Gifting memory palaces:

Factors which support the retrieval of clinical information using mnemonics

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ABSTRACT

Background

Mnemonics (or memory aids) have been used in education and have shifted in popularity in their use over time. They have been criticised in the educational literature for being a surface learning tool. Although there is literature extoling their virtue as a memory recall device. Their use in medical education is documented and there is some literature in nursing education surrounding the use of acronyms (mostly first letter mnemonics). However, this is largely related to passing over information (handovers) rather than vital clinical information. Mnemonic use is documented in public health initiatives (Act FAST for stroke recognition, Back-2-Sleep for sudden infant death) aimed to permeate the public consciousness. Research surrounding mnemonics in nursing focuses on professional discussion articles, with a dearth of primary research within the discipline. This study challenges the orthodoxy surrounding mnemonics from their use in education, to wider nursing and public health patient safety messaging by exploring the factors that influence student nurses' knowledge retrieval using mnemonics.

Cognitive load theory indicates that extrinsic loading of background "noise" or lack of attention can affect memory and in clinical practice, this can have fatal consequences. Selective attention theory is paramount if recognition of patient deterioration is to be timely. Within healthcare, there is an increasing focus on sepsis as a life-threatening illness, with high rates of morbidity and mortality. The challenges of early recognition and response are well documented. Human factors have highlighted that clinical decision-making relies not only on

early warning scores and sepsis care bundles but also on attention to important situational “flags”, which are often missed by staff in key positions who could intervene early in the sepsis trajectory. Staff who are placed in this clinical situation are often students or healthcare assistants, charged with recording clinical observations and recognising deterioration. Educational and healthcare literature has suggested that the use of mnemonic devices as a memory aid may assist in the retrieval of clinical information in such time-critical clinical situations.

Aim

This study explores the factors associated with the retrieval of clinical information and mnemonic devices among student nurses.

Method

The underpinning philosophical approach to this study was pragmatism as defined by Dewey (1903), as a ‘real world’ understanding of the research in both educational and clinical settings was required. A mixed methods sequential design was used to gather data from a sample of 47 undergraduate student nurses on their Masters of Nursing programme, from the three branches (adult, mental health and child). The quantitative part of the study used an Objectively Structured Clinical Examination (OSCE) scoring tool to gather data at three time points: pre-examination, during the OSCE examination and 12 months post-examination. The scoring tool consisted of questions surrounding sepsis recognition, the use of a sepsis mnemonic (O_2 FLUID) based on the sepsis six care bundles and a ROME mnemonic (respiratory blood gases). The ROME mnemonic was used as a control, as

this was not part of the students' taught module content. This data was used to inform the design of semi-structured interviews for the qualitative part of the study. Semi-structured interviews took place with nine participants from the Masters of Nursing programme, exploring the use and influence of mnemonics in clinical practice and on students' professional development and their own learning.

Results

A number of statistical tests were used to analyse the quantitative results, indicating that the use of the O_2 FLUID mnemonic shows higher retrieval during the OSCE examination and remains high 12 months later (for mnemonic word usage). The use of the ROME mnemonic shows poor retrieval across the three time points. Retrieval of the full O_2 FLUID mnemonic was highest during the OSCE examination phase of data collection. The total knowledge scores in relation to sepsis dropping by over half at the last stage of data collection. However, the words representing each letter of the O_2 FLUID mnemonic show higher retrieval levels than the first letter of the mnemonic or the details associated with it of how to undertake treatment. This is an unusual finding for a first letter mnemonic. Hierarchical cluster analysis tests revealed that science-based undergraduate degrees are a significant cluster. Clinical placements, specifically medical, surgical and paediatric placements also appeared to be a significant cluster. Within these placements, exposure to the O_2 FLUID mnemonic is higher, due to the sepsis care bundles / treatment associated with its use in an acute sepsis management situation. For the qualitative strand, the semi-structured interviews were transcribed, coded, categorised and themed using thematic analysis. Three main themes emerged

prior mnemonic use; the significance of the mnemonics to learning; and the role of visual learning in mnemonic use and development.

Conclusions

The findings indicate that a number of factors influence the retrieval of vital clinical information. This study found that many students valued mnemonics as active learning tools and strategies to develop their future learning and practice. Nursing students who had prior experience of mnemonic use value this learning tool. In addition, some students spoke of seeing previous septic patients they had cared for in their “mind’s eye” and used this memory as a “trigger” or “hook” when using the O_2 FLUID mnemonic. However, not all students had such a memory. Therefore, this thesis recommends that instructional design for simulated mnemonics may be used as a framework to support future learning and rethinking of how mnemonics could be taught with nursing students. Future research may focus these findings more broadly in higher education contexts. The findings and reviewed literature suggest that mnemonics are a multi-dimensional learning tool, often used in a unidimensional manner. The proposed design framework is an amalgamation of simulation, metacognition, cognitive load theory and selective attention theory, encompassed in an instructional design approach. This could provide students with a facilitated “memory palace” based on a chosen mnemonic. Thus gifting students with a learning tool/ mnemonic device which can be used not only to pass summative examinations but to save lives, by maximising accurate and timely recall of vital clinical information in clinical settings.

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Declaration

I declare that the work contained in this thesis has not been submitted for any other award and that it is all my work. I also confirm that this work fully acknowledges the ideas, opinions and research of authors, being referenced within the thesis.

Ethical clearance for my research was granted by Northumbria University ethical committee in March 2014. The research data was undertaken at Northumbria University, as I was a part time PhD student there until transferring to the University of Sunderland. Name: Guy Tucker

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CHAPTER 1 BACKGROUND

1.1 Introduction

This chapter will explore the nature and use of mnemonics in healthcare and nurse education. It will define different types of mnemonic devices, their use in education and society generally together with their usefulness in learning and teaching in medical and nurse education. Despite the fact that teaching using mnemonics has changed over time, the United Kingdom National Health Service (NHS) has promoted the use of such recall devices to both staff and the public as part of the drive to develop safer healthcare and as part of public health campaigns. This thesis will challenge the orthodoxy that mnemonics are of little relevance beyond rote and surface learning as they are increasingly been used within education and wider society as aids to recall important information. This thesis will explore the use of mnemonics related to clinical information and the factors that support the retention of such information. Sepsis, a clinical condition characterised by an intense immune response that leads to significant morbidity and mortality, will be used as a vehicle to highlight the importance of mnemonics in the clinical context and as part of wider patient safety messaging. At the start of my research journey, clinical recognition of sepsis was still developing within nurse education and clinical practice. The issue of sepsis is now much more widely recognised. Student nurses play a vital role in patient care and clinical observation, and consequently in recognising and responding to the signs and symptoms associated with sepsis.

The vast amount of information student nurses are required to recall during their training, often in stressful and time dependent situations requires cognitive “off-loading”. As this thesis was being written, there has emerged a proliferation of mnemonics related to sepsis, with an increased focus on the condition within both acute and community services. With this in mind, this chapter will end with a review of why research into the use of mnemonics is important and why it is necessary to identify what factors influence and aid recall of vital clinical information.

1.2 Defining mnemonics

The word "mnemonic" is derived from the ancient Greek word “mnemonikos”, meaning "of, or relating to memory" and is related to Mnemosyne (remembrance), the name of the goddess of memory in Greek mythology. Buzan (2000) describes the Greek philosophers’ idea that memory has three distinct pillars: association (the brain creating links between objects); image (multisensory to aid memory recall); and location (memory located in a special place). Worthen and Hunt (2011) define mnemonics as techniques or strategies consciously used to improve memory that is a memory aid. Neurophysiology, cognitive neuroscience and psychology have added to this historical philosophy of the mind concerning memory and mnemonic literature.

Teaching aims to improve the retention and recall of information, with educators using a number of strategies at their disposal. Semantically, the following terms share a similar ethos in their educational application:

Mnemonic tools (Bafile, 2005), mnemonic devices (Sokmen, 1997), mnemonic strategies (Mastropieri and Scruggs, 1998) and mnemonic triggers. Teaching materials leave a lasting effect in that they can change the behaviour of an individual. This measurable change detected in the brain or memory may result in behaviour change through the learning process (Metsamurronen and Rasanen, 2018). Although associated with “drill and practice”, there is empirical evidence that supports repetition as having a positive effect on learning (Yonelinas, 2002, Bergerbest, Ghahremani and Gabrieli, 2004). Colbert et al. (2009, p4) define an ac mnemonic as a “device where the type of mnemonic may stand for the information being encoded; at retrieval the full information is recalled”. The following section will provide an example of the different types of mnemonics. These will be discussed in greater depth when discussing the supporting literature and studies in chapter 2. There are four basic types of mnemonic, these are:

1. Method of loci (the journey method);

2. Acronyms;

3. Rhymes and;

4. Chunking.

All of the above may use sub-approaches within the main method, for example: music, name, expression/word, model, mode/rhyme, note organization, image, connection and spelling. For example, an everyday example of an acronym, used in pre-school education to help children remember the colours of the rainbow is: Roy G. Biv. Here, each letter is

assigned to a colour of the rainbow (red, orange, yellow, green, blue, indigo, violet) or a historical example of an acrostic would be Richard Of York Gave Battle In Vain. Another example of an acrostic is the order of the planets in the solar system: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, the first letters of which can be arranged to make up a phrase: “My Very Excellent Mother Just Served Us Nachos”. Like Roy G. Biv and the planets mnemonic, the information matched to these examples are not logical in that nonsensical information links the mnemonic to the “to be remembered” information. Different strategies affect their use, for example: within the acronym mnemonic type, there are peg mnemonics or letter strategy mnemonics, whereby each letter represents the name of the information to be remembered but also spells a word associated with the mnemonic (see further detail in Chapter 2 – Literature review). Such mnemonic approaches have been associated with a higher degree of recall, if representing stronger meaning to the user of the mnemonic (Saber and Johnson, 2008).

The history of mnemonic devices has spanned many centuries; indeed, the presence of mnemonics has been noted in many cultures. The earliest known mnemonics were used in early hunting/gathering communities some 28,000 years ago (D`Errico, 2001). Their methods of recording where game could be located involved notching pieces of wood. Mnemonics grew out of a need for a memory aid, due to advances in communication and socialisation. As a result, external methods of reducing cognitive load were required with internal methods of aiding encoding and retrieval, as natural memory did not match the evolving demand.

The concept of a mnemonic is a sequential word, picture, sound or combination of one or more of these (Saber and Johnson, 2008). Sweda, Mastropieri and Scruggs (2000) define a mnemonic as a learning technique that aids information retention; this may be achieved through associations within the visual, auditory, semantic or kinaesthetic domains of memory encoding. The viewer or user of the mnemonic device applies a level of association between these domains and the information being stored. In essence, complex information is converted into a more simplistic structure using key words/pictures, which have meaning, to recall further information. Research into mnemonics has revealed that they improve memory by capitalizing on naturally occurring memory processes such as visual imagery, organization, and elaborative encoding (Bellezza, 1981, Higbee, 2001, Worthen and Hunt 2011). However, Cornoldi (1988) argues that the real-life value of mnemonic strategies cannot be assessed by laboratory studies alone. An important distinction to make regarding mnemonic use in learning is the single use mnemonic, to remember a one-off fact or a repeated-use mnemonic, the method of loci, a cognitive cuing structure that, once learned, can be used to store different information on different occasions (Putnam, 2015). Although experimental cognitive neuroscience has yielded much in terms of the scientific explanation of mnemonics and memory retention, there is also a need for the study of mnemonics from a social sciences paradigm.

1.2.1 My interest in this topic area as a researcher

My interest in this topic area stems from my own experiences using mnemonics both as a student and an educationalist and my personal view is that they benefited me as a student. Both as a learning aid, to facilitate the retrieval of information under examination conditions. As a clinician using advanced nursing skills that required large amounts of clinical information to be recalled during patient assessment, mnemonic devices aided my recall of information. This ultimately benefitted the patient by enabling me to accurately recall and apply clinical information for diagnostic purposes. As an educationalist, I have used mnemonics to teach students how to assimilate "chunks" of information for storage and later retrieval, in the hope that this helps students use this recalled information to save lives, support informed decisions and delver safe and effective care. However, within the wider educational community their use is variable partly because of concerns that they result in surface learning.

1.2.2 Mnemonics in education

The role of mnemonics in education is well-documented (Levin, 1993, Lorayne, 1990, Manalo 2002, Worthen and Hunt 2011). The deconstruction of complex concepts into manageable "chunks" has been successfully implemented when teaching curricula. The teaching and learning of core subjects such as Mathematics, English and the Sciences has seen the adoption of mnemonic devices in primary and secondary education (Mastropieri and Scruggs, 1999). However, the use of mnemonics within education is not without controversy and acceptance among contemporary

academic communities has “waxed and waned” in popularity and use (Saber and Johnson, 2008). Their value within education has been criticised within the literature (Dunlosky, Rawson, Marsh, Nathan and Willingham, 2013) compared to other learning techniques that are easy to use and applicable to a wide range of materials, such as retrieval practice or spacing (condensed chunks of information repeated three times ten minutes apart with distractors in between). Putman (2015) further highlights how often students use mnemonics, or if such use is correlated with academic performance, is an under researched area. Although there are some studies which have explored their use in a survey by McCabe, Osha, Roche and Susser (2013) of 481 undergraduates revealed that students rated mnemonics as less useful than rereading notes, relating material to themselves, doing practice problems, self-testing, or spacing. First letter or acronym mnemonics appear to be the most widespread using key words then rhymes, with more complex methods of loci, peg system the least used (Soler and Ruiz, 1996). This may be due to their complexity, paradoxical nature, and that due to their complexity educationalists did not favour them during their own studies and subsequently do not expose their own students to these within the classroom setting.

