluctant to share due to perceived barriers of power (Lyon, 2004).

Equally as part of this defined relationship, the surgical teacher would have an expectation that the learner has genuine interest and motivation to develop laparoscopic procedural skills and acts with professionalism (Lyon, 2004).

Context: The learner is aware of the social norms of laparoscopic simulation and how this both aligns and differs to their own perceptions of laparoscopic surgery. For example on the one hand the learner may relate to a surgical teacher supervising them

learning a procedural skill, akin to a surgeon supervising them in theatre. On the other hand they see peers trying to support and help each other learn procedural skills which they had not experienced in their clinical world before.

Critical Reflection: Reciprocal critical reflection on any of the above dimensions. The surgical teacher for example may reflect on themselves, believing that as an experienced surgeon their standards are far above what should be expected of the learner during the simulation (Cranton and Carusetta, 2004b, Serby, 2011).

Langan et al (2009) model expand on this authentic teacher - learner relationship further in a practical context with five themes as shown in Figure 15.2 (Langan et al., 2009). Each of these themes is explored further.

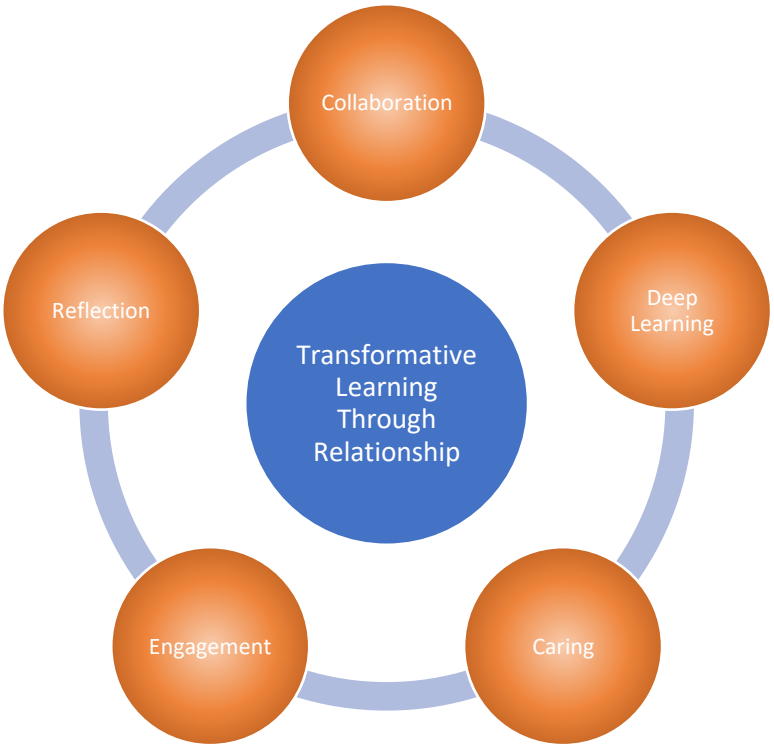


Figure 15.2 The teacher-learner relationship as depicted by (Langan et al., 2009)

Collaboration: Both teachers and learners understand their roles and the necessity for working together rather than in individual isolation. This can be challenging, for example a surgical teacher may have another role as the learners assessor in surgical competencies but they must adopt the role of a surgical teacher and embrace the need for a different relationship altogether here. In laparoscopic simulation perceived barriers of power and authority need to be dissipated with mutual respect and understanding for the facilitated reflection tool to work. In an ideal educational world such conflicts would not arise but this is unlikely to be pragmatic.

Deep Learning: Understanding the objectives and expectations from the simulation and linking connections between the different elements of the simulation to enable deeper learning. The surgical teacher should ensure the learner is aware of what the aims and expectations from the laparoscopic simulation activity are. In conjunction the learner should actively seeking knowledge and skills not only from the active simulation experience itself but also from other sources such as fellow peers and through processes of critical reflection. The facilitated reflection tool should encourage deep learning through these principles.

Caring: Understanding and acceptance of each other's similarities and differences. This concept has been repeatedly highlighted in transformative learning literature and has already been discussed. To foster a culture of openness and willingness to share, both learners and surgical teachers have to understand that they may

share similar agendas such as development of laparoscopic skill, however their presuppositions may be at polar opposites.

Reflection & Engagement: Reflection in this context describes the need to encourage learners to connect the simulation experience with existing presuppositions. Engagement refers to feedback from the surgical teacher to justify, critique or validate these presuppositions. Both these concepts are inherently principles of critical reflection and transformative learning and together scaffold the framework for the facilitated reflection tool.

Learner sense of self-worth is more likely to be affected if there is a lack of implicit trust between themselves and the surgical teacher or their peers (Fanning and Gaba, 2007). A supportive climate where learners feel confidentiality would not be breached and dignity is valued, is likely to be more conducive to learners engaging with a facilitated reflection tool, empowering them to share open and transparent responses (Fanning and Gaba, 2007).

Learners should have the confidence to experience error and mistakes and be willing to discuss them without fear of reprisal (Piercy, 2013). This principle keeps the patient safety agenda at the forefront of laparoscopic simulation and it is critical that it is embodied in the facilitated reflection tool as well. Learners will feel more free to engage in genuine dialogue with surgical teachers resulting in an overall richer learning experience (Clapper, 2010).

Learner empowerment has been conceptualised by Zimmerman (1990) as *"(learners) gain control and mastery over their lives and learn to utilise skills for influencing life events as they become empowered"* (Zimmerman, 1990). The facilitated reflection tool

has a role of empowering learners through the relationship between the teacher and learner. An educational tool that aims to develop critical reflection and transformative learning needs to empower the learner - as Cranton (2017) aptly summarises this concept of "*learner empowerment is both a pre-requisite and outcome of transformative learning*" (Cranton, 2017)

Transformative learning with critical reflection requires both learners and surgical teachers to be open to new perspectives and reassessment of underlying presuppositions. Critical reflection that results in transformative learning may result in the learner questioning and challenging the teachers own underlying presuppositions (Mezirow, 2003). This could be construed by some surgical teachers as negative criticism and result in them feeling devalued (Leach et al., 2001). This is further compounded with a traditional resistance amongst some surgeons being challenged on deeply seated views (Kellogg et al., 2006) (Thomas and Hardy, 2011). Therefore a surgical teacher who uses the facilitated reflection tool in laparoscopic simulation needs to be willing to have their own presuppositions challenged.

It is envisaged that the facilitated reflection tool will result in reciprocal critical reflection in both learners and teachers as discussed in Chapter 16. Surgical teachers should be reassured that this reciprocal critical reflection may strengthen surgical simulation faculty development through sharing of critical insight and feedback.

Mezirow (1997) suggests with a potent teacher - learner relationship, there should be a progressive transfer of leadership from the teacher to the learner as the learner becomes more

confident and self-directive with the teacher appearing less authoritative and instructional (Mezirow, 1997). This is reiterated by existing models of learning and teaching in the operating theatre with learners taking on this new role through building trust and legitimacy with the surgeons supervising them (Lyon, 2004). This also echoes the concept of learner independence discussed earlier in this chapter.

Protecting time to foster these potent relationships is essential. There is some suggestion in the literature that hastening this process in simulation may lead to lower levels of reflection and not critical reflection with a possibility that perspective transformation cannot be achieved (Parker and Myrick, 2010, Mezirow, 2003).

Chapter 16 - The Role Of Video And The Facilitated Reflection Tool

One of the most promising themes identified from the literature review is the evidence supporting the use of video technology during surgical simulation to guide and enhance learner reflection on action. This chapter explores video technology and how it can integrate with the facilitated reflection tool in simulation.

As identified from the literature review, video technology amplifies the effect of reflection in surgical simulation, learners are more likely to engage in deliberate practice and video technology itself can be used to structure a facilitated reflection tool. However, from the literature review no studies or reviews were identified, that explored the use or outcomes of video technology, with facilitated reflection in surgical simulation. There is however literature exploring this in non-surgical simulation and some of the key findings and concepts from research into this phenomena. may give insight into its role in laparoscopic simulation.

Video technology has been researched in non-surgical simulation to structure critical reflection and transformative learning processes as described by Mezirow (Bussard, 2016). The majority of studies identified in the literature exploring facilitated reflection and video recording were conducted with an undergraduate nursing student population (McAllister et al., 2013, Bussard, 2016). Video technology in non-surgical simulation exposes very similar findings such as it can be used to guide the direction, flow and content of the dialogue between the surgical teacher and learner act as a stimulus for reflection (Bussard, 2016).

Delayed debrief, where reflection on action occurs after a pause from the actual simulation and often in a different physical environment, has been shown to lead to superior learning outcomes (Embo et al., 2014, Coutinho et al., 2016). However, inability to fully recall either the experience, the learner behaviour, or their affect at the time may result in poor learning with a reduced ability to facilitate this reflection (Kessler et al., 2015). Video technology is able to objectively capture this to enable a reflective discourse that is authentic and objective between the learner and the surgical teacher.

During the actual simulation, learners are likely to be task oriented and distracted from what they are actually learning. Clapper (2010) suggests" *Learning does not have to be relevant to the learner at the time of the experience because the facilitator can make learning relevant*." Video technology is uniquely placed in facilitating surgical teachers to identify valuable learning from the experience (Clapper, 2010).

Changing underlying behaviours which is at the core of transformative learning requires objective review of performance which can be achieved through video (Scherer et al., 2003). Furthermore, discrepancies between desired and actual performance, as well as discrepancies of self-efficacy, can be elicited and changed (Scherer et al., 2003).

Learners observing themselves on video are more likely to incentivise themselves to source their fundamental values and beliefs and explicitly recognise whether this fits with observed behaviour. As a result of this learners have a greater propensity of perspective transformation (van Den Eertwegh et al., 2014).

Facilitated reflection using video technology enables the learner to gain meaning from the simulation by critically analysing the experience objectively to plan for future experience (Reed, 2012). This critical analysis of the experience is enhanced by a surgical teacher who is able to use video technology to identify specific strategies to change future action by referring to objective and demonstrable learner behaviour (Reed, 2012, Nicholls et al., 2018).

Video recording the simulation not only enables learners the potential to achieve higher levels of reflection, it perpetuates reciprocal critical reflection in the surgical teacher as well who examines their own presuppositions in the context of what they have observed during the video recording (Parker and Myrick, 2010).

Selecting the correct segment of video is crucial for the facilitated reflection tool. Deciding which segment is analysed can be learner or surgical teacher driven. Segments played that do not amplify important behaviours or skills may hinder effective dialogue between the surgical teacher and learner or divert learner attention (Fanning and Gaba, 2007).

Following the simulation, the video recording of the learners simulation can either be destroyed or given to the learner. However, there is some evidence that learners taking the video recording home and self-reflecting on the footage, further enhances reflections on procedural skill development and motivates learners to engage in deliberate practice (Farquharson et al., 2013, Vaughn et al., 2016).

Objective 4

To Design The Facilitated Reflection Tool And Integrate It Into A Laparoscopic Simulation Activity Using Video Technology

Chapter 17 - The Facilitated Reflection Tool

From the literature and subsequent discussion of Mezirow's work on both transformative learning and critical reflection, it is clear that the learning framework and the model of reflection are inextricably interwoven. Facilitated reflection can only be achieved by a surgical teacher enhancing different phases of transformative learning including critical reflection through discourse. This concept is reiterated both in transformative learning theoretical literature as well as in the existing literature on transformative learning in simulation (Mezirow, 1998, Fannon, 2004, Parker and Myrick, 2010, Roberts, 2013).