The research pertaining to mnemonic impact on academic performance is unclear with the educational literature, representing a conflicting landscape. Putnam (2015) argues that although there have been studies that showed correlations between mnemonic use and academic performance of grade average increase associated with the recalled list learning items (Carlson, Kincaid, Lance, and Hodgson, 1976 and McCabe et.al. 2013). These do not

show how students are using these in the classroom setting and are not causal. Although the results of some studies do indicate that by providing students with specific mnemonics may lead to improvements on related test question scores (Stadler, 2005). In addition, Sadley (2005) used acronyms with psychology students and Van Voorhis, (2002) used jingles with students to remember statistical information. However, the criticism levelled at mnemonics being memorisation of rote learning, that there is little understanding or higher order thinking attached to their use may be outdated and based on a limited view of their potential in education. Higbee (2001) argues that mnemonics should be used for their intended purpose; they were designed to aid recall and never higher order thinking. Education requires the learning of facts, this in turn may free up memory for higher order thinking, and so in this regard, mnemonic devices may be beneficial to aid learning (Bower, 1973).

There exists supporting literature surrounding the learning of foreign languages and recall of vocabulary using key word mnemonics (Atkinson and Raugh, 1975), Pressley, Levin, and Delaney, 1982). The phonetic structure of the mnemonic complementing the phonetic aspect of learning a new language other than one`s own. However, it has been proposed that first-letter mnemonics, although the most popular amongst students are not effective retrieval cues, and thus will likely not aid recall unless students are already familiar with the material (Carney, Levin and Levin, 1994). Hall (1988) observes how target materials that are not “keyword friendly”, they lack an obvious keyword or are difficult to visualize may not aid recall when using a

key word mnemonic. For mnemonics to be considered an effective strategy there would need to be a trade-off between the time spent learning the mnemonic and the gain in recall. This may be considered a two-part process, with the mnemonic strategy being one stage and then using the mnemonic strategy with the information to be remembered the second. Roediger (1980) argues that a mental palace (method of loci) can be memorised in an evening. Whereas ten item peg list mnemonics requiring minutes to memorise (Elliott and Gentile, 1986). An immediate test using the desired mnemonic having a higher degree of recall of the material (Roediger and Karpicke, 2006). There would be a natural correlation between longer lists and larger palaces taking slightly more time to encode. The association between mnemonic use and lifelong learning is conflicted with some researchers stating that key word mnemonics have a high degree of recall long after the test (Atkinson and Raugh, 1975, Carney and Levin, 2011). Carney and Levin, (1998) asserting that mnemonic use leads to faster rates of forgetting than rote learning techniques. Within education if learners know why, how and when to use mnemonic devices they can aid recall within an educational setting (Putnam, 2015). Outside of the educational environment there has also been media attention regarding the public using mnemonics. How they have permeated into the consciousness of society from a health perspective. The role of mnemonics in education and the recall of information will be explored in greater detail in the next chapter as part of a review of the literature. Having described the use of mnemonics in education the following section will discuss how they have become part of everyday life and part of wider society.

1.2.3 Mnemonics in society

Many people will have used a mnemonic to recall things like times tables often using a musical or singing based approach. It is not uncommon to see individuals reciting in their head the tune in order to identify the correct sum. Mnemonics have become widely used within society because of education but also because of public awareness and public health campaigns.

There have been a number of public health campaigns that have used mnemonics to communicate their important messages. Rowat (2009), advocates using the mnemonic ‘brain attack’, think FAST to enable prompt public responses to strokes. The act FAST campaign aimed to help lay people recognise and respond using key information on the condition of stroke. Each letter stands for a symptom: Face – is there any facial drooping? Arms – can the victim raise their arms above their head? Speech – is the speech slurred? Time – call an ambulance immediately. The campaign was run with the mnemonic alongside striking visual images of a fire in a person’s brain with the strap line: ‘the faster you act the more of the person you save’. The success of this campaign has been difficult to measure, as it relies on ambulance control centres capturing if the FAST mnemonic was used by the person first on the scene, who might not be the person who phoned for help. These public health campaigns such as Public Health England (2009) and (2018) Act Fast campaign to address recognition of stroke and earlier campaigns such as Back to Sleep (1988), Safer to Sleep (1994) to combat deaths from Sudden Infant Death syndrome (SIDS). In addition, more recently targeted campaigns such as surviving sepsis (2016). However, other health-related mnemonics such as CPR have permeated society’s consciousness as more lay people are trained

in first aid at their organisations and workplaces. The evidence of the effectiveness of these and other campaigns will be explored in more detail in the literature review (Chapter 2).

1.2.4 How useful are mnemonics?

Experienced or specialist nurses may rely on pattern recognition to further support prompt decision-making. Wallin, Wilkinson, Longmore and Baldwin (2014) define pattern recognition in healthcare as a systematic approach to support diagnostic reasoning, which in turn may necessitate further clinical actions or treatment. The ability to be able to recognise patterns requires knowledge, clinical exposure and the capacity to act within one`s own professional remit or role. This may be problematic for student nurses, as they may lack the ability to recognise or retain the required information to inform the decision making process. This could be due to time pressures, cognitive overload or being situationally unaware.

Memory recall devices such as mnemonics may be useful in assisting novice practitioners who may be using pattern recognition as part of diagnostic reasoning and decision-making. Cued recognition using a mnemonic as a prompt, may aid recall that is more accurate. Moult (2011) defines cued recall as being presented with a word or information that relates to the information being remembered, this aides the process of memory retrieval. Recognition requires no prompt to aid the recall process. A logical conclusion to draw from this is that a cued memory device, which facilitates recall in a time-dependent

situation, such as those frequently encountered in healthcare, could be of benefit.

1.2.5 Mnemonic use in medical and nurse education

Mnemonics have been widely used in medical education for a number of years. They are so well established that there are entire textbooks based on mnemonics for clinical practice (Bentley and Lovell, 2019) and for clinical reasoning (Lovell, Lander and Murch, 2020). The recall of knowledge is often regarded as a precursor to and a stimulus for action (Bowling, 2009). Indeed, the effectiveness of acronyms in enabling medical students to retrieve knowledge of physiology and in medical training generally is well documented (Brotle, 2011). A pragmatic example of closing any such theory/ practice gap, for example, in recalling the twelve cranial nerves, the medical acronym On Old Olympus's Towering Top A Finn And German Viewed Some Hops. Each letter or word representing one of the twelve cranial nerves to be remembered.

Within nurse education, literature exists on the value of using mnemonic devices, for example the NHS Institute for Innovation and Improvement's (2013) work on SBAR handovers (Joffe et al, 2013 and Kear, 2016).

Within the discipline of nursing mnemonic devices have been used to aid recall in patients who have cognitive decay associated with memory loss and old age (Johnston and Gueldner, 1991). A 2012 study by Soemer and Schwan (2012) found that static visual representation when the pictures had a strong association with the information to be encoded had a statistically significant

positive impact on recall compared to intermittently flashing animated morphs. More commonly used mnemonics in healthcare are acronyms, as defined at the start of this chapter.

Initialisms are often used in healthcare, such as ABC (Airway, Breathing, Circulation) when performing CPR (Cardio Pulmonary Resuscitation). Using such a device can facilitate students' recall of the steps in a critical situation, retrieving key clinical information in a time dependent context. Within nurse education, abstract concepts (such as pathophysiology) may prove more challenging to encode and retrieve due to the association the encoder makes with the volume of information attempting to be stored. Therefore, a device that facilitates this by assigning a visual (picture) or auditory (story) to the information aids greater retrieval at a later point, for example in an examination or test.

Skilled communication is an essential component of pre-registration nurse education (Nursing and Midwifery Council (NMC), 2010). Professionally, a qualified nurse must foster effective communication at all times (NMC, 2015). There are numerous communication techniques and theories aimed at enhancing such skills. One such aid is the acronym SBAR – Situation, Background, Assessment, Recommendation – which is a structured approach to improving the communication of clinical information between healthcare staff at a number of clinical levels, grades, disciplines and professions (Mahlmeister, 2005). There is a paradox that every year millions of patients

worldwide suffer adverse outcomes because of receiving poor communication and the resulting lack of or inappropriate medical care (Spranzi, 2014). The SBAR tool originated from the US Navy and was adapted for use in healthcare by Dr M Leonard and colleagues from Kaiser Permanente, USA. The Institute for Innovation and Improvement's "Safer Care, Leading Improvement in Patient Safety" (NHS, 2013) attempted to integrate the SBAR structure throughout varied clinical environments (see Table 1.0). These environments may be clinical or a "mock" clinical environment, such as a simulated one.

Table 1.0 Component parts of SBAR Mnemonic (Acronym)

Components of SBAR structure
Situation - What is going on with the patient?
Background – What are the clinical facts surrounding the problem?
Assessment – What do you think the problem is?
Recommendation - What should be done to correct the problem?
NHS Institute for Innovation and Improvement (2013)

Kesten (2011) concluded that the SBAR structure could be useful during role-play if being used by student nurses, as it facilitates a structured method of delivering relevant patient information in a quick and logical manner. The Joint Commission, Agency for Healthcare Research and Quality (AHRQ), Institute for Health Care Improvement (IHI), and World Health Organization (WHO) recognize SBAR as an effective communication tool for patients' handoff (Shahid and Thomas, 2018). However, Shahid and Thomas (2018) in their narrative review of the SBAR tool concluded that future research is needed to

assess the impact of the SBAR communication tool on patient outcomes, validation of tool in other subspecialties.

1.2.6 Mnemonics and patient safety messaging

The notion of safety messaging is not particularly well developed in healthcare. Other industries have developed systems of safety messaging to promote vehicle and driver safety (Jaber, Cassidy, Wiilian et al, 2015) and employee safety in the construction industry for example (Health and Safety Executive, HSE, 2005). Safety messaging involves the communication of key safety information to individuals by visual means. Such communication often includes symbols, pictures and words. Some industries have developed more elaborate methods of safety messaging with safety briefings at the start of a shift for example in construction they do safety briefings or toolbox talks (HSE, 2017). The notion of patient safety messaging is interesting as such communication could assist in reducing safety incidents. The Institute for Healthcare Improvement (2004) have outlined a process for safety briefings at the start of shifts in healthcare organisations. The healthcare safety briefings include an element of 'The things people need to be mindful of today..' as a result, they utilise safety messaging to ensure safer care for patients.

The clinical significance of the value of acronyms/mnemonic devices may be linked to clinical areas such as risk reduction. In the United Kingdom, the National Patient Safety Agency (NPSA, 2007a) defines sentinel events as events in which patient death or deterioration occur. The term 'sentinel' is

used, as there is an opportunity to intervene. Studies have shown how ineffective communication between nurses and physicians has been linked to medication errors, patient injuries and patient deaths (Gurses and Carayon, 2007). The NPSA advocates the use of processes and procedures to prevent and reduce the alarming number of fatalities and healthcare-associated delays to treatment because of poor communication. In 2007, as part of its review findings, the NPSA concluded that 576 patient safety issue-related deaths could have been potentially avoided (NPSA, 2007a). Many of these related to miscommunication of vital clinical information (NPSA, 2007b). This underpins the teaching of mnemonics to facilitate retrieval of vital clinical information on the recognition of patient deterioration, early intervention and the management of sepsis, further supporting the importance of this research study.

1.3 The transformation of nurse education

Nurse education has been transformed since the inception of the National Health Service. The nursing paradigm has been shaped by policy, education and the emancipation of the role of the nurse from the doctor's "handmaiden" to skilled nurse practitioner. Nursing has been historically influenced by changes taking place in medicine, along with more updated teaching on nursing skills, students are taught more detailed theory on physiology, pathology, diagnosis, therapeutics and microbiology (Grindle and Dallat, 2000). As nursing is now a graduate profession, the balance between theory and practical elements of nursing curriculum having evolved since the 1990's. Pre the degree profession era, the importance of the quality of educational provision in nursing has been acknowledged. In that, there has always been a

need for good sound education in order to nurse (Loder, 1998). The move towards professionalising nursing as a career and the move to update, enhance and augment standards for nurse education (Nursing and Midwifery Council, NMC, 2019) has evolved to reveal a new paradigm. A new paradigm where holistic individualised care and reflective practice have taken precedence over the knowledge of diseases, which characterised the previous medicalised model of nursing. However, this has not been without tensions within the debate of the balance of a theory and practice split within nursing curricula. Indeed, nursing is a profession, which has been perceived both historically and contemporarily as 'eating its young' (Meissner, 1986; Stanley et al., 2007 and Wolff, Pesut and Regan, 2010). New standards for nurse education require core skills supplemented with effective evidence-based practices. Demonstrated through robust and transparent forms of assessment of nursing students within both the University and the clinical practice environment. Whereby standard programmes of full-time study, nursing apprenticeship programmes and accelerated nursing programmes aim to produce registered nurses who play a vital role in providing, leading and coordinating care that is compassionate, evidence-based, and person-centred (NMC, 2018b).

Indeed, nurse education has equally undergone a transformation from a strong historical focus on a biomedical approach to illness, to a more reflexive approach. Using structured reflexive practice to facilitate and further deep learning (Schon, 1983 cited in Schon 1999; Gibbs, 1988). However, it could be argued that a shift towards patient safety messaging has featured strongly

within healthcare policy direction and nurse education. Moreover, physiological patient deterioration has been associated with a rise in mortality (discussed later in this chapter). Historically a failure to recognise and respond appropriately, nurses may have lacked the perceived importance or knowledge in interpreting the physiological signs and symptoms associated with patient deterioration. Therefore, it could be argued that the goal of nursing curricula should be to reduce the disparity between nursing as taught and nursing as practiced which can be described as the theory–practice gap (Gallagher, 2004). Factors preventing the translation of theory into practice include lack of support, poor nursing role models, time pressures, role constraints, work overload and staff shortages (Maben, Latter and Macleod-Clark, 2006). By refocusing the equilibrium of nurse education in a contemporary context, which views the teaching of physiology, pathophysiology, the understanding of key clinical conditions given equal credence to reflection for example could be a challenge to the orthodoxy of nurse education. Understanding of the importance of physiological patient deterioration as a teaching priority in nursing curricula, being equally as important as reflection and reflexive practice skills, is a controversial proposition. A critical review by Freeling and Parker (2015) exploring experienced nurses' attitudes, views and expectations of new graduate nurses, concluded that experienced registered nurses discussed themes including nursing skills, inadequate preparation during academic program, attitudes and ward culture and concerns with confidence.

The overview above highlights that healthcare has fundamentally changed over the past 20 years, with advances in clinical care and management of conditions. This means that people admitted to hospital may have multiple long-term health conditions, although living longer with these conditions and deemed at risk of deterioration (Department of Health, DH, 2015). This increasing acuity of patients and the movement of care closer to home present a number of challenges for individuals providing care – and nurses are at the forefront of such care provision (Queen`s Nursing Institute, 2011). Due to such changes, nurses require robust and effective tools to facilitate early recognition of patient deterioration. The early recognition of changes in the patient's condition depends on vital observations and a health professional who can interpret and act on these results to support an evidence-based approach to their decisions, interventions and care. Changes in staffing and the skill mix has resulted in a reduction in the number of registered nurses and a corresponding increase in non-registered support staff (Royal College of Nursing, 2020). As a result, vital observations are often given to the least qualified and potentially inexperienced staff members to conduct (Unsworth, Tucker, and Hindmarsh, 2015). This section has highlighted that the depth of nursing practice has evolved requiring contemporary nursing to act promptly and effectively to recognise and respond to patient deterioration or to treat and manage life-threatening conditions. In addition, some of the more traditional nursing "tasks" such as vital observations and hands on care, have placed students nurses closer to patient care. Thus necessitating an evolved perspective to recognise, respond and be more involved in the treatment and management of conditions, matched to the levels of the expected

competence. This requires the practitioner to recall information, swiftly and accurately to provide effective nursing care. The next section will discuss why mnemonics are significant as a memory recall device in supporting this process.

1.4 Why mnemonics matter

Rather than being perceived as old and outdated, teaching using mnemonic devices may be as important now as it has ever been. Healthcare has become more technical and highly pressured largely because of rises in the acuity of patients within both hospital and community settings. Alongside this, we now know that a number of human factors such as situational awareness, stress and distractions impede our ability to respond appropriately to clinical issues. It could be argued that student nurses in clinical practice are in such a position, with the recording of clinical observations, such as blood pressure, pulse or temperature being expected to be recorded and relayed accurately. In relation to patient deterioration, early recognition and response requires clinical decision-making and knowledge of altered physiology (Tucker, Unsworth, and Hindmarsh, 2015). Many qualified nurses rely on recognition associated with the tacit experiential learning gained from nursing patients who are at risk of further deterioration, for example those patients with a diagnosis of infection who may be at “further risk” of deterioration.

It could be argued that the focus on exploring the use of mnemonics as a means for promoting the recall of clinically important information challenges

the view that mnemonics should not merely be about the recall of information and facts. Mnemonics continue to make a significant role in the retrieval of such vital clinical information in high-pressure clinical settings. By their very nature, nurses are the health professionals who are most frequently in contact with patients and therefore most able to recognise and respond to physiological changes in the patient's condition (Unsworth, Tucker and Hindmarch, 2015). Therefore, a logical conclusion to draw is that mnemonic use when linked to clinical conditions could reduce mortality rates. Such a reduction could be achieved through the mnemonic acting as a trigger to recall information vital to the recognition and treatment of a clinical condition or issue.

1.4.1 Cognitive load theory

Modern health care is complex, due to advances in new technologies and increased interdisciplinary care. Cognitive Load Theory (CLT), first developed as a theory by Sweller (1988), describes the factors that influence how much working memory is occupied, by both intrinsic and extrinsic factors which influence cognition relayed to a task (Harry, Pierce, Kneeland, Huang, Stein and Sweller, 2018). Intrinsic loading is determined by the complexity of the materials being processed, while extrinsic loading is the mental load imposed by the organisation of the task or information. Germane load (GL) refers to the mental resources devoted to acquiring and automating schemata in long-term memory. This is an important concept as some instructional formats could increase cognitive load (Sweller 1988). Young, van Merrienboer, Durning and Cate (2014) add a third stage to this concept, 'germane load', which is associated with the deliberate use of cognitive strategies to facilitate learning.

The two main learning processes of CLT are schemata construction and automation. During knowledge acquisition and problem solving combing and recombining elements together into chunks of information allow information to be refined so that it is easier to work with and recall. The cognitive processes that support this are: activating prior knowledge, comparing new information against what is already known, and elaborating this new information into existing schema stored in the long-term memory (Young et al., 2014). The value of CLT in medical education has been attributed to the time and context-dependent role of the medical professions, relying on varied sets of knowledge, skills and behaviours (Young et al. 2014). This can be extended more broadly within healthcare professionals, including nurses and student nurses, in whose professional education CLT can be applied.

Extraneous or extrinsic loading ‘consumes working memory space. Harry et al. (2018) propose that working memory space is limited when dealing with novel (new) information but has an unlimited capacity when dealing with familiar information. Both new and existing knowledge needs to be passed through working memory, and processed through explicit and implicit memory to be recalled. The relevance of this to healthcare is two-fold. Firstly, there exists a split-attention effect, when clinicians are expected to deal with multiple information sources to arrive at a decision. Secondly, the redundancy effect, when the same information is presented alongside existing information, causing further extraneous cognitive loading. The resulting noise or new information may be filtered out, resulting in key information being lost or diverting our attention away from the task in hand (Harry et al. 2018). These

attentional blinks cause momentary lapses in attention for up to 90 seconds (Harry et al. 2018). Harry et al. (2018) assert that healthcare professions can learn much from the aviation industry in teaching students to think aloud in a questioning manner, thus hearing the intrinsic load and reducing the background noise of “extraneous loading”.

Spacing complex information appropriately and encouraging students to develop concept maps can facilitate human cognition. How students learn, in terms of matching learning with cognitive processes, is explored in the concept of instructional design. Indeed, CLT suggests that learning happens best when instructional materials align with human cognitive architecture (Sweller, van Merrienboer and Pass, 1998). It is for this reason that memory devices such as mnemonics offload information or move information into a longer-term store, with cued information being able to be retrieved at a time critical moment (Young et al., 2014). This would require learners to be aware of the impact of acting on this retrieved information to influence the clinical situation and decision-making.

1.4.2 Human factors - clinical decision making and situational awareness

As discussed earlier, identifying and responding to patient deterioration can be challenging; clinical judgement should be supported and augmented by physiological assessment (National Institute for Clinical Excellence (NICE), 2017). However, healthcare practitioners may often overlook the situational context. Situational context is the cognitive skill of knowing what is going on around you. It is defined by Flin, O’Connor and Crichton (2008) as a dynamic,

multifaceted process, involving the maintenance and anticipation of critical task performance events. Temporal awareness anticipating future events based on past and present, with a focus on the impact of time-critical incidents, may have many benefits in a clinical context. In relation to this research, the clinical need to act quickly in a suspected sepsis case is time critical and requires the practitioner to have a working knowledge of sepsis. Appropriate and prompt interventions based on evidence-based practice, for example the sepsis six care bundles, may be beneficial to student nurses if coupled with memory recall devices, such as mnemonics. Monitoring the environment so that potential problems can be corrected, monitoring physiological observations, reporting these promptly and initiating sepsis treatment pathways can avert further patient deterioration. If practitioners do not have the required clinical information in relation to sepsis treatment and management, they may also lack the situational awareness to act or to pre-empt further deterioration.

Flin, O'Connor and Crichton (2008) assert that situational awareness is often the first stage in the decision-making process, ongoing (monitoring) of a situational assessment being the basis of a change in the task within the environment. Due to the nature of nursing practice, nursing staff are required to use clinical judgement and evidence-based practice, and are professionally accountable for their actions and omissions (NMC, 2018a). The impact of noticing what is going on in the environment and responding to it relies on the perceived importance of those environmental (or workplace) cues. Although student nurses do not become registered with the Nursing and Midwifery

Council (NMC) until they complete a validated nursing programme, their programme requirements, legal accountability and moral obligations are to work towards the “spirit” of the NMC code (NMC, 2019). As a result, student nurses often have an influential role in the passing and receiving of patient safety messages because of their direct involvement in patient monitoring, shift handovers and multi-disciplinary team discussions. How the brain processes the information to act when faced with clinical decision-making relies on large amounts of clinical information, based on knowledge and understanding of pathophysiology, evidence-based treatment and management guidelines, as well as effective non-technical skills such as communication. These professional tensions, requirements along with perception, attention and situational awareness will be explored in depth in Chapter 2.

1.4.3 Recognition and response – early intervention in sepsis saves lives

This research has at its heart the importance of mnemonics in patient safety to aid the recall of clinically important information in highly stressful and time dependant situations. One such situation which is commonly encountered is patient deterioration.

Failure to recognise and respond to deterioration in a patient’s physical condition by healthcare staff can result in patient death (NPSA, 2007). A number of professional issues are implicated in why this has happened and still happens within contemporary nursing practice. From the acknowledgement that patients are acutely unwell being cared for within the hospital and community setting, coupled with reduced levels of confidence and

competence in certain aspects of practice nursing skills and a lack of recognition of the key signs and symptoms associated with physiological conditions. This has been reported to be a global concern (Jones, 2017). Failure to recognise and appropriately rescue the deteriorating patient is a global issue that has the potential to cause serious harm to patients (Clarke and Aiken, 2003; Tucker, Unsworth and Hindmarsh, 2015). The use of Early Warning Scores can support clinical decision-making in the acute setting. Using these tools to support clinical decision-making as well as treatment and management of clinical conditions, have been shown to improve patient outcomes (Jones, 2017).

For example, the National Early Warning Score (NEWS), developed by the Royal College of Physicians (2012) has been estimated to save around 6000 lives each year and, it is recommended that all hospitals introduce the tool. Within the hospital setting, NEWS is the standard method of assessing patient deterioration and infection (Royal College of Physicians, RCP, 2017). Evidence-based practice informs the development of such decision-making tools; the NEWS scoring system was updated to reflect research findings supporting the inclusion of cognition as part of the assessment. The inclusion of new-onset confusion as part of the physiological track and triggering system has been incorporated in the revised tool, NEWS^2. This aids clinical decision-making as it acts as a trigger for responses for practitioners, facilitating them to act quickly to escalate and provide intervention.