The conceptual framework and theoretical orientation of the facilitated reflection tool is complex and multifaceted. However, the actual design of the facilitated reflection tool needs to be simple and pragmatic for both surgical teachers as well as learners.

The paucity of literature available on the methodology for designing reflective tools or models in simulation, with none identified in a surgical simulation context, makes designing such tools that are theoretically or empirically evidence based, near impossible. Even existing debrief models that are discussed further in Chapter 19 do not explicitly state the methodology of how they were constructed, only alluding to theoretical or conceptual principles incorporated into the model (Gum et al., 2011, Jaye et al., 2015, Collaborative, 2017).

The conceptual term of *tool* is used rather than model. This is because a tool conceptualizes a learner intervention that acts on a known phenomenon – in this case reflection where as a model in

education has been described as a synthesis of various theories, to design programmes that organise teaching and learning, and is more generalisable than specific instructional methods (Collaborators, 2016, Norcini and Burch, 2007).

In this thesis the foundation and the rationalisation for the facilitated reflection tool design is based on the theoretical orientation and the conceptual framework discussed in section 2 & 3 of this thesis. Educational interventions must address the philosophies underlying it as this ensures theoretical justification, academic legitimacy and an educational intervention that has a credible practical application (Bunniss and Kelly, 2010).

The facilitated reflection tool has been designed in six consecutive steps as shown in Figure 17.1. The explanation for each step, whether it involves individual or group reflective discourse, along with relevant technical information will be discussed in this chapter.

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V1.0

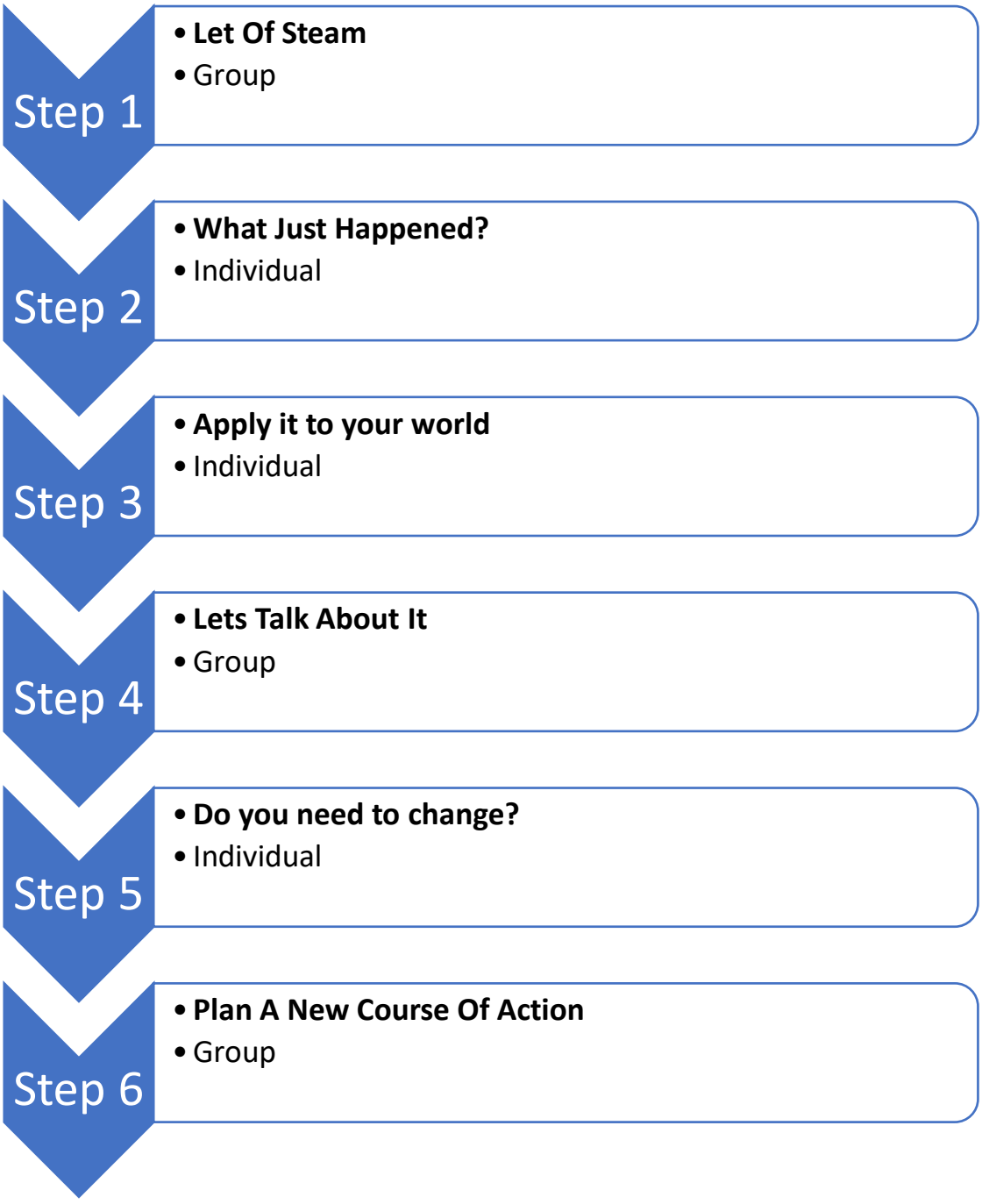


Figure 17.1 The Facilitated Reflection Tool

17.1 Step 1

Let Of Steam

Rationale

At this step, discussions immediately following the simulation are typically unstructured and include venting a range of emotions such as elation, discontent, relief as well as views on the simulation related to the fidelity and difficulty of the actual tasks (Gum et al., 2011). Any venting that remains unresolved in the view of the learner can further be discussed further during the debrief stage as well.

Though exploration of emotion does not follow an explicit stage of Mezirow's conceptualization of transformative learning or critical reflection, the essentiality of emotion to reflection, learning and memory necessitates a step that explores emotions. Furthermore, as identified from the literature review, it is critical that exploration of the learners initial emotions and reactions from the impact of the simulation occurs (Ahmed et al., 2012)

This step is for the group as the conventionally in most laparoscopic simulation courses, it is expected that all participants will finish at the same time. Furthermore, sharing of initial emotions and reactions are more likely to lead to a cohesive community of practice due to greater shared empathy among the learners.

Technical

Once the initial explorations of emotions and reactions have been expressed and the learners are more settled, the video recording of the learner should be played. Ideally technical support should be available from a simulation assistant or facilitator if needed.

The selection of learner order to view the video recording, could be through random allocation or on a volunteer basis. In both circumstances confirmation of consent to play the video recording should be obtained.

The video recording is paused when a significant behaviour is noticed. It is expected that this will generally be driven by the surgical teacher but it can also be learner driven.

17.2 Step 2

What Just Happened

Rationale

In this step the reflective discourse between the learner and surgical teacher initiates through identification of the disorienting dilemma. It is crucial that at this step, any negative emotions associated with the disorienting dilemma are identified and discussed to prevent persistent negative self-regulatory behaviour from occurring. The surgical teacher should try to support the matching of any significant emotions with meaning.

Positive behaviours that are observed can also be validated at this step, however as discussed this is less likely to lead to perspective transformation. Nevertheless, there is still great value in identifying positive behaviours and skills, including the execution of procedural skills to a high standard, as not only does this validates the learners underlying knowledge and skills it also encourages positive self-regulatory behaviour including self-efficacy. Furthermore, this learning can also be shared with peers through observation of the video recording.

The identification of the disorienting dilemma requires communication that uses good judgement (discussed in Chapter 18) so that the learner does not in any way feel that this process is humiliating.

At this step it is individual reflective discourse as the disorienting dilemma identified from the video recording is unique to the learner.

Technical

The video recording is played and can be rewound to help the learner notice the disorienting dilemma.

17.3 Step 3

Apply It To Your World

Rationale

During this step the learner relates the disorienting dilemma identified in step 1 to their own presuppositions. Presuppositions must be explicitly identified and the source, nature and consequences of these presuppositions analysed (Cranton, 2017).

The surgical teacher needs to encourage the learner to draw on previous experiences and identify the presuppositions that have evolved as a result of this. Most often it is expected that learners presuppositions will relate to what they have observed or practiced previously in the operating theatre. However, the surgical teacher should try to identify if there are any other influences related to the learners internalised values and beliefs. Examples of this are discussed in the scenarios in Chapter 21.

At this step it is individual reflective discourse between the surgical teacher and learner. Presuppositions are unique to the individual learner and often closely guarded and valued. Here again communication that uses good judgement (discussed in Chapter 19) is essential in avoiding an atmosphere where the learner may feel interrogated.

17.4 Step 4

Let's Talk About It

Rationale

Following the identification of the disorienting dilemma and after relating this to the learners existing presuppositions, the next step involves critiquing of these presuppositions through critical reflection and reflective discourse as supported by the conceptual framework.

Reflective discourse needs to ensure that the discussion is focused around the disorienting dilemma and related presuppositions and not tangential. The surgical teacher should facilitate the navigation of this discourse.

At this step it is group reflective discourse. The rationale and justification for reflective discourse involving peers and teachers during the process of analysing presuppositions has been discussed in Chapter 9 and Chapter 15.

The aim as reiterated of the discourse is not to compel learners into an alternative view, it is to facilitate a rich reflective discussion whether the learners presuppositions match the experience identified from the disorienting dilemma.

Technical

If necessary the video can be rewound if repeat clarification is needed.

17.5 Step 5

Do You Need To Change?

Rationale

During this step, the learner must critically reflect and evaluate whether the disorienting dilemma identified from the simulation experience necessitates a change for them. The group reflective discourse from the previous step helps guide this decision.

At this step it is individual reflective discourse as the decision whether to change presuppositions is unique to the learner. The surgical teacher and peers can offer insight; however, it is the learners responsibility for taking this decision to change that ensures preservation of learner autonomy and encourages practices of self-directed learning as discussed in Chapter 15. It also validates the role of the surgical teacher as a facilitator of learning and moves away from traditional paradigms of learning through rote instruction and associated learner passivity.

The features of authenticity of a relationship between the surgical teacher and learner (discussed in Chapter 15) is critical in determining the learners responses. Learners are more likely to give honest, genuine and transparent answers, such as to the response do they believe they need to change, if they have an authentic relationship with the surgical teacher. The practicalities and limitations of this are discussed in Chapter 23.

If a learner is able to give genuine and open response at this stage, such as they do not believe they need to change in contrast

to the views of peers and the surgical teacher, then this can facilitate an even richer reflective discussion that is more likely to lead to perspective transformation (Parker and Myrick, 2010)

17.6 Step 6

Plan A New Course Of Action

Rationale

Garvet (2004) empirical study on action research and transformative learning identified that transformative learning cannot result on an epistemological change alone. Strategies to implement the new action as well as institutional support to for these changes is essential to sustain this new learning (Gravett, 2004).

The learner at this step should be informed of the opportunity to repeat the simulation with a chance to provisionally apply the new learning whilst building confidence. Strategies to reintegrate learning into the operating theatre should also be discussed at this step completing Mesirow's stages of transformative learning described in Figure 9.2 (Mezirow and Marsick, 1978).