Failure to rescue the deteriorating patient is a complex and multi-faceted problem with multiple potential points for failure, from technical skills in vital observation measurement and patient assessment, to non-technical skills such as communication, situational awareness and clinical decision-making (Macintosh and Sandall, 2008). Globally, healthcare systems have implemented a number of interventions designed to reduce the likelihood of failure in terms of the recognition and rescue of the deteriorating patient. Such systems include the implementation of physiological track and trigger systems or early warning scores (Jansen and Cuthbertson, 2010). The aim of these scoring tools is to highlight deterioration, to trigger appropriate responses and clinical decisions that give rise to interventions that correct/ reverse further deterioration (NPSA, 2007a; 2007b). In acute hospital ward environments, Odell, Victor and Oliver (2009) recognise that the nurse has a major role in this detection. For example, the impact of sepsis on mortality and morbidity is well documented (National Confidential Enquiry into Patient Outcome and Death (NCEPOD), 2015). A full set of vital signs are a systemic indicator of sepsis. While one set of observations may not indicate sepsis, it allows nurses to record and re-measure vital signs, incorporating their clinical judgement into responses (Jones, 2017). The ability of this to be retrieved accurately whilst under high-pressure situations remains the epitome of the effective practitioner. Using a learning mnemonic, which supports retrieval of such vital information, in relation to key sepsis information, could improve patient outcomes. As outlined earlier students nurses, due to their theory and practice role are part of the nursing team delivering care, in the care setting. Therefore, it could be presented from the literature in this chapter that serious life-

threatening conditions such as sepsis is one such condition that student nurses will be exposed to on clinical placement. Thus, preparing them from a theoretical and practice perspective is the duty of contemporary nursing curricula, nurse educators and indeed a Professional Statutory and Regulatory Body requirement (PSRB). For example, Nursing and Midwifery requirements for qualified nurses specifies that all nurses should use evidence based practice, this would encompass knowledge and skills in managing clinical conditions (NMC, 2018a, 2019).

1.5 Why focus on sepsis in relation to mnemonics

This research will utilise sepsis as a 'vehicle' for the study of mnemonic use and recall amongst student nurses. Sepsis was selected because of its perceived clinical importance and significance. Sepsis kills someone, somewhere in the world every three seconds (Surviving Sepsis, 2016). It is defined as the body`s immune defences being overwhelmed by invading microorganisms, causing an inflammatory response so severe that the host's defences are not able to fight off the infection and this can lead to multi-organ failure and death (Royal College of Physicians (RCP), 2014). At nearly 30 million annual cases and six million deaths globally, sepsis is one of the world's biggest killers. In the United Kingdom, it affects 123,000 and has a mortality rate of 37,000 annually (NHS England, 2018). However, as sepsis can be caused by many different pathogens and has varying presentations, the diagnosis is often missed (Jones, 2017). 70% of cases are developed in the community setting, with the other 30% occurring in hospital environments (NHS England, 2015). Sepsis is a spectrum of disease. In its least severe form,

one in ten sufferers may die. Severe sepsis claims around one in three patients' lives, and in septic shock, the chances of survival are only one in two. Indeed, surviving sepsis can have an impact on morbidity. Campaigns such as "Surviving Sepsis", aimed at raising awareness of early recognition and diagnosis of sepsis, and its treatment, can ensure outcomes that are more positive for the patient. Annually, sepsis kills more patients than breast and bowel cancer combined (Jones, 2017). By implementing effective practices, it is estimated that 10,000 deaths may be preventable (NHS England, 2015).

The Surviving Sepsis Campaign (SSC), launched in 2002, aimed to reduce mortality from sepsis. In 2002, the mortality rate for severe sepsis was 20.7% and septic shock was 45.7% (SSC, 2002). This has risen to between 40%-60% for septic shock (SSC, 2020). It is estimated that if the correct guidelines are followed over 10,000 deaths can be prevented annually (SSC, 2020). To facilitate the reduction of mortality rates. Two clinical care bundles were created, containing a number of evidence-based interventions to be completed within either three or six hours of sepsis recognition, depending on patient need. These were combined into a one hour bundle in 2018 (Surviving Sepsis Campaign, 2018) these bundles covered aspects of basic interventions, for example the administration of high flow oxygen. Globally the CEO of the Sepsis Alliance has set up the "Sepsis Six", six interventions or care bundles.

Table 1.1 O_2 FLUID Mnemonic relating to the Sepsis six care bundles

O_2 & FLUID Mnemonic			**Rationale for Intervention**
O_2	Oxygen	15L/min via high flow device	Reverse Cerebral Hypoxia
F	Fluid	IV fluid (crystalloid/ colloid) 20ml/kg	Reverse Hypotension
L	Lactate	Measure Serum Lactate	Proxy measurement of tissue Hypoxia
U	Urine	Measure Urine output – catheterise patient	Urine output should be above 20ml/ kg of body weight
I	Infection	Infection screening (including blood cultures)	Ascertain the source by swabbing and obtaining biochemistry infection markers.
D	Drugs	Drug Therapy	Broad spectrum antibiotics

These comprised six clinical interventions to treat sepsis within the first hour of diagnosis. Every hour treatment is delayed the mortality rate rises by 8% (SSC, 2018). Table 1.1 (above) is a mnemonic of the treatment and management stages in the early phases of treatment. Other mnemonics detailing the sepsis care bundles, such as BUFALO, have recently been developed. These, along with other mnemonics in healthcare, will be reviewed in chapter two.

As far back as the early 1990's, concerns surrounding patient deterioration have been highlighted within nursing literature (Sibler et al., 1992). The College of Emergency Medicine and UK Sepsis Trust (2014) have worked in partnership to produced guidelines for emergency departments on the management and treatment of sepsis, advocating urgent treatment, point of care testing and timely escalation of care. A failure to recognise and respond to deterioration in the patient's physical condition often resulted in patient death, due to the inaction of healthcare staff (NPSA, 2007a; 2007b). There are a number of professional issues supporting why this has happened and still happens within nursing practice today, from acknowledgement that patients being cared for within the hospital and community setting are acutely unwell, coupled with poor nursing skills and recognition of the key signs and symptoms associated with physiological conditions (Jones, 2017). As discussed in this chapter, sepsis is associated with high morbidity statistics. Mortality figures also indicate the devastating impact sepsis has on recovery and quality of life for survivors. Indeed, stories of surviving sepsis have an emotive impact on recognition of sepsis. In one such case, Tom Ray discusses his life after having sepsis, emphasising that rapid diagnosis can save heartbreak, distress and money (Royal College of Nursing (RCN), 2019). Within 24 hours of his sepsis diagnosis, he was in a coma; further symptoms were missed by his GP and in the Accident and Emergency department. This resulted in both his arms and legs being amputated and part of his face being removed. For serious cases, antibiotics and other therapy (sepsis six care bundles) needs to be given within an hour of diagnosis. Delays in treatment cost lives and, as in Tom's case, can prove devastating. Although he survived sepsis, his life has

been changed, as he was only 38 at the time. The financial cost of sepsis to the NHS is considerable, £15.6 billion per annum. Further, the emotional cost to the individual is high, and higher still to the relatives of those it claims, as four out of every ten people with sepsis die (Royal College of Nursing, RCN, 2019). The Surviving Sepsis Campaign was launched in 2002 the aim of which was to reduce mortality rates from sepsis (EPG online, 2018). Between 2001 and 2010, there were 226 547 deaths that were directly associated with sepsis in England alone, 4.7% of all deaths (McPherson et al, 2013). As of 2018 figures for the United Kingdom are 52,000 deaths due to all forms of sepsis (ONS, 2019c).

Further developments in the UK have led to the production and implementation of evidence-based guidelines (NICE, 2016), advocating early recognition, diagnosis and early management of sepsis (guideline NG51, recommendations 1.6.7, 1.6.22 and 1.6.37). Indeed, the importance of patient assessment by healthcare professionals in suspected cases of sepsis requires the structured undertaking of a set of observations, which are used to stratify the risk of severe illness or death from sepsis (NICE, 2017, quality statement 1; assessment). Escalation of care for patients whose condition fails to improve within one hour of initial intravenous antibiotics or fluid bolus, require a review by a consultant (NICE, 2017, quality statement 4; escalation of care). Interestingly, these guidelines focus on secondary care, as this is where the majority of ongoing treatment of sepsis and severe sepsis is conducted. However, as discussed in this Chapter, over 70% of sepsis cases develop in community settings (NHS England, 2015). Certain aspects of early treatment

by community nursing staff may still be possible, although implementing the full treatment components of sepsis care bundles may be challenging due to the operational challenges, such as lack of training, lack of consensus on early warning scores (Tucker and Lusher, 2018) and available resources outside of the hospital care setting (Vincent, 2016).

Although these sepsis interventions might be perceived as easy to implement, worldwide compliance is weak. Around a quarter of hospitals in the UK are successfully applying these guidelines (Surviving Sepsis Campaign, 2012). To help address the concerns, a new bundle was developed by the Surviving Sepsis Campaign, incorporating both diagnostic and therapeutic tools. This became “The Sepsis Six”, a collection of steps designed to ensure rapid diagnosis and treatment, with the goal to improve outcomes and reduce the burden of this time-sensitive condition. Septic shock has a mortality rate of 7.6% for every hour that antibiotic therapy is delayed (Kumar, Roberts and Woods, 2006). Therefore, any tools which aid healthcare staff in early recognition of conditions such as sepsis, reducing mortality rates and improving patient outcomes (NICE, 2016), should be taught to nursing students. Indeed, a memory aid that can be used to recall key clinical information in such a time sensitive condition could be of value to key healthcare staff such as student nurses.

Finally, patients with complex long-term conditions or co-morbidities are more susceptible to sepsis (Seymour et.al. 2017). Therefore, checking observations

when visiting patients could help to identify trends or patterns, and early identification of infection to prevent sepsis. Seymour et al. (2017) state that with every hour delayed in the treatment of sepsis, the patient`s risk of mortality increases, so rapid recognition of the condition is vital. McCelland and Moxon (2014) explored nurses' pivotal role in the recognition of a deteriorating patient and in identifying sepsis. Concluding that rapid recognition of deterioration is crucial in streamlining escalation of care appropriately and failure to do so can result in delays in treatment, and increased risk of morbidity and mortality. This not only results in poorer outcomes for patients but also increases the risk for potential litigation for medical negligence. Claims for medical negligence are increasing in prevalence, with the costs of clinical negligence claims estimated to rise to around £3.2 billion by 2020 (National Office of Statistics, 2017). This is particularly significant as the NHS continues to face financial pressures and cuts to public health spending (The Kings Fund, 2017). This section has highlighted the professional, legal and ethical requirement for healthcare professionals to treat and manage the complexities associated with sepsis. Indeed that delays in treatment of sepsis costs lives and is associated with poor quality of life for survivors of the condition. Student nurses play a pivotal role in the care delivery of patients being treated for sepsis, requiring them to have functioning levels of recall associated with recognition, treatment and management, even though they would be working under the direct supervision of a registered nurse until qualified (NMC, 2018). Any delays in treatment associated with poor recall of information by student nurses has the potential to add to sepsis mortality.

1.6 What this research plans to achieve

This research will explore the retrieval of information related to specific mnemonics used in the identification of respiratory problems (acid-based balance) and the early management of sepsis. The study will explore students' use and retrieval of information using these mnemonics and will further seek to explore other factors that assist students with the retrieval of such clinical information. The supporting literature about the proven value of mnemonic devices, coupled with the patient safety agenda within nurse education suggest that student nurses are in a key position to respond to sepsis and prevent further patient deterioration. Therefore, mnemonic memory retrieval devices, for example (O_2 FLUID) that aid the recall of large chunks of valuable information around sepsis is worth exploring, to ascertain its value to student nurses, nurse education and practice. As discussed within this chapter, there are deaths which could have been avoided, which occur each year in healthcare practice. Skilled nursing practitioners rely on recognition (pattern recognition) of conditions, based on knowledge and significant experience of clinical cues. Student nurses may not have significant clinical experience to rely on or to be able to recognise and respond to clinical patterns and treatments. Therefore exploring the value of mnemonics to this practice population is worthy of critical exploration of existing relevant literature and critical enquiry through the research process. Furthered by identifying any gaps in terms of a literature review, the conduct of primary research, with focused research questions will aim to add to the existing body of knowledge (Bryman, 2004).

Given the focus of this research on retrieval of key information, it is worthwhile setting out a working definition of these terms from the outset. For this study, retrieval is the theoretical definition of information that is stored in the student's memory. There are innumerable examples in educational psychology of how students learn and how learning takes place. That is, not only the remembering of facts but the application of this to a given situation. It is also acknowledged in such seminal works as Bloom's Taxonomy of Learning (1956) (revised 2001) that there are domains of learning. These fall into three main areas of cognitive, affective and psychomotor. It is the synergy of all of these domains being addressed by education (Orlich, 2004), which has been associated with greater skill and knowledge acquisition, and application (learning). Therefore, exploring if such taxonomies are factors which support the retrieval of clinical information and memory among student nurses, could be informative to nurse education and clinical practice. Ultimately revealing self-awareness of influencing factors to the student nurses taking part in such a study.

As mnemonics can drive learning and facilitate retrieval of information by student nurses and there may be a perceived importance of this to drive "assessment for learning". As Price et al. (2012) defines that key information required for summative assessments ensures learning, by students perceiving this information as important by the nature that learning is summatively assessed. O'Donovan, Price and Rust (2008) observe that it is the significance of the student's perceptions of the importance attached to the assessment that can shape their learning. However, the impact of summative assessments

using mnemonic devices as perceived by students, not only in terms of “assessment of learning” but “learning for practise", is worth exploring.

1.7 Chapter Summary

This chapter has highlighted the orthodoxy associated with historical use of mnemonics as memory aids both within society, as part of general education and in the education of healthcare professionals. The chapter has also explored the challenges of managing the recall of clinically important information for patient safety such as in the early recognition and response to patient deterioration. This has highlighted that delays in treatment and care are associated with higher mortality rates for key clinical conditions. Epidemiology and prevalence data supporting the focus of sepsis has been explored, highlighting the risk this condition presents to patients. Human factors have highlighted that clinical decision-making relies on not only early warning scores and sepsis care bundles, but also attention to important situational “flags”, which are often missed by staff in key positions to intervene early in the sepsis trajectory. Staff who are placed in this clinical situation are often those who are recording clinical observations and recognising deterioration. These are often student nurses. Educational and healthcare literature has revealed that the use of mnemonic devices can be a valuable memory aid. Therefore, exploring what the literature reveals in relation to these areas is a key consideration before setting any research objectives to investigate. The next chapter will describe the search strategy and literature review that was undertaken in order to inform both the research questions and the choice of methodology for the subsequent research.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

This chapter examines the literature related to both the use of mnemonics in health professions education, and memory and retrieval. Using a keyword search strategy, the chapter will describe an auditable approach to how literature was located, categorised and reviewed. Literature will be presented and critically reviewed with the aim of identifying what we know about the topic and where the gaps in current evidence are.

2.1.2 Why have a search strategy?

Sackett (1997) discusses how having a framework enables the question to be more focused, separating the question into 3 parts: population intervention/ (exposure) and outcomes PIO/ PEO or 4 parts: population intervention comparison and outcome PICO. It is presented that questions structured in such a way are able to retrieve focused literature, thus producing a more focused and easier to answer question (Hek and Moule, 2006). This was the rationale for using the PICO search criteria for including or excluding research studies and discussion articles. Providing such a structure can increase the quality of a literature review by ensuring the retrieved literature is relevant to the research questions (Cutcliffe and Ward, 2007). This was the rationale for developing a search criteria and matching this around the PIO question (population, issue, outcome). A comparison was omitted due to the lack of randomised controlled trials.

2.1.3 Using a PIO structure

Holloway and Wheeler (2010) argue that a comprehensive search question is vital in literature reviews, as it enhances the quality of the literature retrieved. Clifford (1997) observes that this can be enhanced further by using a framework to define a research question, as this facilitates focus on the issue being studied.

Table 2.0 PIO literature search strategy – inclusion and exclusion criteria.

PIO	**Inclusion criteria**	**Exclusion criteria**
Population	Healthcare staff, academic staff Students, in education (>18 years of age) Teachers, Nurse tutors (higher education sector) Adults 18> years of age	<18 years of age, pre-school, secondary school
Issue	Mnemonic use with adults Memory and recall Clinical use e.g. Sepsis Educational United Kingdom & Non-UK Literature	Mnemonic use in patients/ students with brain injuries. In languages other than English
Outcomes	Effectiveness and use of mnemonics in healthcare, educational and psychological literature.	
Types of studies/ literature	Professional editorials/discussion articles, Qualitative, Quantitative research studies, Mixed methods studies, Systematic reviews, RCTs, Cochrane reviews, Discussion articles, Guidelines, Peer reviewed	

2.1.4 Search plan

Table 2.1 PIO structure

P = Population	I = Issue	O = Outcome
Students	Mnemonics	Retrieval

Once the rationale and inclusion/exclusion criteria had been developed, a search of existing literature began. However, a criticism of such a rigid method is that it stifles the creativity of original research (Parahoo, 2006). Nevertheless, using a recognised framework was felt that to add robustness and academic rigor. The PIO framework was the most appropriate at retrieving relevant focused literature, to underpin this study (see Table 2.1).

Table 2.2 Search plan

Stage of Search Strategy	Details/ Sources used
1. Formulate a research question	Use PIO structure. Population, Issue, Outcome
2. Expand search terms	List key search terms under each PIO heading; develop inclusion & exclusion criteria
3. Set search Limits	Use Boolean operators (AND, OR, NOT)
4. Select electronic databases	Cumulative Index to Nursing and Allied Health Literature (CINAHL) British Nursing Index (BNI) Cochrane MEDLINE Psychology collections
5. Retrieve & refine search results	Combined search results Use Critical Appraisal Skills Programme CASP framework for retrieved literature
6. Select research papers	Provide rationale for selected research papers

To further assist with the search strategy, a search plan was devised (see Table 2.2 above). Online databases were used and key search terms inputted. The combining of key search terms can improve search results. Gerrish and Lacey (2006) recommend identifying the three main elements of the PIO structure. This enables a search to yield the desired results; structured key words and phrases are needed to search for each PIO element. The literature search processes was repeated during the thesis development to ensure no recent studies were omitted.

Table 2.3 Identifying keywords and synonyms for the search strategy

Population	**AND/OR Issue**	**AND/OR Outcome**
1.Student(s)	7. Education	12. Retrieval
2. Nurse(s)	8. Healthcare	13. Recall
3. Teacher(s)	9. Psychology	14. Memory
4. Tutor(s)	10. Mnemonic(s)	15 Factors
5. Educator(s)		
6. Combine 1-5 using "**OR**"	11. Combine 7-10 using "**OR**"	16. Combine 12-15 using "**OR**"
The last step is to combine steps 6+11+15 using the term "**AND**"		

Keyword searches (Table 2.3 above) increase the chances of retrieving articles that are potentially relevant by increasing the sensitivity of the search (Bettany-Saltikov, 2010). Houser (2008) argues that the use of Boolean logic (using AND, OR and NOT) to combine search terms can filter results, thus

making for a precise search. The Boolean operator OR was used to expand the search, whereas AND was used to narrow the focus of the search. This gives the search sensitivity (direct articles) and specificity (no unrelated articles). It could be argued that this format provides an audit trail, enabling the search to be replicated and further demonstrating robustness (Aveyard, 2007). The rationale for the literature review process in relation to the thesis development is to inform but also to ensure that the research question does not match pre-existing literature unless the intention was to replicate a study in a different context. Replicating existing research would call into question the original contribution a thesis may make in a subject area.

2.1.5 Inclusion and exclusion criteria

Berg (2009) argues that it is not simply a question of listing the opposite of the inclusion criteria, as exclusion often provides a greater supporting rationale (see Table 2.0 above). Studies that included mnemonic use in patients, learners or students who had brain injury or cognitive deficits were excluded from the literature search. Limits were also set to English language, as it was unrealistic to translate studies printed in an unfamiliar language. However, the search did include studies from other countries, so as not to narrow the scope of the literature. Brown (1999) says that although this may introduce selection bias into the search criteria, inclusion and exclusion criteria are required if a rigorous search is to be made. The rationale for this study's inclusion and exclusion criteria provides further reduces selection bias.

2.1.6 Limiting the search

The internet and electronic databases have increased the availability and rate of information retrieval (Berg, 2009). Search engines such as Google and Google Scholar may yield some relevant information. However, a critical approach to using these search tools requires a discerning reviewer. Equally, databases such as Wikipedia might be considered academically weak, as the source information on this site cannot always be verified (Berg, 2009). Indeed, Higgins and Deeks (2008) argue that relevant search databases would yield focused literature, as they house peer reviewed journal articles. Targeting databases with specific journals such as Medline, CINAHL, BNI and Psychology collections would place limits on the search to retrieve literature to address the search keywords (summary Table 2.3).

This approach reflected the structure of the search plan. I used databases such as CINAHL and Medline to provide a focus for retrieving health and nursing-specific literature. The rationale for using psychology collection databases was to retrieve psychological literature, as memory studies and mnemonic studies would also be found in educational psychology literature. By checking the reference lists of discussion papers for their relevance to the research focus. These revealed direction to the search, as primary research on mnemonics was gleaned. It could be argued that if the search is too limited, it may be inconclusive or yield little in the way of studies, due to papers not being easily retrievable. This may produce an inaccurate picture of the existing literature, leading to a false assumption that there is no literature to be found.

A further search method, not to be discredited, is hand searching and author contacting. Although this method was not used due to time constraints, if these were not an issue, contacting authors of key papers may have added further depth to the search.

Lincoln and Guba (1990) propose that generalisations decay over time and that the empirical proposition has a definitive half-life. However, it could equally be argued that qualitative results are principally subjective because of their research design and non-randomised methodology. Therefore, qualitative findings are meaningful to the reader in the context in which they are presented. This can be equally valuable in the eyes of the reader and a strength of qualitative research. This provided further rationale for developing inclusion criteria surrounding the type of literature to be included, to reflect both qualitative and quantitative research.

Craig and Smyth (2002) observe that there is a hierarchy of evidence, with systematic reviews being the “gold standard”, followed by randomised controlled trials. The literature concerning mnemonic use spans a range of methodologies, from experimental research to qualitative studies. Given the range of literature, the search strategy included studies exploring perceptions, experience and impact of mnemonics. This allowed the inclusion of as wide a range of literature as possible. Both qualitative and quantitative designs have their merits and should not be seen as conflicting paradigms. Both can draw on different methods and philosophies but can also complement one another when used together in the right way (Jones and Kinmonth, 1997). In

healthcare, a great deal of primary research is quantitative (Rosenberg and Donald, 1995). Perhaps this is due to the nature of science within healthcare, wishing to define phenomena by numerical measurement alone.

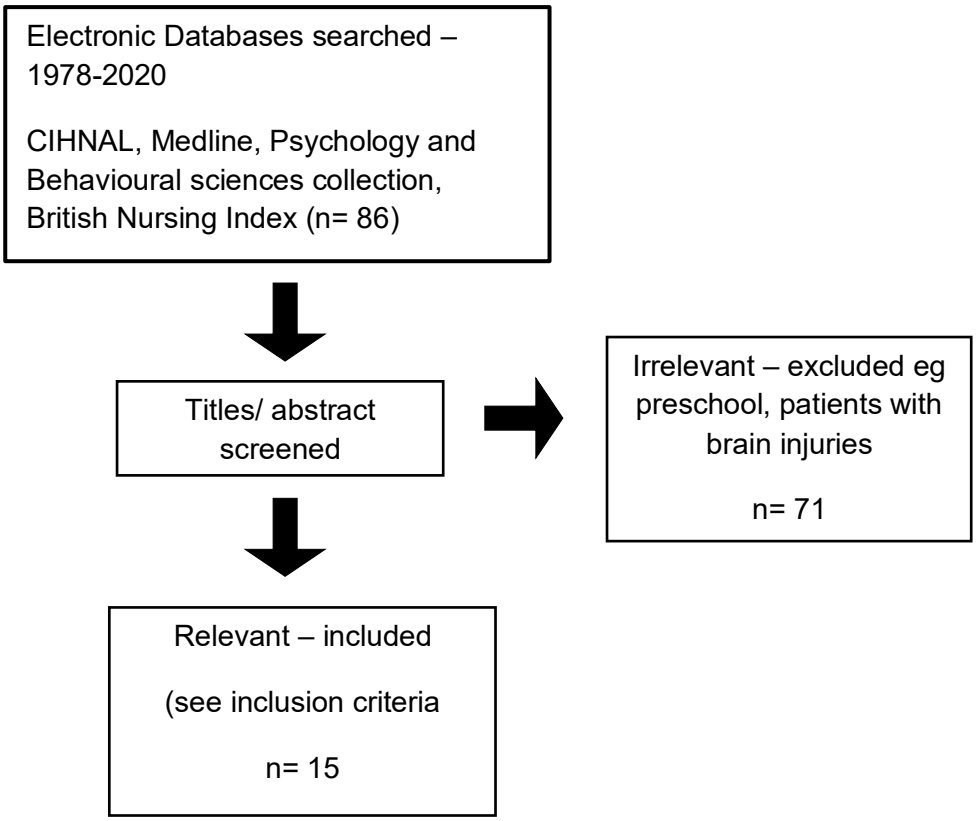
Exploring an individual's subjective perception of using mnemonics by critically reviewing the methodological rigor and significance of this in relation to orthodox practice may provide a deeper understanding of the topic under review. The rationale for undertaking a literature review further supports the concept of research inquiry, arguing that including qualitative literature provides depth and quantitative literature could provide a more scientific data, thus yielding more in the way of understanding phenomena by contextualising it (Bowling, 2009). This was the rationale for including both qualitative and quantitative research studies in the literature review.

2.1.7 Results of the search

The search results are detailed below, providing a rationale for which studies and literature are discussed in the literature review. This enabled the development of further criteria, which yielded further studies that met some or all of the PIO criteria. The screening of both title and abstract against strict filtering criteria further reduced articles to meet the search strategy. The Cochrane Collaboration (2008) advocates reading articles in full before rejecting them. This enabled any uncertainty surrounding the sample population of these papers to be ascertained in more depth. For example, some studies describe mnemonics but not in relation to adult learners and it

was felt that mnemonic use by schoolchildren would not be transferable to the context of nurse or higher education.