Though this usually happens during the debrief stage it is included here as part of the facilitated reflection tool given that the learning prioritization of simulation is transference of skill to the operating theatre and the facilitated reflection tool aims to support this transference of learning.

At this step it is group reflective discourse as both peers and the surgical teacher can help structure a new course of action through their own personal experiences, presuppositions and existing knowledge. Furthermore, the disorienting dilemma may be a common theme relevant to other learners in the group, hence

sharing of this learning of planning a new action should occur through group reflective discourse.

Chapter 18 - The Facilitated Reflection Tool With Good Judgement

Reflective discourse that is sensitive and holds the learner in high regard but at the same time is genuine, focused and rigorous are features that are quintessential to the facilitated reflection tool. Creating such an environment is challenging where the content is objective and honest but at the same time the learning environment is safe and addresses the psychological wellbeing of the learner (Rudolph et al., 2007).

Judgemental discourse refers to traditional paradigms of authoritarianism and power applied to feedback and has become less pervasive through innovations in simulation and medical education as well as recent focus on learner welfare in surgery(Sloan et al., 1996, Gafson et al., 2017).

However this has had a knock on effect of non-judgemental feedback being used where feedback is "sugar-coated" or negative feedback is "sandwiched" in between positive feedback and thus risks filtering out critical behaviours or missing them all together (Rudolph et al., 2006, Cousar et al., 2019). Burns (2015) summarises this type of feedback as "*predictable, patronising and a wasted opportunity to discuss the meat of the issue and improve student performance*"(Burns, 2015). Both judgemental and non-judgemental approaches can limit the clarity of the discourse by either humiliating the learner or confusing and patronising the learner respectively (Burns, 2015, Rudolph et al., 2006).

The facilitated reflection tool with good judgment is an approach adapted from debriefing with good judgement developed by

Rudolph et al (2007), that combines rigorous feedback, genuine inquiry and promotion of learner wellbeing leading to self-reflection and behaviour change (Rudolph et al., 2007, Rudolph et al., 2006). It has been incorporated into several debriefing models such as the Diamond Debrief discussed in chapter 19 (Jaye et al., 2015).

Though no observational studies were identified in surgical simulation exploring debriefing with good judgment, its suggested application has been advocated in surgical education literature (Spearpoint, 2017, Paige, 2019). Furthermore, using good judgment in educational tools that develop and encourage reflection in simulation, has been shown to move towards a higher quality of learning (Thompson et al., 2018).

The facilitated reflection tool with good judgement should involve an open declaration of commitment to learner psychological wellbeing built on respect (Kolbe et al., 2015). It is expected that this would happen at the pre-brief stage discussed in Chapter 20.

However, the good judgement approach does not work with learners who are outwardly negligent with overt disdain for the simulation (Rudolph et al., 2007). Similarly it may challenge learners from cultures where paradigms of authoritarianism and power of the surgical teacher is viewed and believed to be the correct social norm (Rudolph et al., 2007).

Table 6, adapted from (Rudolph et al., 2007),shows questions and statements by the surgical teacher using judgemental, non-judgemental and good judgment in conjunction with steps from the facilitated reflection tool.

Facilitated Reflection Tool Step	Judgemental	Non-Judgemental	With Good Judgement
Let Of Steam	Wasn't that task easy? Let's see what difficulties you had from the video recordings	I'm sure the simulation was easy and hard in different parts. Are you happy if we could go through the video recordings now?	How did it go? How did everyone find the simulation? Let's go through the video recordings unless anyone is not happy to do so
What Just Happened	Did you notice you couldn't complete the laparoscopic simulation task?	Shall we talk about the strengths and challenges in this segment?	What did you observe? I noticed that you were having some difficulty with this step, shall we talk about this?

Apply It To Your World	Is this normally what you do in the operating theatre?	I'm sure lots of people do it this way, is that why you did it?	Why did you do it this way?
Let's Talk About It	Do you normally do this task with such a dangerous technique? Do you all agree this is dangerous?	It's possible you could do it this way but there are other techniques. Shall we talk about them?	Do you think that doing this could have any risks? How does everyone else feel? Does anyone have any other thoughts?
Do You Need To Change	You must change to this technique.	You could change this technique if you want to	Do you agree with changing this technique?
Plan A New Course Of Action	Do not ever repeat this dangerous technique	You can continue your old technique or try the new one we have talked about.	Let's try this new technique again on the simulator and see if it avoids those risks.

Table 6: Facilitated reflection tool with different types of judgement. Adopted from (Rudolph et al., 2007)

Chapter 19 - The Debrief

The facilitated reflection tool focuses on critical reflection on action and this conventionally occurs during the debrief stage as discussed in chapter 3. However, the facilitated reflection tool is designed for use prior to the debrief and is portioned from it. The rationale for this is discussed in the next three chapters.

19.1 The Debrief And The Facilitated Reflection Tool

Lederman (1992) identified seven common elements of debriefing shown in Figure 19.1 (Lederman, 1992)

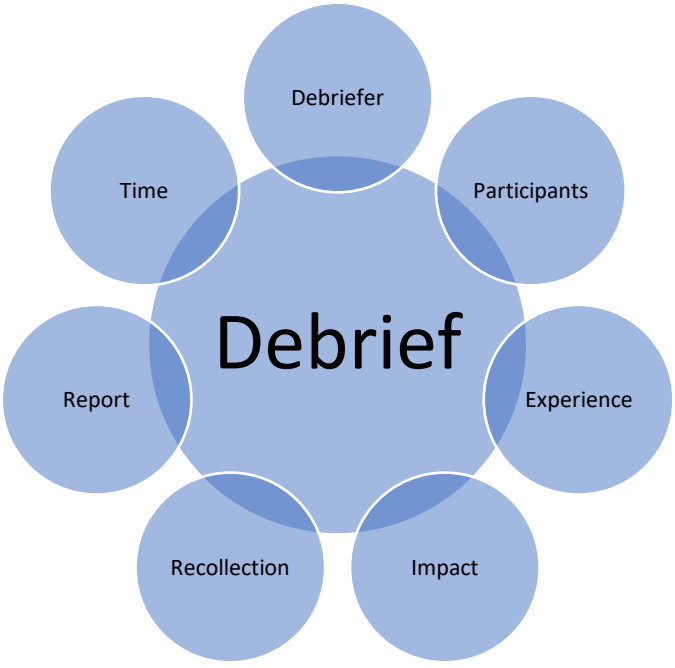


Figure 19.1 7 Common elements of the debrief as described by Lederman (1992).

Many of the seven elements follow the conceptual themes that have been synthesised for the facilitated reflection tool.

Participants are learners; The debriefer is the surgical teacher; the experience is simulation; reflection examining the impact of the simulation and subsequently reporting this in correlation with recollections from the event; and time which denotes the time interval between the simulation and debrief (Lederman, 1992) (Fanning and Gaba, 2007).

It is possible for the facilitated reflection tool to be integrated into the debrief. Many debrief models integrate structured facilitated reflection as part of the debrief. The next chapter will discuss three models of debriefing that integrate facilitated reflection explicitly as part of the model framework.

19.2 Models Of Debrief That Complement The Facilitated Reflection Tool

The model of debriefing will need to be adapted to the aims and objectives of the simulation, learner competence and faculty expertise (Dismukes et al., 2006). For example, an emergency drill simulation such as shoulder dystocia may benefit from an instructional model, however a simulation involving counselling a patient who is unhappy with their care would be better suited to a more open reflective model of debriefing. No theoretical or empirical research was identified in the literature exploring existing simulation debrief models in a laparoscopic simulation context suffice for the application of video technology.

In this chapter three debrief models are described – "SimTRACT" (Gum et al., 2011), "LEARN framework (Collaborative, 2017)" and " The Diamond Debrief (Jaye et al., 2015)". These three models are discussed as they provide conceptual insight into how the

facilitated reflection tool can be integrated into simulation. Furthermore, it is suggested that these models could be used as the debrief model following laparoscopic simulation and the rationale and justification for this is also discussed.

19.3 The Diamond Model

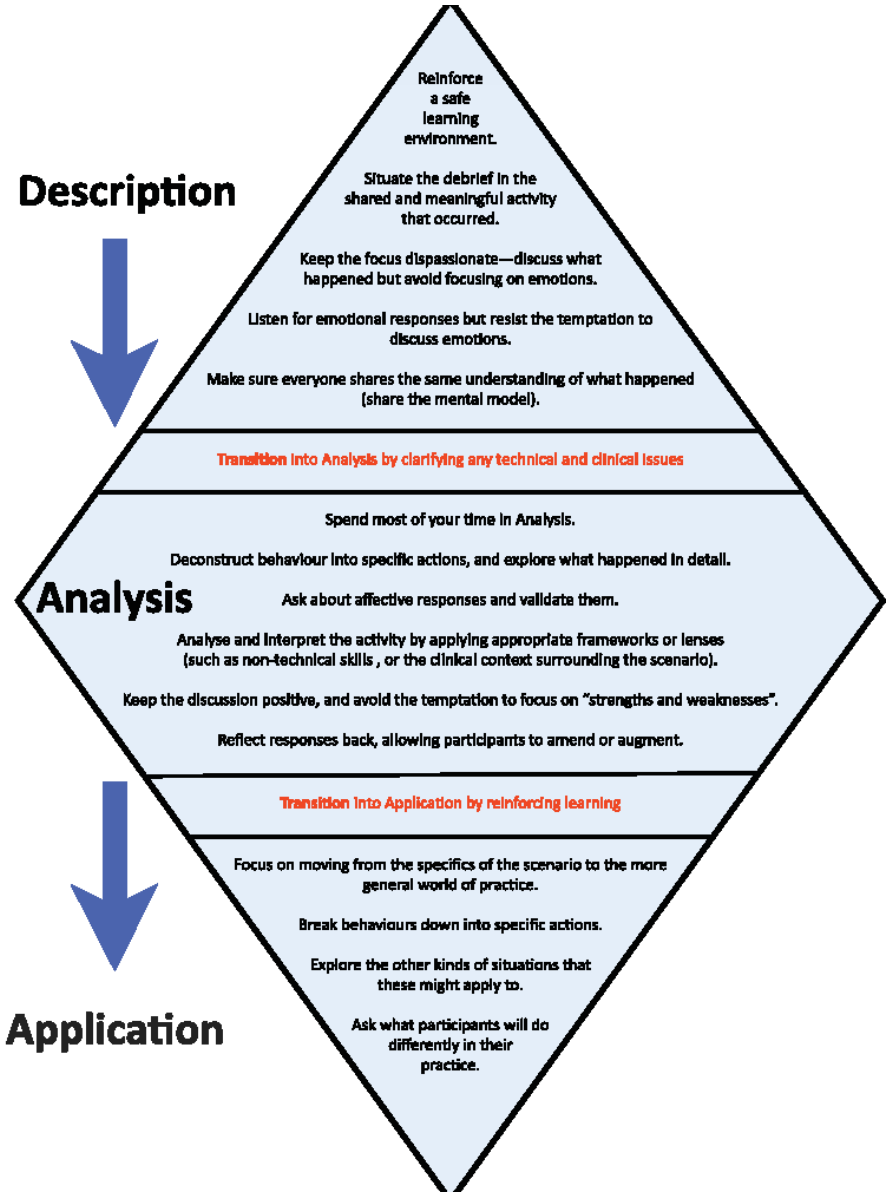


Figure 19.2 Diamond Model Of Debrief taken from (Jaye et al., 2015)

The Diamond Model of debriefing developed by Jaye et al (2015) incorporates good judgement, advocacy and inquiry and description – analysis – application frameworks for debriefing (Jaye et al., 2015).

It has been described as a pedagogically sound framework to navigate feedback and reflection following simulation that can enhance transference of learning from simulation to the live setting. (Yang et al., 2017). The Diamond Model has also been shown to facilitate reflection following simulated patient encounters and has been well received by some stakeholders in simulation education delivery (Bush et al., 2019, Yang et al., 2017).

The majority of laparoscopic simulation activities in the UK are run by practicing laparoscopic surgeons who may or may not have significant educational expertise. The diamond model of debrief can be applied in laparoscopic simulation because of its ease to use without the need for extensive educational expertise, minimal requirement for theoretical training and an intense focus on enhancing transference of learning to the clinical environment (Jaye et al., 2015, Sawyer et al., 2016). Furthermore, this model explicitly incorporates principles of debriefing with good judgement.

However, its limitations are that it has not been validated in surgical simulation and conceptually appears to be designed for team based scenarios than procedural skill learning.

19.4 LEARN Framework

The LEARN framework developed by the Tuckamore Simulation Research Collaborative is an example of a debrief model that applies advocacy and inquiry as part of the facilitated reflection step (Collaborative, 2017). Advocacy Inquiry is an approach for delivering feedback through guided reflection and is especially adaptable in simulation (Tutticci et al., 2018). It aims to uncover the learner's ideas, concerns and expectations, exploring the different drivers and thought process, through facilitated critical reflection (Tutticci et al., 2018).

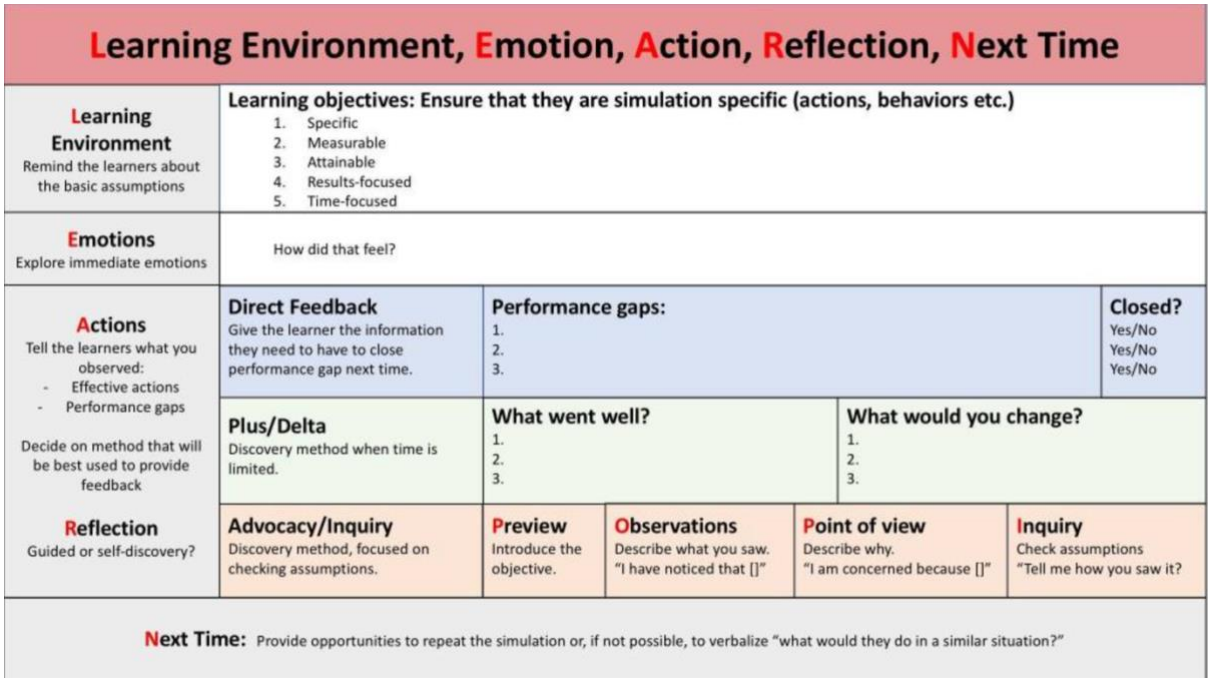


Figure 19.3 The LEARN framework taken from (Collaborative, 2017).

This framework has been used in simulation for procedural skill development such as emergency tracheostomies (Chiaravalli et al.,

2017). Furthermore advocacy and inquiry has been applied in simulation to achieve transformative learning outcomes (King et al., 2013) and could synergistically act with the facilitated reflection tool. The framework can be adapted to be individualised in order to focus on procedural skill development. Furthermore, it emphasises the need for repeating the simulation. However, it does rely on surgical teacher/learner recall of the experience.

19.5 Sim TRACT

Gum et al (2011) developed a video assisted reflective framework for debriefing called Sim TRACT for obstetric emergency simulation. This study found combining video assisted debrief with a reflective framework enabled a rich space for transformative learning to occur through reflection (Gum et al., 2011).

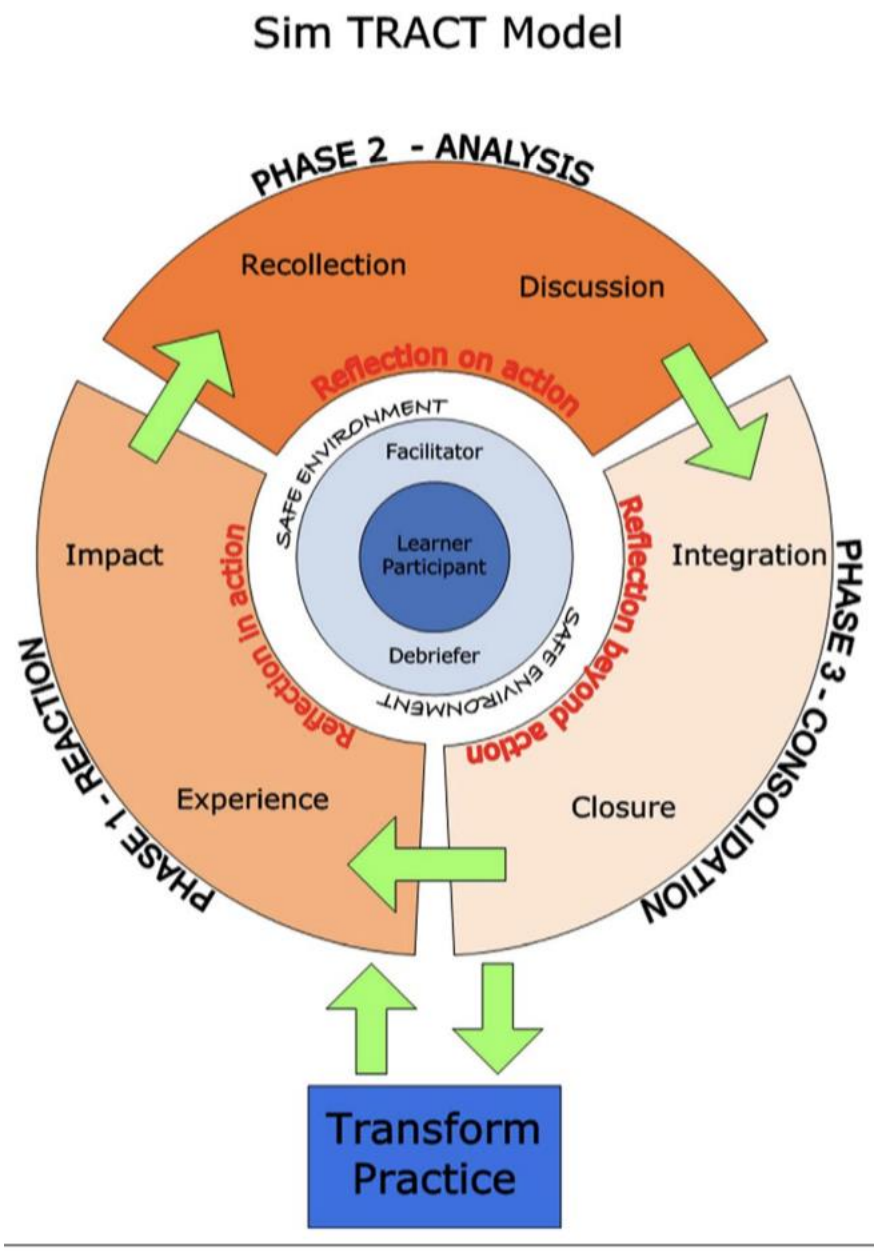


Figure 19.4 Sim TRACT model taken from (Gum et al., 2011)

This model is learner centric requiring proactive involvement from the learner. The model has four stages involving reaction, analysis, consolidation and finally transformation of practice. During the reaction phase, the learner shares their views and emotions of the

experience. This generates introspection in the learner with a critical analysis of the experience.

The second phase analysis – involves recollection and critical analysis of the experience with the surgical teacher acting as a "cognitive detective" building the bridge between desired vs actual performance.

The third phase is consolidation where underlying beliefs are either validated or challenged from learning accrued through the experience. The surgical teacher helps support linking the experience with learning. Strategies to implement this new learning into future actions are constructed in conjunction with a surgical teacher.

The final phase is transformation of practice. During this phase the learner experiments on their newly accrued beliefs and knowledge. This would either involve repeating the simulation exercise or practicing in the clinical setting (Gum et al., 2011).

Out of the three models the Sim TRACT model seems to resonate the most for complementing both the facilitated reflection tool as well as the potential for being applied within a laparoscopic simulation context. The model clearly follows the theoretical orientation of transformative learning, explicitly incorporates a safe learning environment and focuses on bridging the gap between desired and actual performance – essential to procedural skill development.

19.6 Rationale For Not Integrating The Facilitated Reflection Tool Into The Debrief

However, though the facilitated reflection tool can be integrated into a debrief model and the fact that many of the core principles of debriefing coincide with the conceptual framework of the facilitated reflection tool, the facilitated reflection tool forms a separate stage of the simulation to the debrief.

The debrief has other functions besides the facilitated reflection tool such as learner feedback and evaluation (of the simulation faculty, programme and organization), an opportunity for didactic teaching, it can serve as evidence for continuing professional development, a platform for formative or summative assessment and to develop specific skills such as teamwork and leadership (Rudolph et al., 2008, Fanning and Gaba, 2007, Burns, 2015).

Furthermore, the design and construction of an effective debrief model that integrates facilitated reflection for laparoscopic simulation, as well as the subsequent theoretical investigation of this phenomenon, mandates an entirely different programme of research to the one in this thesis.

Chapter 20 The Right Place And Right Time For The Facilitated Reflection Tool.

The timing of interventions such as the debrief or the facilitated reflection tool in a laparoscopic simulation programme is crucial. There are very few studies in the literature exploring when is the right time for the debrief following simulation. As discussed in Chapter 16 delayed debrief in simulation, where the debrief happens after a significant time lapse from the actual simulation, has in some studies shown superior learning outcomes such as increased sense of self-efficacy and an enhanced ability to self-assess (Embo et al., 2014, Coutinho et al., 2016).