Diagram 2.0 Summary of database searches
Review/ Search topic: Mnemonics Memory Date: 23/03/20



Electronic searches were conducted using a range of databases (Diagram 2.4), based on keywords (Table 2.3) used in work published in English between 1976 and 2020. This timespan was based on how far the databases went back. The returned hits and whether the publications were deemed relevant or irrelevant are detailed in Table 2.4. Relevant studies included quantitative, qualitative and mixed methods research. Additional classical educational psychology, memory and mnemonics studies were retrieved and

deemed relevant for inclusion in the literature review, along with evidence-based guidelines. The results of this categorisation are shown in Table 2.5.

Table 2.4 Summary of evidence by type

Type of Evidence	Total
Quantitative research studies	7
Qualitative research studies	1
Mixed methods studies	0
Government papers (e.g. guidelines)	9
Professional discussion papers (peer reviewed)	10

2.2 Literature review

The remainder of this chapter will critically review the published work identified using the search strategy outlined. Research studies and seminal theories will be discussed in terms of their relevance and this will be used to inform the generation of the research questions, which in turn identified by gaps in the current literature. The section will use sub-headings that correspond to common theoretical threads within the published work.

Given that mnemonics are traditionally used as memory aids or “hooks”, the first area to be explored was key concepts concerning memory. It is important to review the literature about the architecture of memory so that we can better understand how mnemonics work and how they influence working and long-term memory.

2.2.1 Defining key concepts: what is memory?

The complex nature of memory comprises physical, chemical and contextual components. From a physical perspective, medical science has explained much in terms of its structure and function. Science has reveal the structural components and key processing areas within the brain, through CT Scans, Magnetic Resonance Imaging and EEGs. Many factors influence the storage and retrieval of memory, such as an individual's emotional state, rehearsal, association and automatic memory (Marieb and Hoehn, 2013). Memory is associated with the hippocampus and is often described in terms of three key stages: encoding, storage and retrieval. For memories to be committed to long-term memory, then each stage must be successful and this is informed by numerous contextual and physical variables (Anderson and Lebiere 1998). Psychological theories have developed cognitive explanations to complement biomedical explanations of the role of synapses and neurotransmitters.

The power of the mind to retrieve an idea long after it has disappeared is something that has fascinated and confounded neurologists and psychologists, attempting to explain this enigma through memory studies (Locke, 1690 cited in Cowan, 2005). Locke discussed primary memory being the trailing edge of consciousness and secondary memory being information stored for a lifetime. A notion of primacy and recency effect was theorised by Ebbinghaus (1885 in Thorne and Henley, 2005), who postulated the serial position effect using a list of unconnected words. The words at the end of the list were recalled more frequently due to the recency effect (their commitment to short-term memory). Conversely, the primacy effect describes better memory of the first items in a list, due to increased rehearsal and commitment

to long-term memory. Waugh and Norman (1965 cited in Cowan, 2005) found that words at the start of the list were better recalled than those in the middle of the list, adding to the understanding of the primacy effect. Rundus (1971, cited in Cowan 2005) and Tan and Ward (2000, cited in Cowan, 2005) discovered that reading the words aloud produced greater recall than items later in the list, indicating that auditory rehearsal increased the primacy effect in committing information. Craik, Gardiner and Watkins (1970) explored the negative recency effect; if asked to recall all of a list of words, the start is best recalled, then the middle and then the end. This is different to the serial position effect of the primacy effect, first and last items then the middle words the worst recalled. These studies remain seminal and connect with the "real world" through everyday tasks and activities that may require connected word lists or relevant stimuli to be recalled.

2.2.2 Structural vs. neurotransmission (brain biology)

Figure 2.0 Initial processing of Information within the brain

Memory is stored in the brain in different ways depending on many variables and external stimuli. Figure 2.0 visualises the processing stages of memory. The amygdala is an area within the medial temporal lobes of the brain, which encodes visual stimuli to more permanent storage; that is long-term memory. Acoustic encoding is the encoding of auditory impulses. As phonological stimuli, the sounds of words are processed in terms of their lexical and semantic factors, working with the phonological loop to aid memory recall

(Marieb and Hoehn, 2013). This is important also in semantic encoding. In essence how the words sound, coupled with their meaning, as processed by working memory, are factors in the encoding of hearing and word associations. Elaborative memory occurs when new information is matched with old memories; memory being a combination of new and old stored stimuli (Morris and Gruneberg, 1994). The context of what we perceive about the information deepens our encoding, which has been shown to aid retrieval if appropriately stimulated. This thesis explores which factors support the retrieval of information using mnemonics. From a biological perspective, this may be considered paradoxical, as the need to construct an artificial adjunct (mnemonics) to what would be termed in nature as an almost perfect system, on the surface, seems unnecessary. However, as discussed, the expanse of the human mind is more than the sum of its physiological parts. Furthermore, the reality of forgetting information is one which cannot be ignored.

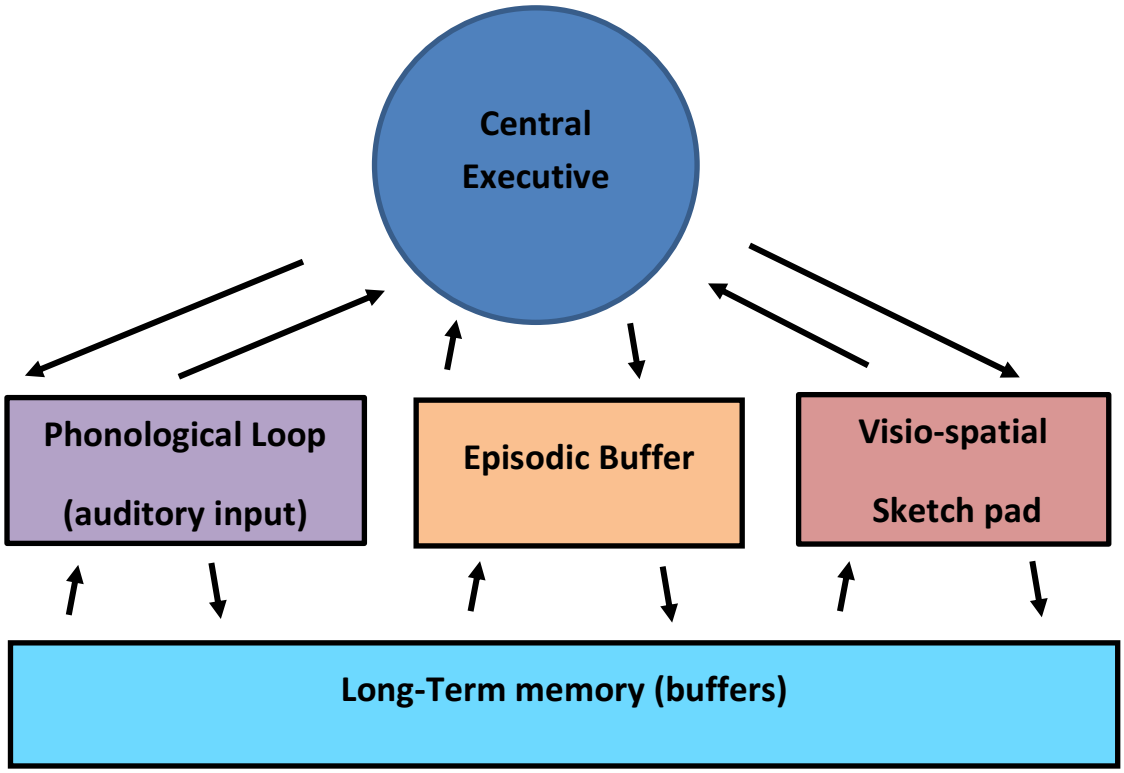
2.3 Working memory - models and theorem

Working memory is the brain's ability to hold a small amount of information in an active state while doing a task. There are a number of seminal theories on working memory. From a biological perspective all animals, including humans, in a natural setting have to locate food, which requires memory to recall where the food is. In 1976, Olton and Samuelson designed a test placing rats in a maze, with spokes from the centre, some of which contained food or not. The task proved that while the rats could remember where they had been to get the food, they required a "working memory" of where they needed to go next (cited in Wickens, 2005). As humans have evolved, memory has been used

in activities other than finding nutrition. According to the Atkinson and Shiffrin (1968), memory is a staged system, capable of manipulating information before it is stored, passing through sensory memory, working memory and long-term memory (Metsamurronen and Rasanen, 2018).

Other models of memory incorporate visual processing. Baddeley's model of working memory states that visual information is stored in the "visuo-spatial sketchpad" (Baddeley, Eysenck, and Anderson, 2009). Baddeley and Hitch (1974) theorised that working memory consists of three components: phonological loop, central executive and the visual sketchpad. This was elaborated further by Baddeley (2000) (diagram 2.1). The two slave systems of the visuo-spatial and phonological loop processing limited short-term memory information, which can be interfered with or lost to decay. However, Baddeley et al. (1975a) explored the disruption to the phonological loop using nonsensical words and blocking visual stimuli using moving targets hindered processing of this dual tasking memory apparatus. The central executive supporting higher brain function.

Figure 2.1 Structure of working memory Baddeley (2000)



The phonological loop is considered to be of the utmost importance in understanding the empirical evidence from studies into working memory. Baddeley's (1986) model details that spoken words are automatically stored in the phonological store, with sub vocal (mental repetition) rehearsal preventing decay. However, non-auditory rehearsal of verbal material such as printed words can be stored in the phonological short-term store through sub vocal rehearsal. The length of words is significant. Baddeley, Thompson and Buchanan (1975b) postulate that word length was a key factor in effecting articulatory rehearsal and memory encoding. However, Baddeley (2000) revised the model to include an episodic buffer, which accounts for information that is not exclusively phonological or visuospatial. Styles (2016) observes that the model does not entirely explain how sensory information is processed.

Anderson devised a theory of memory processes called Action Thought Control (ACT) (1983). This was later developed into a computational model, ACT-R (where the R stands for rational), which has since been applied to research in artificial intelligence (Anderson and Lebiere, 1998). The original ACT model attributes cognition to the brain's structure and individual processing modules. One of the model's main propositions is that human knowledge can be divided into two multifaceted representations: declarative and procedural. Declarative (or explicit) memory is conscious and is concerned with the retrieval of factual information, such as experiences and concepts (Ullman, 2004). It can be subdivided into two further types: episodic memory, where personal experiences or events are stored; and semantic memory, which stores factual information. Conversely, procedural (or implicit) memory is where unconscious memories, mainly skills, such as driving a car, can be recalled without having to re-learn that skill. In the ACT model, stimuli from the outside world are encoded into working memory and stored into declarative memory. From here, retrieval can occur the memory can be matched to a previous procedural memory (Anderson, 1983); the output being performance or action/behaviour.

2.3.1 Chunking and cognitive load theory

The brain is capable of storing large amounts of information. Our understanding of how this is achieved requires a combination of the biological and psychological theory. Worthen and Hunt (2011) believe that the artificial system of a mnemonic is unnecessary to the natural memory processes.

However, as memory is sometimes inadequate, cognitive cues are required to bolster this process. Mnemonic devices lend artistry to the process and enabling learners to create meaning in such recall, as there is a natural deficit to working memory and cognitive load (Artino, 2008). Cognitive Load Theory rests on several assumptions of limited capacity theories and how we process information in the brain. Sweller, van Merriënboer and Paas (1998) assert that working memory has limited space, while long-term memory is unlimited. If instructional material is too complex, it will hinder working memory and cognitive learning. This provides further justification to the study of mnemonics in educational contexts.

2.3.2 Miller's theory of "memory chunking"

George Miller, a founding theorist in educational psychology, wrote "The magical number seven, plus or minus two: some limits on our capacity for processing information" (1956). Here, he proposed that human working memory is limited to seven objects of information plus or minus two objects. An example of this could be information to be remembered for an examination or test and the principle has become known in cognitive psychology as Miller's Law. He theorised that this is due to limited working memory during the encoding stage. However, memory is stored in different ways depending on many variables and external stimuli. Miller argued that if each chunk of information to be remembered was more familiar and meaningful, then it would become a smaller chunk than, say, a word or phrase that was completely unfamiliar. In his classic study, participants were able to retain seven, plus or

minus two, chunks of information in their short-term memory processing, before these were committed to longer-term memory.

2.3.3 Memory and attention

Although working memory and attention are closely connected (Barrouillet and Camos, 2012), their specific roles are poorly understood (Vergauwe et al., 2018). Broadbent (1954) presented the concept of attention being the result of a limited-capacity information processing system and its method of filtering out numerous external environmental inputs and internal, bodily, inputs. This selective analysis is our way of paying attention to the important things and de-focusing from distractions. Broadbent describes how cognitive processing is a staged sequence in which stimuli are presented and acted upon, attentional processes are transferred to short-term memory and, if rehearsed, encoded into long-term memory (Broadbent, 1958). Glass and Holyoak (1986) propose that the main problem associated with attention is how to monitor the environment sufficiently to detect unexpected but important events without disrupting the processing of the main focus of attention. For example, studying for an examination in a library; the ability to filter out background noise, changes in temperature, hunger, or other external or internal stimuli. Therefore, dividing our attention depends on how complex the task is and any data limitations.