Kim and Kim (2017) argue that not starting the debrief immediately after all the participants have finished the simulation, results in memory lapses and reduced time for reflection (Kim and Kim, 2017). However, as discussed in Chapter 16 the use of video technology reduces the impact of these memory lapses and it is conceivable with appropriate planning, the concept of a delayed debrief or a delayed facilitated reflection tool could be applied in laparoscopic simulation but this phenomenon would need to be explored after the debrief and facilitated reflection tool have been validated.

The suggested programme plan of the laparoscopic simulation activity is shown in Figure 20.1. This chapter will explore the rationale for this program and will also discuss the pre-brief in further detail.

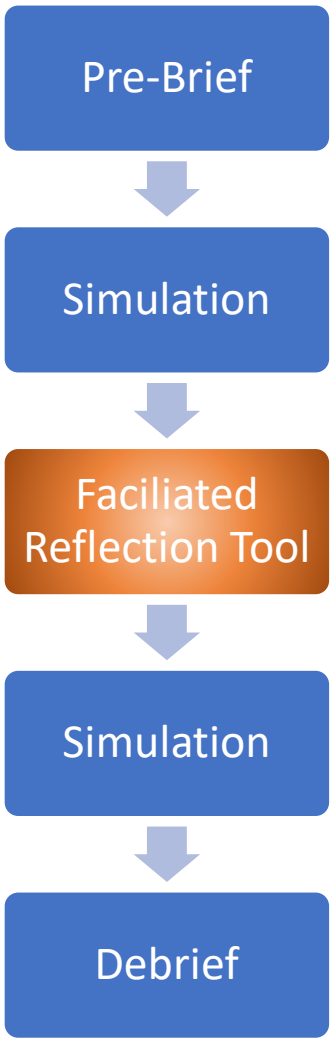


Figure 20.1 Suggested Laparoscopic Simulation Programme

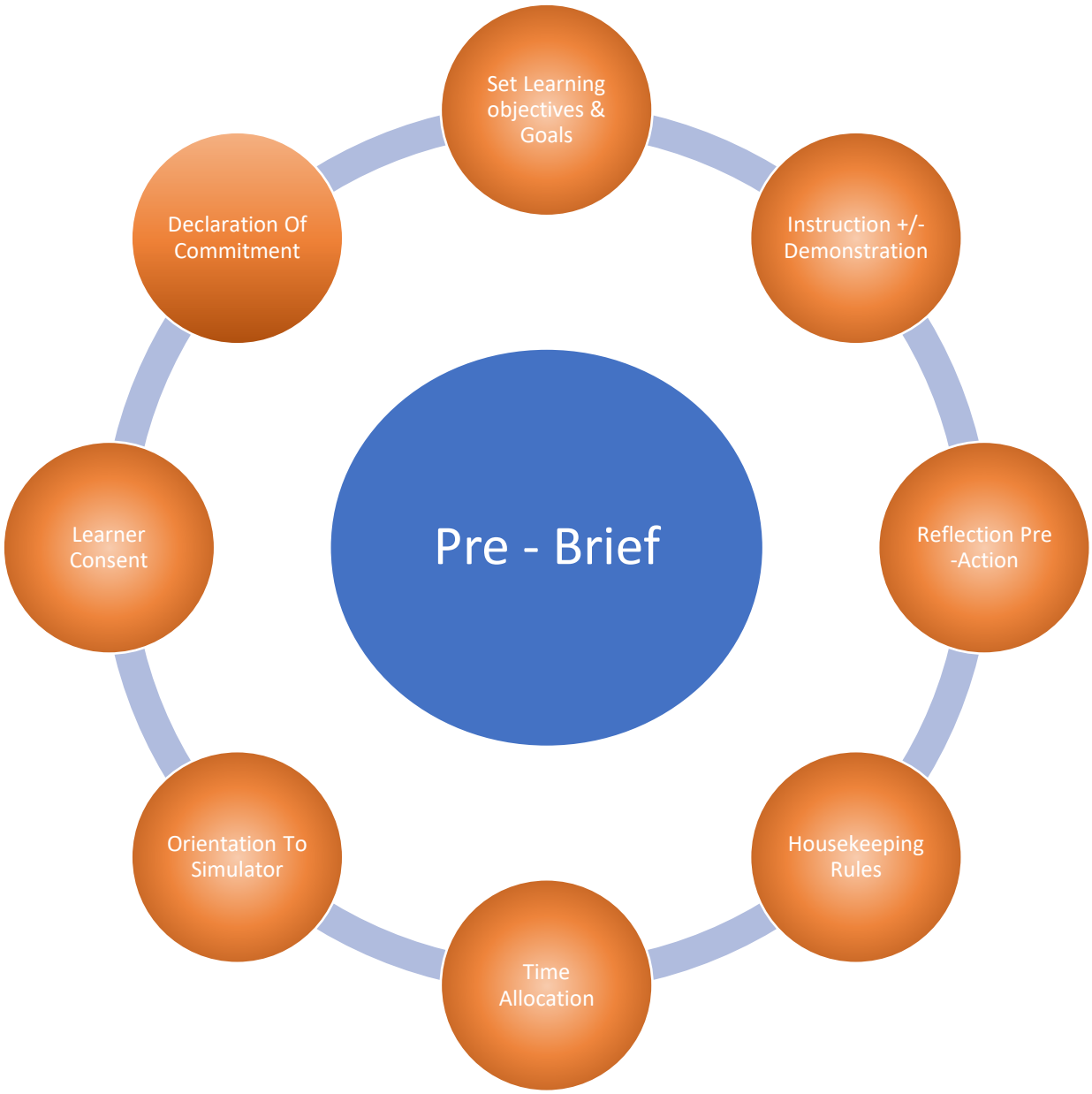


Figure 20.2 Functions of the Pre-Brief

20.1 Pre-Brief

The first stage of the simulation is the pre-brief. The functions of the pre-brief are summarised in Figure 20.2 (Stephenson and

Poore, 2016, Burns, 2015). This is also the stage where reflection pre-action i.e. before the simulation occurs and this is discussed further in Chapter 23.

An ideal simulation ignites learning prior to the actual day of the simulation itself (Stephenson and Poore, 2016). This could be through communication from the faculty organisation regarding the venue, programme and structure of simulation. This would also be an ideal opportunity to discuss the use of video learner technology in simulation and the facilitated reflection tool.

Giving the opportunity to consent in advance not only helps with regards to resource planning as to how many learners would be likely to attend such a simulation experience , it is also the ethically sound and moral thing to do.

Further more attention to logistical preparation, as discussed in Chapter 5, where learners are aware of what to expect, forms one of the core principles of learner psychological safety in simulation (Palaganas et al., 2016).

It is recommended that the surgical teacher demonstrates the task that they are expected to perform at this stage to clarify understanding of the learning objectives.

During the pre-brief learners should be told that the simulation is intended as a formative learning experience and learners should be empowered to voice their concerns at any point during the simulation activity. The declaration of commitment to learner psychological safety including the need for empathy should occur at this point as well. (See Chapter 5).

20.2 Two Simulations

From the literature and the facilitated reflection tool, the need to repeat the simulation is clear. The suggested simulation programme therefore offers the opportunity for learners to participate in the actual simulation twice.

During the first simulation it is suggested that faculty observe learners unless specific help is requested by the learner. As identified from the literature review, faculty who are involved with the simulation and also have a role in providing feedback can have their objectivity impaired (Yule et al., 2007). Furthermore, The facilitated reflection tool aims to uncover and either validate or challenge core underlying behaviours in the learner and minimal faculty interaction enables this by avoiding the mentor effect. If however learners request support such as a repeat demonstration of the task then this should be offered to enable learners to progress.

During the second simulation greater faculty involvement can refine technique and harness and build confidence into the learning accrued through the facilitated reflection tool.

The debrief following the second simulation, in addition to the extra roles of the debrief discussed in Chapter 19, can ensure that there is an opportunity for positive learner behaviour to be acknowledged and validated given that the disorienting dilemma in the facilitated reflection tool tends to focus on challenging learner presuppositions.

Chapter 21 Example Mock Scenarios Using The Facilitated Reflection Tool

This chapter portrays the use of the facilitated reflection tool following two fictitious laparoscopic simulation scenarios. The scenarios are intended to demonstrate the context and application of the facilitated reflection tool. The scenario commentary is based on personal and anecdotal recollections of laparoscopic simulation. The discussion following each scenario is to illustrate of transformative learning could potentially occur through the facilitated reflection tool.

Scenario 1

Laparoscopic Simulation Task: Stacking sugar cubes on top of each other using laparoscopic graspers.

Step 1 (Group)	**Let of steam**
Surgical Teacher:	**"***How did everyone find the simulation?"*
Surgical Teacher:	**"***Are you happy if we go through the video recordings now?"*
Step 2 (Individual)	**What just happened?**

Example behaviour observed: The learner tries to move the sugar cubes using laparoscopic graspers but applies excessive pressure breaking the sugar cubes.

Surgical Teacher: **"***What do you think was happening here?"*

Learner: **"***I was trying to pick up the sugar cube but it kept breaking. It was really frustrating."*

Step 3 (Individual) **Apply it to your world.**

Surgical Teacher: **"***Why do you think this was happening?"*

Learner: **"***Well I was really focused on trying to stack the sugar cubes on each other. I'm not sure why it kept breaking but I really didn't want to give up"*

Step 4 (Individual + Group) **Let's talk about it**

Surgical Teacher: **"***Did you perceive that the pressure you applied with the graspers could possibly cause tissue damage in real life?"*

Learner: **"***Yes, I guess in real life you could damage tissue with excessive pressure"*

Surgical Teacher: **"***How does everyone else feel? Does anyone have any other thoughts?"*

Peer 1: **"***I don't think you can stack the sugar cubes on top of each other without applying significant pressure."*

Peer 2: **"***Yes I nearly got all the way across before it crumbled."*

Peer 3: **"** *I found I could do it if I didn't grasp the corners but the sides instead."*

Surgical Teacher: *"I think this can be a challenging part of laparoscopic surgery – treating and handling tissue with precision and care at the same time as being able to complete the procedure efficiently. I agree, it is possible to move the sugar cube without breaking it by grasping the sides rather than the corners of the cube"*

"However, it is worth mentioning that sometimes in the operating theatre managing to complete the procedure, especially when it is a planned elective case, isn't always the safest thing to do if it means causing significant damage to vital structures"

Learner: *"I'm not sure, I thought you always have to be able to complete the procedure."*

Surgical Teacher: *"Laparoscopy for endometriosis often ends up as two separate procedures where during the first surgery if severe endometriosis is seen, then extensive excision is often not performed. The patient is counselled for repeat surgery and appropriate planning is put in place."*

Step 5 (Individual) **Do you need to change?**

Surgical Teacher: *"Do you agree with that?"*

Learner: **"***Yes that does make sense, we should always do what's safest for the patient. I also think trying to grasp the sides makes sense as there's less focal pressure"*

Step 6 Plan a new course of action
Group

Surgical Teacher: **"***Great, let us try to see if we can stack the sugar cubes without breaking them. We could try grapping the sides rather than the corners of the sugar cube to see if this makes it easier to stack."*

"I also want you to think about other scenarios when it would not be safe to continue with an operation and what would you do at that point. We can discuss this during the debrief."

In this scenario a frame of reference based on presuppositions of capability, credibility and competence in completing a task is revised. The learner understands that patient safety and wellbeing should always be prioritized, even if it means abandoning the surgery and the learner undergoes perspective transformation. This rich reflective topic can be further continued during the debrief following the repeat simulation. The learner is also given direct strategies they can transfer to the theatre such as principles of tissue handling.

Scenario 2

Laparoscopic Simulation Task: Insertion of Verres needle into the box simulator.

Step 1 (Group)	**Let of steam**
Surgical Teacher:	**"***How did everyone find the simulation?"*
Learner:	**"***I'm not sure it didn't feel at all like real life"*
Surgical Teacher:	**"***OK, I can empathise with that, shall we go through the video to have a look at your technique?"*
Step 2 (Individual)	**What just happened?**

Example behaviour observed: The learner inserts the Veress needle at an angle rather than perpendicular to the skin.

Surgical Teacher:	**"***What do you notice here?"*
Learner:	**"***I was inserting the Veress needle"*
Surgical Teacher:	**"***Do you think there could be any problems with using this technique"*

Learner: **"***I'm not sure what you mean, I have always done it this way"*

Surgical Teacher: *" Did you notice you inserted it at an angle?*

Learner: **"***Yes I always do it this way"*

Step 3 (Individual) **Apply it to your world.**

Surgical Teacher: **"***Why do you do it this way?"*

Learner:

"*Well I have always been told you should never go vertical as this risks injuring the aorta and since then I have been terrified of changing the angle"*

Step 4 (Individual + Group) **Let's talk about it**

Surgical Teacher: **"***Do you think that doing this could have any disadvantages?"*

Learner: **"***Yes, I know there is more distance for the needle to travel and therefore less likely to achieve pneumoperitoneum"*

Surgical Teacher: **"***How does everyone else feel? Does anyone have any other thoughts?"*

Peer 1: **"***I agree, I have always been told to insert the Veress needle vertically."*

Peer 2: **"***Yes I do it vertically too but I'm very nervous when it happens."*

Surgical Teacher: *"Yes I agree as well, I too do it vertically and that's in keeping with the advice from RCOG guidelines. However your right to be cautious but when you are really worried about hitting large vessels such as in patients with a low BMI you could consider an open entry technique instead"*

Learner: *"Yes, I didn't even realise that a lot of people inserted it vertically including yourself."*

Surgical Teacher: *"There is a wide variation in surgical techniques with a limited evidence base to support them. However an appreciation of anatomy, learning from experienced surgeons and being aware of best practice or guidelines can help guide you to some extent."*

Step 5 (Individual) **Do you need to change?**

Surgical Teacher: *Do you agree with that?*

Learner: **"***Yes that does make sense, I still feel really nervous inserting it vertically but I could try it on the box model."*

Step 6 Plan a new course of action Group

Surgical Teacher: **"***Great, let us try to insert the Veress needle on the box simulator and see if this makes a difference to our insertion technique."*

"I also want you to think about other variations in techniques you have witnessed in laparoscopic surgery and we can discuss them further ."

In this scenario a frame of reference based on presuppositions related to fidelity and value of the simulation is revised. The learner through the simulation and the facilitated reflection tool uncovers that there is a range of techniques in laparoscopic surgery and there might be better ones than theirs that they can adopt in the operating theatre.

Chapter 22 - Optimising The Potential Of The Facilitated Reflection Tool

This chapter discusses three further themes for optimising the potential of the facilitated reflection tool – the suggested physical environment for the facilitated reflection tool, closure of the actual simulation experience and faculty development training on the facilitated reflection tool itself.

22.1 Physical Environment

This physical environment for the facilitated reflection tool needs to be conducive to learning as discussed in Chapter 5. It is going to vary according to the resources available.

The ideal environment should be in a separate venue to the actual simulation that is comfortable and non-intimidating. This enables learners to compartmentalise intense emotions associated with the simulation and focus on reflecting from the experience. Furthermore it has the logistical advantage of enabling the next group of learners to participate in the simulation experience if resources permit (Fanning and Gaba, 2007).

It has been suggested in gaming simulation literature that learners and teachers sit in a circle without gaps. It is postulated that this effect avoids "energy gaps" and dissolves barriers of power and authoritarianism with a focus on community of practice learning (Steinwachs, 1992).

Clapper (2010) interestingly postulates that learning involves all senses including taste, sound and touch and hence learners

possibly may view the simulation more positively if all senses are embraced. It is conceivable that a good lunch may leave learners with favourable emotions, however there are obvious implications of cost and time.

22.2 Closure Of The Simulation

Achieving transformative learning in simulation requires not only optimisation of the simulation itself to be conducive for learning but the overall experience of the simulation should be a strong stimulus for experiential learning (Glowacki-Dudka et al., 2012). This involves multiple factors such as organisation of the day, faculty who have the necessary educational and subject expertise, allocation and appropriate closure of the simulation.

Closure of the debrief and simulation experience is often neglected as an afterthought. Effective closure ensures the objectives of the simulation have been met but also unresolved emotions or cognitive conflicts that have not yet been explored should be addressed. This strengthens the argument further for a separate debrief to the facilitated reflection tool. Closure should also try to identify what practices from the simulation experience would motivate learners to return (Reed and Koliba, 1995, Clapper, 2010)

An effective closure of the simulation experience should include conclusion and articulation of crucial learning points, such as reinforcing key strategies that have been discussed to transfer skills into the operating theatre, an appreciation of learner involvement with the simulation experience and direction to further resources if needed (Gum et al., 2011).

22.3 Faculty Development Training On The Facilitated Reflection Tool

Having developed the tool for facilitated reflection it is necessary to discuss the necessity and challenges of implementing training for surgical teachers who will be engaging with the tool.

Mezirow (2000) suggests understanding transformative learning is the "*business*" of all adult educators (Mezirow, 2000). However, this concept needs to be pragmatic given that educators in this context are often serving a multitude of other roles and the surgical teachers in laparoscopic simulation are unlikely to have careers as educators as their sole profession.

Furthermore even teachers who have a role in education in a full time capacity and adopt transformative learning are given little support to manage as Taylor (1998) describes "(training in) *the ethical and emotionally laden minefield of practicing transformative learning*".(Roberts, 2013, Taylor, 1998)

Facilitated reflection that achieves transformative learning requires establishing an authentic, meaningful, positive and productive relationship with the learner. There can be many reasons why this would be difficult to achieve such as limitation of time, learner/surgical teacher diversity, lack of surgical teacher expertise amongst faculty. It is anticipated that preparation through pre-briefing and judicious simulation faculty training in learner diversity, may facilitate in establishing such a relationship between the surgical teacher and the learner (Santiparp et al., 2014).

Surgical teacher training workshops are increasingly popular in medical education and attendance often a mandatory requirement

for appraisal. There is evidence of improved learner performance, when medical educators engage in such workshops compared to self-directed learning on educational methodologies or similar interventions (Jafri et al., 2007).

Training in assessment tools such as workplace based assessments, have one day training workshops for teachers supplemented with e-learning (Anderson et al., 2009). However this does require surgical teachers to be free from other commitments such as clinical work as well as resources available to facilitate this.

Even with surgical teachers attending such workshops there is evidence to suggest that surgical teachers still only feel comfortable using new educational tools that involve phenomena such as facilitated reflection, through experience of using the tool and having the presence of an expert in the tool (Fanning and Gaba, 2007).

Cheng et al (2015) review article discusses training in debriefing for medical educators and suggests using video to record the teacher debriefing can promote self-reflective activity in the teacher and this in combination with feedback from other educators can provide an individualised training faculty development program (Cheng et al., 2015).

When designing the methodology to explore the outcomes of the facilitated reflection tool, this will need include designing a robust and comprehensive faculty development program for training surgical teachers in the facilitated reflection tool.

Chapter 23 Limitations And Challenges Of The Facilitated Reflection Tool

In addition to the individual, institutional and cultural barriers of reflection discussed in Chapter 4, this chapter explores some of the challenges and limitations specific to the facilitated reflection tool. Seven conceptual themes were identified from the previous discussions and the literature – **reflection**, **the surgical teacher**, **setting standards, time and conflict of roles, the learner, video technology** and **Non-technical skills.**

23.1 Reflection

23.1.1 Reflection Pre-Action

As identified in the literature review studies exploring the role of reflection, in all forms of simulation including surgical simulation, have almost exclusively focused on reflection on action, occurring predominantly during the debrief phase. There is theoretical justification as well empirical evidence from the literature to support exploring reflection before the actual simulation – reflection pre action (Burns, 2015, Stephenson and Poore, 2016)

Reflection pre-action i.e. before the simulation experience allows learners to explore learning objectives, actively seek knowledge gaps and allow learners to reflect on their own perception of self-efficacy prior to the simulation (Rashid, 2017, Stephenson and Poore, 2016, Rudolph et al., 2014).

Fostering transformative learning in simulation should not just focus on what experiences trigger the disorienting dilemmas. There

should be a focus on what shapes these disorienting dilemmas and how to ensure they are noticed (Taylor, 2007). Reflection pre-action with a surgical teacher can prime the learner for this.

It is clear the establishment of a robust surgical teacher / learner relationship as well as learners feeling safe in a group is crucial for transformative learning. These relationships which require time to develop ideally should originate before the actual laparoscopic simulation. Prior to the simulation learners should feel safe and free to engage in open dialogue with surgical teachers and the group and avoid unstated assumptions that detract from valuable learning opportunities (Debra and Annette, 2014).

23.1.2 Facilitating Reflection In Action

Sanfey et al (2013) postulates that the expert surgeon is able to reflect both in action as well as on action. Reflection in action shortens the learning curve for achieving automaticity during the live simulation whilst reflection on action informs future experience through reasoning and critical deliberation of the event (Sanfey et al., 2013).

Facilitating reflection in action is a theoretically contentious minefield with some scholars believing that such a phenomenon cannot exist as it is both automatic and innate and hence conceptually flawed (Eraut, 1995).

23.1.3 Necessity Of Critical Reflection

In this thesis Mezirow's model of critical reflection has been integrated into the facilitated reflection tool. However there is an

assertion in the literature, that the level of reflection desired from the learner, needs to match the outcomes expected (Ambrose and Ker, 2014). Critical reflection could be considered necessary when a change in attitude is desired such as in Scenario 1 (Chapter 21) where the learners presuppositions towards surgical practice have been transformed and has future implications on surgical practice. However when an immediate change of behaviour is desired, this requires lower levels of reflection such as in Scenario 2 where the learner changes the angle of insertion of the Veress needle through "ordinary" reflection (Ambrose and Ker, 2014).

In the context of laparoscopic simulation, it is arguable that both reflection and critical reflection should be integrated with the facilitated reflection tool given that a sustained change of future attitudes as well as behaviours is a desired learning outcome.

23.2 Surgical Teacher

23.2.1 Educational vs Subject Expertise

Throughout this thesis the educational expertise required of the surgical teacher has been extensively discussed, however subject expertise are equally vital for laparoscopic simulation to achieve its learning outcomes and its essentiality cannot be overstated. It is important that subject matter is not partitioned or neglected but needs to be tactfully integrated into the facilitated reflection discourse (Reed and Koliba, 1995). Otherwise the facilitated reflection tool risks being decontextualized from the simulation experience and overall learning goals.