From a behaviourist perspective, Maslow`s hierarchy of needs (1954) would rank basic internal physiological stimuli such as hunger or tiredness as higher priorities if not addressed (Gawel, 1997). Selective attention was first theorised

by Cherry, in the “cocktail party problem” (1953), which is the capacity to follow one conversation while another is going on in a noisy room. Cherry concluded that the brain`s ability to separate out auditory stimuli, based on relevance to the individual, resulted in a selective filtering response; effectively tuning in pertinent stimuli and tuning out non-essential information. Cherry’s (1953) experiments on shadowing demonstrated that if a spoken passage was played in one ear to be remembered and another message was played in the other ear, the unattended message was not recalled as in as much depth. Participants were unable to recall most of the unattended message due to being prevented from using a mnemonic strategy by the attended shadowing spoken passage (cited in Gawel, 1997). Important processing factors included sex of the voice, tone and the listener’s own name being spoken.

Moray (1959) built on Cherry’s work, theorising that almost none of the rejected messages were able to penetrate the shadow set up, except for subjectively important messages such as names, taboo language and backwards language. A 33% detection rate was found in the ignored auditory channel. From this, Moray concluded that individuals have the ability to selectively attend to information. In his research, the reasons for this were attributed to a general warning signal, requiring the individual to respond (Moray, 1959). This ability has also been documented in babies as young as thirteen months old, theorising a protective warning to potential danger (Newman, 2005).

Treisman (1969) presented students with a spoken list of digits in both ears. Occasionally, a letter was presented along with the digits but in a different voice. The students detected almost all of the letters presented in both ears. From this, Treisman to develop her attenuation theory, a model of selective attention, to explain how unattended stimuli can be weakened. This added a new dimeson to Broadbent's selective attention theory; instead of a filter, which barred unattended inputs from entering awareness, it was a process of attenuation (Treisman, 1969). According to the work of Deutsch and Deutsch (1963), and Norman (1968), in terms of the qualities of the words being attended to, this is based on the semantic importance. This attention model included a second selection mechanism based on meaning. In the Deutsch-Norman model, information in the unattended stream is not processed all the way into working memory; it is passed through a secondary filter after pattern recognition. If the unattended information is recognized and deemed unimportant by the secondary filter, it is prevented from entering working memory. In this model, only immediately important information from the unattended channel can enter awareness. From a processing perspective, all inputs are processed by the sensory receptors; the hierarchy of this processing being compared to previous memories. The input from the environment can influence the output or action but not determine it. For example, we may choose to ignore the room getting warm if we are busy with a task. However, if someone shouts "fire", our attention would shift to bring unattended information into our consciousness. Indeed, there exists a body of research that has explored the survival links between these external mnemonic cues and human evolution. These naturally evolved "crib sheets" enable human

survival, learning and development (Nairne, Coverdale and Pandeirada, 2019).

Studies involving visual stimuli and attention have revealed the impact of colour, location and brightness of shapes on a card. Rock and Gutman (1981) asked participants to say which shape was more aesthetically pleasing compared with another. The study concluded that fewer details in an unattended input compared with an attended input are capable of evoking a response when later recalled. The shapes that were attended to (aesthetically pleasing) were recalled more frequently.

2.3.4 Long and short-term memory

The term “short-term memory” has been historically associated with its temporal nature (Thorndike, 1910). However, research that is more recent holds that it is not so simple. Styles (2016) accepts that the term short term memory does not express the multi-faceted nature of temporary retention processes, as is now commonly accepted in cognitive psychology.

Ericsson and Kintsch critique both Anderson’s ACT model (1983) and Baddeley’s working memory model (1986) by claiming that memory, as a skilled activity, needs to include long-term memory. Their (1995) theory of long-term working memory (LT-WM) is an extension of Chase and Ericsson’s (1982) skilled memory theory, in which rapid access is required to long-term memory. To achieve this, LT-WM is used in addition to short-term working memory (ST-WM). This allows skilled experts to use LT-WM, reducing the load

on ST-WM, such that only the nodes that allow for the retrieval cues are held in ST-WM. For example, in Ericsson and Oliver's (1984) study involving expert chess players, the players were asked to mentally play a chess game without a board. The results indicated that recall of game positions in a cued task was fast and accurate, exceeding the capacity of ST-WM and suggesting that LT-WM was being used to access chess positions. Styles (2016) asserts that our ability to perform tasks automatically depends on a number of factors and, as we become more expert, what has been learned changes the way tasks are controlled.

2.3.5 The socialisation of learning and of memory

There are examples in educational psychology of how students learn. Behaviourists such as Pavlov (1897), Skinner (1938) and Watson (1913) consider learning to be manifested by a change in behaviour, with fundamental principles such as the importance of a stimulus or activity, repetition, reinforcement or reward, acting as the catalyst for this change. Cognitivists recognise that learning involves associations and the mental processing of information; major theorists include Piaget (1936), Bruner (1957) and Lewin. Humanists, such as Maslow and Rogers (1971), are concerned with self-actualisation. The premise of a student-centred theory is that student learning is driven by a desire to self-actualise and reach one's own potential. The role of the teacher in this context is to act as a facilitator of learning and the learner's goal is to be self-directed in their own learning. However, to achieve this, there needs to be a development of meta-cognition; the ability to think and process knowledge. Social learning theorists such as Bandura developed the theory that learning is a social phenomenon, occurring in a social context

through interaction with others and experiential learning. Constructivist learning theory adopts a learner-centred approach, in which learners construct knowledge through a process of self-led learning (Dewey, 1903, Vygotsky, 1950, Piaget, 1936).

Learning considered not only the remembering of facts but the ability to apply these to a given situation. Bloom's Taxonomy of Learning (1956) asserts that there are three main domains of learning: cognitive, affective and psychomotor domains. According to Bloom, the cognitive domain is linked to thinking and the attachment to the learning process. The Psychomotor domain is linked to the acquisition of skills-based learning. The affective domain addressing the emotional dimension of learning. The synergy of all of these domains, addressed by the educator, has been associated with greater skill and knowledge acquisition (Orlich, 2004). However, Bloom`s taxonomy was revised slightly in 2001, with some variation to the levels: Remember, Understand, Apply, Analyse, Evaluate, Create (rather than Synthesize) (Krathwohl, 2002).

Miller's social modelling theory (Miller and Dollard, 1941) rests on the premise that we learn by observing others. Indeed, it could be argued that we learn by pro-social modelling of behaviours we consider positive, which are reinforced, and negative ones, which are not. Bandura's work took this to the extreme and explored what would occur if negative behaviours were socially modelled (Bandura, 2001). Social learning theory explains human behaviour in terms of continuous reciprocal interaction between cognitive, behavioural and

environmental influences (Bandura, 1977). Theorists such as Vygotsky (1962) view learning as a social process, which is influenced by others in the learning environment (Simon, 1987). The concept of socialisation of professionals, is something which may draw parallels with Piaget and Vygotsky`s theoretical principles of how knowledge develops in a social situation. Healthcare situations may be considered such microcosms of professional practice for example handovers, where nursing and healthcare staff may be mnemonic devices to aid the structure of recalled patient/ client information, for example SBAR mnemonic Joffe et al, 2013 and Kear, 2016). Therefore, it could be argued that undergraduate nurse education has evolved to represent a balanced mix of theory and practice (NMC, 2019). To provide a holistic picture, nursing educational literature concerning memory and the recall of key information needs to include which factors influence learning not only in the classroom but also in practice. This could indicate how student nurses are using mnemonics to facilitate their own learning and future professional development. Furthermore, the context in which retrieval occurs could further facilitate or act as a barrier to retrieval. As there may be social enablers or disablers in healthcare teams such as how mnemonics are viewed by the nursing team either positively or negatively and nursing leadership regarding the value of student nurses as team members (Uren and Shepherd, 2016) or breaking the link between recall and action due to cognitive overload (Sweller, van Merriënboer and Paas, 1998).

2.3.6 Memory: learning, forgetting and recalling

How fast information is learnt can involve many factors, for example, intrinsic and extrinsic motivational factors to learn (Ryan and Deci, 2000); emotion and learning (Phelps, 2006); and attention and learning (section 2.3.3). Ebbinghaus (1885 cited in Thorne and Henley, 2005) described this learning, as a learning curve, how quickly information is learnt, its sharpest increase seen when first committing the information to memory, after each subsequent try, less information is committed to memory after each attempt until this this evens out. He also described a forgetting curve, linked to the decline in memory retention over time. Stored information is lost (decays) when there is no attempt to retain it (Thorne and Henley, 2005). The strength of the memory is a significant factor in not forgetting.

Recall is the mental process of retrieving stored information (memories) after encoding and storage has occurred. The term 'recall, recognition and retrieval' is used throughout this study and thesis. However, there are some marked differences in defining them, retrieval is the act of obtain information from memory, the process of recall is more superior, requires fewer cues than recognition (Bower, 2000). Indeed, there are different associations to describe these cues, for example, free recall is normally concerned with recalling a list in any order (Murdock, 1962). Cued recall is associated with the recall of a memory with the help of a cue or prompt, this could be visual or auditory information, for example a test, as this induces retrieval (Little, Frickey and Fung, 2019). Serial recall occurs when a list is presented, which needs to be recalled in the exact order it is presented, and is the most widely used short-term memory test in psychology and neuropsychology (Bhatarah, Ward, Tan,

2008). There are a number of techniques to aid recall, including the use of mnemonics (section 2.4). The use of 'external cues' by learners, which is defined in the below section can also support retrieval by reducing the demands placed on limited short-term memory capacity. Tullis and Benjamin (2015) acknowledge that although there is little research on cue generation in mnemonic tasks, learners must exercise accurate metacognitive control when generating effective mnemonic cues. As discussed, encoding is the first stage in memory production. Learners can have control over this process by choosing what is encoded (Benjamin, 2008) and by exercising intentional control over retrieval (Goldsmith and Koriat, 2007). In a study by Harris (1980) that aimed to discover how learners used external cues to aid retrieval of information, it was postulated that learners used such cues to offload into their environment, for example, writing on a calendar or putting items in special places to remind them of something. In healthcare, a number of studies have explored medication and prescription adherence (Caranasos, Stewart and Cluff, 1974). Leaving out a medication box as a reminder to take tablets is an example of external cue generation; the box is seen and acts as a visual cue. In a study on self-selection of memory cues, learners set up advantageous testing conditions by choosing cues to support later learning (Finley and Benjamin, 2015). Choosing their own cues improves memory performance, compared with randomly assigned cues. Nairne (2002) argues that the cue's distinctiveness – the more unusual it is – is the most important factor that determines if the target memory is recalled or forgotten. Cues that are consistent at both encoding and retrieval stages are deemed beneficial in that the more consistently they match, the higher the likelihood of information being

recalled accurately (Tulving and Osler, 1968). For example, when teaching students how to draw up a syringe of medication, which will be later tested under examination conditions, using the same information and equipment (sharps bin, needle) during the practice and the exam can aid recall. Under the examination conditions, having the environment set up in the same way allows for leaner selecting of the correct memory cues. Mnemonics in this instance are external cues, rather than written, rhyming and the method of loci (journey method)-based cues.

Both learning and remembering are inherently linked. Heuristically speaking, the old adage “easy come, easy go”, in that how quickly one remembers information indicates how quickly it is forgotten, does not always ring true. Koriat (2008) devised a new maxim, “easily learned, easily remembered” (ELER), concluding that easily learned items are better remembered due to their correlation to future learning. Koriat discusses memory cue validity, suggesting that this correlation is relied upon in monitoring one’s own knowledge (cue utilization). Simplicity, familiarity and predictability are all contributing factors to the learnability and recallability of items. To understand how someone remembers, it is not enough to understand neural mechanisms alone; one must also understand how visual cues in the environment effect memory and recall (Coman et al., 2009). From a social interactionist approach, Bartlett (1993) describes the act of remember as not the retrieval of stored replicas from the past; remembering is the act of reconstructing the past out of what is in the head and what is in the outside world. These schemas, formed from experiences, are built out of the interaction between environmental cues

and remembering, producing knowledge. These visual cues can be used as cognitive associations, building cognitive architecture. Tang et al. (2019) used different experimental conditions to explore the effect that mental time travel had on recall. Taking participants back to the time of memory encoding using specific activities associated with that time was shown to produce greater recall.

Creating stronger memory associations has been shown to enhance recall. In mnemonic training, an ancient memory game known as “concatenation”, or chain-making, creates interlocking concepts or links by using external material objects to augment the mind’s capacity and agility (Kirkbride, 2009). These cognitive adjuncts lend themselves to exploring a shift in thinking about mnemonics being more than superficial learning aids. Their value in challenging the historical context of how they support learning, renders them more than one-dimensional but instead, multidimensional. The following sections will now look at the evidence and literature surrounding the use of mnemonics and memory aids, both in education and nursing literature.

2.4 A typology of mnemonics

Mnemonics have also been shown to promote efficient encoding and retrieval (Smith and Phillips, 2001). However, the exact factors that influence this recall within healthcare, is not well documented – in fact, this applies in all disciplines across the educational sector. A number of different types of mnemonics exist with different educational applications. These are described in Table 2.6.