Getting surgical teachers who have this balance of subject and educational expertise is going to be a major challenge for the facilitated reflection tool. Recognition for the need of educational expertise not only in surgery but in fact even laparoscopic surgery specifically is increasing (Silvennoinen et al., 2009, Sadideen and Kneebone, 2012). However, many laparoscopic simulation activities still lack educational design and a curriculum despite the growing evidence base for this (Kolozsvari et al., 2011).

Arguably the greatest challenge of implementing the facilitated reflection tool is going to be encouraging key stake holders in surgical education the need for this paradigmatic shift and supporting them through this transition.

23.2.2 Surgical Teacher Self-Efficacy

Sukhato et al (2016) conducted a mixed methods study exploring the surgical teachers perceptions of facilitated reflection with medical students. This findings highlight that surgical teachers may experience feelings of consternation or confusion with an educational tool such as facilitated reflection. The surgical teacher may feel unsure whether they have the competency to execute the tool functions and this is exacerbated if they are limited by experience or training in the tool (Sukhato et al., 2016).

23.2.3 Neutral Environment

The ambiguous term neutral environment is often asserted in the literature when applied to facilitated reflection. Surgical teachers may feel that to achieve a neutral environment, they have to try and negate the effects of cognitive conflict within the learner.

However, this has been shown to not be conducive to instilling reflection in the learner (Sandars, 2009). A pragmatic approach to this term neutral environment would be that learners engage in a contract with surgical teachers built on mutual respect and honesty and valuing the agenda and opinions of each (Reed and Koliba, 1995, Sandars, 2009).

23.3 Learner

23.3.1 Perceptions Of Simulation

Suspension of disbelief and the proactive participation of the learner and the surgical teacher in simulation has been repeatedly cited to be critical to achieve effective learning in simulation. Learners must feel connected to the experience to achieve transformative learning. Certain learners despite a positive learning environment and support and guidance from a surgical teacher may still struggle to engage in this fictional contract reducing the value of not only facilitated reflection but the overall simulation experience.(Gum et al., 2011)

Learners who have a positive view of the facilitated reflection tool are more likely to have positive mental models and gain the most value. Conversely learners who are adverse to the tool are less likely to benefit (Kleinheksel, 2014). The surgical teacher does have a crucial role in portraying the use of the tool in a positive light and learners are more likely to engage if they can relate to "infectious enthusiasm" from surgical teachers (McGlinn and Chung, 2014). However there will be learners who despite this will still formulate a poor opinion of the facilitated reflection tool and are less likely to engage with it.

23.3.2 Learner Anger

There is some suggestion in the literature that facilitated reflection in simulation may result in learner anger or frustration at the surgical teacher that cannot be abated or pacified. This could be due to reasons such as the learner lacking "emotional maturity" as described in Chapter 9 to manage the challenges of the disorienting dilemma (Roberts, 2013) or discontent with feedback from the surgical teacher or humiliation at the limitations of their knowledge or skills (Cheng et al., 2016, Parker and Myrick, 2010) .

This anger and frustration could also spill over into the discourse at any stage either with the peer or with the teacher. Transformative learning relies on trust with one another to manage conflict during discourse (Mezirow, 2000). However, trust between a surgical teacher and learner in a clinical setting is built on a variety of factors such as familiarity, empathy, openness and is reciprocal in nature and takes time to develop. (Sklar and McMahon, 2019).

Another strategy that has been suggested for managing conflict during discourse is "power sharing" where the opinions and beliefs are reciprocally valued between the learner and the surgical teacher with a negotiation when a disagreement or conflict occurs built on mutual respect (Leach et al., 2001).

Nevertheless learners are humans who are prone to dislikes and disagreements (Newman, 2010). It is hoped that a cohesive community of practice is achieved through joint enterprise, mutual engagement and a shared repertoire combined with the learner population demonstrating high levels of professionalism as would

be expected from postgraduate gynaecologists in training (WHITE, 2004).

23.3.3 Community Of Practice

There is some suggestion that learners who are from a very different background to what normally would be expected may struggle with similar tools such as this one (Roberts, 2013). For example an international learner who has never participated in simulation and traditionally has only learned laparoscopic skill through the Halstead master-apprentice model may find the tool quite alien and struggle to embrace the ideology and advantages of investing in active reflection. This is further compounded by any potential language barriers (Roberts, 2013).

This is why it is crucial during the planning stage of the simulation learning environment discussed in Chapter 2, thought must be given by the faculty towards the diversity of learners that would be expected to attend that specific simulation and how they will form a community of practice.

23.4 Standards

Setting standards for transformative learning and critical reflection can be challenging as this relies on the learner conforming to the standards defined by the facilitated reflection tool. This appears to be at odds with the principle of empowering a learner centric environment.

Freire (1970) discusses the concept of “banking education”. In this context he describes teachers focusing on learners achieving demonstrable outcomes from a tool such as facilitated reflection,

restricting freedom for critical thinking and not truly embracing the conceptual value of the facilitated reflection tool (Freire, 1970).

For example the surgical teacher may engineer the discourse focusing only on technical skill improvement that would be demonstrable if the simulation was repeated, rather than a holistic view of transformative learning where learners question their underlying presuppositions. Not approaching transformative learning holistically has been a significant criticism of empirical research exploring transformative learning and critical reflection (Taylor, 2007).

23.5 Time And Conflict Of Roles

All the simulation studies suggest that time is a pre-requisite for transformative learning to occur. Critical reflection, mental processing and formation of mental models are all stifled if the simulation experience is rushed (Fannon, 2004, Kleinheksel, 2014).

The addition of an extra step in the simulation program with the facilitated reflection tool and a separate debrief is likely further limit time for these processes. This is further exacerbated by the strong suggestion of providing an opportunity to repeat the simulation exercise.

However the opportunity to repeat the simulation is vital to completing the loop of transformative learning and the evidence for iterative exposure to simulation and higher learning outcomes has been discussed in Chapter 2.

It is arguable regarding the function and the need for a debrief following facilitated reflection. However a separate debrief ensures any remaining doubts are clarified, continuation of any rich reflective discussions discovered from the facilitated reflection tool, an opportunity for learners to feedback to faculty and suggest improvements for the simulation as well as a platform to undertake any assessments needed such as workplace based assessments from the training curriculum.

The conflict of educators role can greatly limit time as well in the simulation. The surgical teacher may have to offer technical support to the simulation experience, undertake summative assessments which may be detrimental in engaging with learner reflection and potentially managing several learners at the same time (2016, Reed and Koliba, 1995, Nickel et al., 2014). Managing a multitude of roles threatens the viability of the facilitated reflection tool.

Arguably this is the greatest challenge with facilitated reflection in laparoscopic simulation. Limiting time can result in greater cognitive errors, premature closure of dialogue and restricted learning outcomes. A much needed change in education policy to ring fence time for facilitated reflection in simulation may alleviate this dilemma but it is still likely to remain a significant challenge for surgical teachers and learners.

23.6 Video Technology

As discussed in the literature review, using video technology requires explicit consent of both faculty and learners, compliance with the general data protection regulation act, and familiarity with

the technical aspects of video technology (Paige and Chauvin, 2008). Failure to not anticipate and prepare for these factors not only restricts the use of video technology but potentially could drastically undermine the value of a simulation experience with video technology.

23.6.1 Intimacy Of Being Recorded

Video technology that records individual performance will be intimate, private and expose vulnerability in the learner. Learners understandably may be reluctant to share such personal information with either peers or surgical teachers especially when they feel they are in an unsafe environment.

However, as discussed in Chapter 18 it is being increasingly accepted in simulation that non-judgemental feedback and debrief is conceptually flawed as it results in omission of critical insights or "sugar coating of the subject"(Rudolph et al., 2007). Surgical teachers and peers should feel empowered to be able to share critical insight with learners under a pretext that as Rudolph et al (2007) aptly describes the learner is "*operating with good will and is trying to do the right thing*."(Rudolph et al., 2007)

Team based surgical simulation ,where peers and surgical teachers observe learners developing procedural skills as one part of the overall simulation activity, has shown a positive improvement in learner performance of these skills (Koutantji et al., 2008). Furthermore, both peer and surgical teacher observation of an individual learners laparoscopic simulation performance has received positive learner feedback in several laparoscopic simulation studies with increased learner motivation, self-efficacy

and camaraderie cited. (Ahlborg et al., 2015, Vedel et al., 2015, Lehmann et al., 2018, Porte et al., 2007)

Nevertheless it is a pre-requisite learners have the opportunity not to consent to their video being shared with the group. However, they should still have the opportunity to have an active and meaningful participation in the discourse and overall learning.

23.6.2 Hawthorne Effect

One limitation of video recording may be the Hawthorne effect. This involves learners modifying their behaviours as a result of being observed through the video recording. However evidence from simulation studies suggest the impact of this is minimal in affecting translational outcomes from simulation to the clinical setting (Sirihorachai et al., 2018, Scherer et al., 2003).

23.6.3 Video Technology & Transformative Learning

The use of video technology in conjunction with a tool such as facilitated reflection requires surgical teachers to be comfortable in such an environment. The surgical teacher needs to not only have an understanding of the facilitated reflection tool but also how video can amplify this process and a familiarity with the technology. (Ha, 2014, Gum et al., 2011)

23.7 Non-Technical Skills

Laparoscopic surgery involves more than just mastering procedural skills, it is embedded in an complex environment drawing qualities such as interprofessional communication, insight and ergonomic

awareness (Hull et al., 2012). Simulation of laparoscopic surgery therefore should not be reduced to replication of isolated skills such as manual dexterity but instead foster changes in behaviour that are likely to lead to lifelong learning (Kneebone, 2009).

The evidence for non-technical skills in surgery is increasing with stronger evidence to support their role in safety. Furthermore, as evidenced from the literature review in Chapter 4, non-technical skills can scaffold and inculcate active reflection in the learner. Once the facilitated reflection tool has been validated, this may be another promising avenue to explore.

Chapter 24 – Conclusion

This chapter will explore what this thesis adds to the literature as well as the exploration of a research paradigm for the future pilot study that validates the facilitated reflection tool in laparoscopic simulation and corresponding possible outcomes.

24.1 What Does This Thesis Add?

This thesis has designed a facilitated reflection tool, underpinned by educational theory, using video technology in a laparoscopic simulation context. No other tool, or similar, that explicitly serves this function and purpose within this context, has been identified in the literature either as a theoretical construct or as part of an empirical study.

Furthermore, this thesis has also addressed three other significant gaps in the literature in relation to laparoscopic simulation - the need for a surgical teacher to develop reflection, the relevance of emotion and its relationship with reflection and the design and construction of educational tools in such a context.

24.1.1 The Need For A Surgical Teacher

Facilitated reflection in laparoscopic simulation, shows potential for achieving higher learning outcomes through transference of learning and behaviours into the operating theatre. The results from the critical review in surgical simulation validate this potential.

However, this facilitation requires a surgical teacher with both subject and educational expertise. The need for surgical teachers is not just restricted to facilitated reflection, but also for imparting theoretical knowledge and skills, role modelling for learners, designing laparoscopic simulation in conjunction with its curriculum, planning and evaluating such a curriculum and organising faculty development programmes for laparoscopic simulation (Crosby, 2000). It is not suggested that all these roles are accomplished by one individual but a comprehensive laparoscopic simulation activity should be governed by a faculty who have a consortium of these skills.

Furthermore, conducting such research as this may act as a stimulus for a much needed paradigm shift, that encourages stake holders to invest in educational research and ensures the progeny of surgical teachers who can support the delivery of education to the current and future generation of trainees.

24.1.2 Emotion And Reflection In Laparoscopic Simulation

There is limited discussion in the literature regarding learner emotion and laparoscopic simulation. Not only can learner emotion affect the ability to reflect, it can impact task performance in laparoscopic simulation as well as in the operating theatre (Rogers et al., 2011).

Negative learner emotions can threaten learner psychological safety if the learner is left feeling vulnerable. Whilst it is not suggested that objective discourse should be avoided to prevent precipitating negative learner emotions, the discourse should be

based on principles of good judgement described in Chapter 18. The need for surgical teachers who can understand the role and significance of learner emotion, support matching of this emotion with meaning and follow principles of good judgment during this communication is clear.

The evidence base and need to understand learner emotion in surgical education is growing and laparoscopic simulation activities should take accountability for ensuring learner psychological wellbeing.

24.1.3 Construction And Design Of Educational Tools In Surgery

Recent advances in surgical education has seen a plethora of educations tools developed that structure earning or feedback. However, the processes involved in designing and constructing these tools as well as the implementation of any educational theory or research, is greatly lacking.

By researching and selecting a theoretical orientation, constructing a conceptual framework and integrating this into a logical and practical design, subsequent educational tools are grounded in theory, backed by existing educational evidence, have validated instruments to measure outcomes and ensures overall academic credibility and legitimacy of the tool.

Chapter 25 Future Work

This chapter discusses the proposed study design for evaluating the facilitated reflection tool as well as future exploration of research within this field.

25.1 Designing A Study Evaluating The Facilitated Reflection Tool

The foundation for designing such a study will be based on its underlying research paradigm. The proposed methodology, suggested outcomes and instruments to measure these outcomes are also discussed in this section.

25.1.1 Research Paradigm

Illing (2010) discusses the term "research paradigm" and describes it as "*a set of beliefs and dictats that influence what should be studied, how the research should be conducted and how the results should be interpreted*". This is important to justify the theoretical perspectives that underlie the chosen research methodology (Illing, 2010).

Qualitative research is viewed with an interpretivist paradigm that has an inductive epistemological stance compared to quantitative which has a positivist approach and is considered as deductive (Illing, 2010). The perceived dichotomy of the two can restrict researchers exploring the broad possibilities of complicated phenomena such as facilitated reflection where a single method may potentially be deficient (Glogowska, 2011).

The research paradigm suggested for the proposed study is pragmatism. In the pragmatism paradigm there are no philosophical or theoretical restrictions and freedom is given to designing the methodology that best explores the research question (Glogowska, 2011).

25.1.2 Proposed Methodology

Though exploring the methodology in detail is beyond the scope of this research, one suggested research methodology – mixed methods with triangulation is briefly summarised here. Mixed methods research methodology follows a pragmatism paradigm where the methodology is the one that is most apt at answering the research question (Glogowska, 2011, Illing, 2010).

Mixed methods research methodology facilitates critical inquiry into complicated phenomena, such as facilitated reflection, using a structured and pragmatic approach. The research question is central to the research design with careful integration of both qualitative and quantitative data, unravelling the dichotomy between them, without restriction of outcomes (Glogowska, 2011, Johnson et al., 2007).

The study design should be initially piloted as cross sectional rather than longitudinal due to timing and costs involved surveying participants over a long period of time (Lundgren and Poell, 2016). Triangulation is the commonest model used in mixed methods research methodology where data is collected with a single population over a short period of time -ideal for the study design. Triangulation ensures the data from one method cross

checks and validates data from another, overall supporting the congruence of the research findings.

This methodology has been validated in laparoscopic simulation to explore other related educational phenomena such as self-efficacy as well as in other empirical studies exploring the phenomenon of facilitated reflection (Ahlborg et al., 2015, Fuller et al., 2015).

25.1.3 What Are The Suggested Outcomes For The Facilitated Reflection Tool And Respective Instruments To Measure Them?

The two most pertinent outcomes suggested for validating the facilitated reflection tool are the development of learner critical reflection and the enhancement of procedural skills that can be replicated in the operating theatre. However, other outcomes such as learner self-efficacy, flow, learner and faculty feedback, acceptability of the tool, feasibility of implementation including costs and system responsiveness, are equally relevant.

Exploring these outcomes using short term methods such as conducting a pre-test post-test study of task based performance with a laparoscopic simulator, may not represent the complexities of these outcomes (Norman and Eva, 2013). However, it is equally not pragmatic that the study design is longitudinal in order to achieve Kirkpatrick Level 4 outcomes such as patient outcomes.

The Operationalization Of Critical Reflection

Measuring the degree of learner reflection has been suggested in medical education literature as fundamental to analyse following an educational intervention that involves reflection.

However, critical reflection as discussed in chapter 12 is highly complex multidimensional matrix of metacognitive processes. Critical reviews analysing empirical studies on critical reflection have repeatedly found it difficult to identify and quantify critical reflection with no clear and valid single reliable instrument to measure its effect (Taylor, 2007, Lundgren and Poell, 2016).

To gain a more accurate depiction of learners reflection, it is likely mandate using multiple instruments that are validated and established as well as utilising several data collection pathways (Lundgren and Poell, 2016). Possible instruments include Kember's scale to measure reflective thinking which demonstrated reliability and validity in measuring critical reflection in simulation (Tutticci et al., 2016, Kember et al., 2000) as well as Cook's (2010) reflection rating rubric ,which demonstrated high interrater reliability, in a study involving critical reflection and transformative learning processes during virtual patient simulation(Cook, 2010, Kleinheksel, 2014).

Instruments To Measure Procedural Skill Development

As discussed using a pre-test post-test study design of procedural skill before and after simulation would add external influences on the learning during simulation and pre-test performance itself will affect post-test performance. It is therefore suggested that procedural skills are assessed in the operating theatre (Cook and Beckman, 2010). The case for this is further reiterated as

simulation needs to transfer learning and behaviours into the operating theatre. However, this would necessitate a control group which is a challenge in itself that would need to be addressed in the methodology.

One suggested instrument to assess laparoscopic procedural skill is the Global Operative Assessment of Laparoscopic Skills (GOALS) (Vassiliou et al., 2005) shown in Figure 25.1. The reliability and validity of GOALS has been established through more than a decade of research and has shown construct validity with both novice and experienced learner populations (Kramp et al., 2015, Hogle et al., 2014).

The alternative would be to consider the Objective Structured Assessment Of Technical Skills (OSATS) as described in Chapter 2. Whilst there is evidence for validity and reliability of OSATS, there is a wide variation in the content, structure and anchors of OSATS. This is compounded with limited evidence found in the literature regarding the validity or reliability of this specific laparoscopic surgery OSATS that is used in the UK postgraduate Obstetrics & Gynaecology curriculum (Patel et al., Kilani, 2018). However using OSATS may be more feasible than GOALS given that it is already imprinted into the curriculum.

Depth perception

1. Constantly overshoots target, wide swings, slow to correct
2.
3. Some overshooting or missing of target, but quick to correct
4.
5. Accurately directs instruments in the correct plane to target

Bimanual dexterity

1. Uses only one hand, ignores nondominant hand, poor coordination between hands
2.
3. Uses both hands, but does not optimize interaction between hands
4.
5. Expertly uses both hands in a complimentary manner to provide optimal exposure

Efficiency

1. Uncertain, inefficient efforts; many tentative movements; constantly changing focus or persisting without progress
2.
3. Slow, but planned movements are reasonably organized
4.
5. Confident, efficient and safe conduct, maintains focus on task until it is better performed by way of an alternative approach

Tissue handling

1. Rough movements, tears tissue, injures adjacent structures, poor grasper control, grasper frequently slips
2.
3. Handles tissues reasonably well, minor trauma to adjacent tissue (ie, occasional unnecessary bleeding or slipping of the grasper)
4.
5. Handles tissues well, applies appropriate traction, negligible injury to adjacent structures

Autonomy

1. Unable to complete entire task, even with verbal guidance
2.
3. Able to complete task safely with moderate guidance
4.
5. Able to complete task independently without prompting

Figure 25.1 GOALS assessment taken from (Vassiliou et al., 2005)

25.2 Exploration Of Future Research In This Field

The primary aim of this thesis of designing a facilitated reflection tool for a laparoscopic simulation activity has been achieved. However through this programme of research, a framework for the construction of educational tools based on underlying theory, an understanding of the role of teachers in surgical education and an exploration of learner emotion in laparoscopic simulation has also been accomplished.

It is envisaged that the facilitated reflection tool will not be restricted to improving learner outcomes in laparoscopic simulation alone. There will be several transferable skills and benefits that accrue from utilisation of the tool such as faculty development, robust simulation design and potentially an increased awareness amongst key stakeholders regarding the need for delivering high quality surgical education.

Though the tool has been designed for a laparoscopic simulation activity, it is conceivable the tool could have a wider application and be adaptable in other procedural simulation activities such as venepuncture or catheterisation. However the theoretical construction of the tool is based on a population of postgraduate learners and focuses on individual rather than group reflection. Therefore this must be carefully considered before arbitrary use in every simulation activity.

The facilitated reflection tool itself could be enhanced further through the potential use of virtual patients. This has already been shown to enhance facilitated reflection by supplicating well designed instructional feedback to leaners contemporaneously (Kleinheksel, 2014, Lee et al.). Furthermore the addition of

complex learning tasks to simulation, which can be achieved through utilisation of virtual patients, has been shown to promote higher levels of reflection in the learner (Tremblay et al., 2019).

The uncertainty of novel education tools, including simulation itself, in improving outcomes, has led to scepticism and subsequently a reluctance of key stakeholders to engage and fund such learning activities (So et al., 2019). There is an urgent need to implement effective research approaches to evaluate such tools.

One approach that could be considered to understand the potential of the facilitated reflection tool is to use a realist approach towards analysing the tool. This is summarised as a "what works for whom, how and in what context" (Charles et al., 2015). This programme of research can be complex with a requirement of researchers with expertise in this field (Wong et al., 2012). However the findings from using a realist approach can uncover rich information on how effective such a tool is, when, how and with whom to use such a tool and the mechanisms of the tool that leads to changes (Wong et al., 2013)

As is evident from this thesis, this field of research warrants a close collaboration between clinicians and educational researchers. Ultimately exploration in this field of research could advance patient safety enabling surgical learning to be both ethical and effective.

Thesis Summary

There may be understandable apprehension and consternation for stakeholders, the faculty who deliver laparoscopic simulation, as well the learners who attend such activities to integrate and use such an intervention as the facilitated reflection tool into laparoscopic simulation due to the reasons discussed in Chapter 23.

However, it is hoped that designing the facilitated reflection tool, with a solid theoretical grounding backed by existing educational research, will allay some of these concerns by demonstrating compelling academic legitimacy and credibility.

Furthermore, as Mezirow himself asserts "*only through reflection, active learning, and placing ourselves in an uncomfortable situation are we fully able to develop our understanding of the world and of ourselves* (Mezirow, 1991)" and this true for learners, teachers and stakeholders.

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