Table 2.5 Types of mnemonic devices – primary research, discussion articles

Mnemonic Type	Details	Examples	Literature/reference
Acronym	A pronounceable word formed by using the first letter of each word you want to remember. It uses those letters to make a new and more memorable sentence or phrase.	Method for remembering key sepsis treatment information: O_2 FLUID O= Oxygen, F= Fluid, L= Lactate U= Urine output, I= Infection screening, D= Drugs.	Surviving Sepsis Campaign (2016).
		A method of handover of healthcare information: SBAR = Situation, Background, Assessment recommendation.	SBAR NHS Institute for Innovation and Improvement (2013)
		Pre and Post-test using SBAR Mnemonic	Blom et al. (2015)
		Evaluation of a problem-specific SBAR tool to improve after-hours nurse physician phone communication:	Joffe et al (2013)
		A method of remembering blood gas analysis. ROME R= Respiratory, O= Opposite, M= Metabolic, E= Equal.	ROME

		Act FAST F = Face, A= Arms, S= Speech, T= Time Public health campaign aimed at raising the awareness of strokes and prompt referrals to healthcare practitioners by the public if they suspect a stroke is occurring.	Public Health England (2009, 2018)
		TIME Anaesthesia handoff tool T= Transaction, I = Induction, M= Maintenance, E = Emergency	Gibney et al (2017)
		SWITCH perioperative handoff tool S = surgical procedure; W = wets, I = implants, T = tissues, C = counts, H = have any questions	Gleadall et al (2018)
		UYE YAP (Turkish words) Undergraduate nursing students' mnemonic linked to nursing roles Practitioner, Administrator, Educator, Creative, Researcher and Professional.	Koksal et al (2013)

		CARE mnemonic nursing staff providing patient education C = Checking understanding, A= adapting education, R = reassessing comprehension and E = electronic documentation	Page, Cordon and Wong (2019)
		PREP mnemonic. Discussion article Nurse educators, preparing nursing students for clinical placement. P= purpose, R = realistic, E = evaluation and P = performance	Vogelsang and Besse (2019)
		AEIOU mnemonic. Discussion article A mnemonic aimed at student nurses to increase decision-making and clinical reasoning. Assessment, Education, Implementation of a Plan of Care, Outcomes and Understanding.	Maykut and Hung (2017)
		CHEST PAIN mnemonic, door-to-ECG time.	Ballard et al (2011)

		(Commenced, History, Extra symptoms, Stays/ radiates, Timings Place, Alleviates/ Aggravates, Intensity, Nature).	
		GLUCOSE BAD, Discussion article improve health outcomes for the diabetic patients. (Glycaemic control, Lipids, Urine microalbuminuria, Cigarettes, Ophthalmology, Sexual dysfunction, Extremities, Blood pressure, Aspirin, Dental checks).	McCrudden and Hull (2015)
		SLEEP MAD mnemonic Study to improve patient sleep quality in the ICU. Sedatives and stimulants, Lights, Earplugs, Environmental disturbances, Pain assessment, Medications, Activity, and Delirium.	Tang et al (2019)
		SAGE and THYME mnemonic. Discussion article Setting, Ask, Gather, Emphasise and Talked, Helped, You think, Me, End/exit	Griffiths (2017)

		A person-centred, evidence-based communication skills model that addresses district nurses' concerns about time and skills.	
Acrostic	A rhyme or poem whereby the first letter of each line is related to the information to be remembered.	WAVES: **W**ashing **A**shore **V**olumes of water **E**bb and flow on **S**andy beaches	
Peg mnemonic	A memory aid that works by creating mental associations between two concrete objects in a one-to-one fashion that will later be applied to information to be remembered.	Linking a list of words together e.g.: One is sun, two is shoe, three is tree	Henry Herdson (1651) Takahashi et al (2006)

Method of Loci (Journey Method)	Learners may choose a visual place in their mind, mentally place objects into that environment. The visual acting as a memory cue.	e.g. their car, if needing to remember information for a driving test. Mentally driving your car can help you recall the information. Back to sleep Safer Sleep campaign, SIDS Encourages parents to place their baby in the supine position to prevent infant death, SIDS.	Back to Sleep (1988) Safe to Sleep (1994)
Rhyming mnemonics	Rhymes use acoustic encoding to make concepts easier to remember.	I before e, except after c, and when sounding like a as in neighbour and weigh.	Phonetic encoding (Baddeley and Hitch, 1974)
Phonetic system	A number can represent a consonant sound.	eg 1=g 2= r 3= n. Numbers being remembered as words 321 = Energy. Then the words decoded back into numbers.	
Key word method	An unfamiliar key word is used.	eg “pod wrist” to recall podiatrist, the image of a big toe. Seeing pod wrist activates the image of the big toe, which in turn should activate podiatrist.	
Chunking mnemonics	Only so much information at a time; a device helps simplify information that	e.g. a 10-digit phone number. Broken into two three-digit sets and one four-digit set: 123-456-78910	Chunking (Miller, 1956) Cognitive load theory

	might otherwise be too complex to remember.		6 C`s (care, compassion, competence, communication, courage and commitment)
	Sepsis six	Six clinical interventions to treat sepsis	UK Sepsis Trust (2006)

As detailed in Table 2.6 above, there are a number of different types of mnemonic devices. The literature search reveals that acronyms and acrostics appear to be the most commonly used. Although other types, such as peg mnemonics, are quite common, which will be discussed later.

2.4.1 Acronyms and acrostics

Healthcare examples of mnemonics exist in nursing and medical literature, for example O_2 FLUID, ROME, and SBAR. The O_2 FLUID mnemonic, which is associated with the 'sepsis six' care bundles, details the treatment required for sepsis within the "golden hour" of diagnosis (Surviving Sepsis, 2018). As discussed in chapter one, this mnemonic, alongside ROME and SBAR, deals with critical time-dependent information that needs to be retrieved and acted on quickly. Having all the information to hand by being able to recall it accurately and promptly is advantageous within healthcare. ROME and SBAR are logical in terms of the relationship of the first letter to the facts being recalled. The O_2 FLUID mnemonic spells words that carry meaning; oxygen (O_2) and fluid. Worthen, and Hunt (2011) discusses how mnemonics, which use more meaningful words attached to the mnemonic, are more likely to be encoded, due to linking vital pieces of information together.

2.4.2 Peg mnemonics

The concept of a peg mnemonic was first postulated by Herdson (1651) in "The art of memory", which advocates hanging what you want to remember on mental image pegs. Common peg mnemonics include number rhymes, number shapes and alphabet sounds. Numbers can be used to pre-memorise associations between the numbers and the information that is to be remembered. In essence, the pegs become the words,

this can be associated to a rhyming method to aid the encoding process further. For example, one is sun, (the surgical cap), two is shoe (surgical overshoes) in an operating theatre, and so forth. To assist in the chunking of information assigning a rhyme or number to information to be committed to memory may use a “peg mnemonic” technique. It is the pre-memorising of numbers that rhyme in a list with the information to be recalled later. Takahashi et al. (2006) criticises this method, as the “peg” is only as effective as the individual’s ability to memorise the rhyme and numbers associated with it. Further mnemonic devices exist that are specific to numbers, such as the phonetic number system (Bremer, 2011). In this instance, mnemonics may be represented visually. Having explored different mnemonic devices, the next section will describe ‘method of loci’, in which the visualisation of a journey or walk can aid in memory recall, either with or without a mnemonic device.

2.4.3 Method of loci

Method of loci refers to a concept first theorised by ancient philosophers such as Cicero (Yates, 1966). ‘Loci’ comes from the Latin ‘place’; this is an information recall technique based around spatial navigation of memories. Visual information is organised and encoded into memory for later retrieval. For example, the information to be recalled is associated with different features of the layout of a building, such as where doors are, or other spatial information. To recall the information, the individual would “walk” through their memorised building as though it were a physical being (Gutman, 2007). This mnemonic device is also called the “journey method”. It is theorised that observing the visualisation of spatial cues and relationships acts as a memory hook to aid retrieval and commitment to long-term memory (Bremer, 2011). The concept is explored in seminal works, such as Bugelski’s (1968) study on the use

of images and visual cues to aid recall of word lists. Contemporary cognitive psychology literature has coined the phrase “mind palace” or “memory palaces”. Gruneberg and Morris (1992) assert that memory aids instruct learners on *how* to use techniques, but not *when*, and that these variables are difficult to control in a laboratory but should be examined and explained in the real world.

Spatial memory is concerned with encoding information from one’s environment and spatial surroundings to generate a cognitive map of images, later used for recall (Skoyles and Sagan, 2002). Maguire et al. (2002) discuss specific areas of the brain that deal with spatial memory, emphasising that individuals using a method of loci technique for storage and retrieval of spatial information demonstrate strong activation of the medial parietal (encoding and retrieval) and retrosplenial (memory and navigation) cortices. The right posterior hippocampus is considered the central point of spatial framework for events and neural processing (Hassabis et al., 2009). Having examined the role and architecture of memory and various types of mnemonic, I will now examine the use of mnemonics in healthcare and nursing education.

2.4.4 Mnemonic studies in healthcare, nursing and nurse education

Meta-analysis of studies shows that approximately 30% of students’ learning is directly related to the teacher’s impact and 70% from other factors (Hattie, 2003 and 2006; Hattie et al., 2015). Mnemonics may play a role within this 70%. Within healthcare and nurse education, there have been a number of studies using mnemonics to describe clinical features such as heart sounds (Warnica, 2007) or to pass on clinical information. The following literature has been themed to demonstrate the breadth and scope of mnemonic use in healthcare.

2.4.4.1 Mnemonics - handovers

Communication during transitions in care has been increasingly investigated due to its relationship with patient safety, quality of care and efficiency. Nurses have adopted strategies to improve the structure of handovers (Kear, 2016). Mnemonic strategies to promote structure in handovers (named “handoffs” in countries outside the UK). A handover may be described as the transfer of information, professional responsibility and accountability for some or all aspects of care for a patient or group of patients (British Medical Association, 2004). A descriptive study by Gibney et al. (2017) explored the impact of using a structured handover mnemonic in the anaesthetic department, aimed at improving communication and providing healthcare staff with a structure to achieve this. Gibney et al. argue that 80% of serious medical errors involve miscommunication between healthcare staff when transferring patients. Their structure consisted of an observation phase, where the outgoing provider used the TIME mnemonic to give structured information in the confirmation phase to the incoming provider (staff member). In the mnemonic, T represented the transaction phase (observations, procedure, patient history), I represented induction (airway, invasive lines), M represented maintenance (case specific timing, interventions) and E represented emergence (plan, goal and medications). The study concluded that using a structured mnemonic such as TIME, specific to the clinical environment, developed improved communication of key information that was vital to patient safety and increased efficiency in the flow of this communication.

Gleadall et al. (2018) studied the use of a handoff mnemonic (SWITCH) to improve communication in the ophthalmic perioperative setting. This was a quality improvement project, using a survey method with healthcare staff working in that clinical setting. Inaccurate or missing information or lack of structure can influence the

quality of such handovers (Abraham, Kannampallil and Patel, 2014). The mnemonic consisted of: S representing surgical procedure; W representing wets (drains and medications), I representing implants, T representing tissues (specimens/grafts), C representing counts (sutures, needles, instruments) and H representing 'have any questions?' (Equipment issues). The findings indicated that using the SWITCH mnemonic improved handovers by having a standardised format. The surveys were self-reported, which is acknowledged by the authors as potential weakness of the study. This may be reductionist if used exclusively to convey information. However, in complex clinical settings, where large volumes of information are communicated almost constantly some form of structure (mnemonic) is important to ensure that vital information is passed on, to avoid catastrophic error or omission. Thus, enhancing patient safety.

A narrative synthesis conducted by Spranzi (2014) took a systematic approach to studying the literature surrounding clinical handovers on the labour ward. The review found that many of the studies reviewed adopted a mnemonic during the handover of clinical information, and that these were often specific to the clinical setting, for example: CHAPS (Clinical picture, History, Assessment, Plan, Sharing of information), or SHARED (Situation, History, Assessment, Risk, Expectation, Documentation).

As discussed in the background literature to this research, SBAR features prominently in the literature surrounding handovers and could be considered a catalyst for the structuring of handovers among nursing, medical and allied health professionals. Although widely implemented as a quick handover method within healthcare globally. SBAR has not been widely tested in terms of its effectiveness with only a handful of

studies. Indeed, there is variation of practice consensus in the use of the R within the mnemonic structure (Mahlmeister, 2005). With some practitioner`s suggesting this is review and some recommendations and some adding an extra letter r for review (SBARR). However, there has been a number of research studies that support the use of SBAR as an effective communication method. Blom et al. (2015) used pre- and post-SBAR questionnaires to evaluate healthcare professionals' communication experiences. They found that SBAR increased efficient oral communication among healthcare workers (p=<0.001) and improved patient safety in the two 26-bed hospital surgical wards in Sweden. Cornell et al. (2014) studied the frequency of responding to patient deterioration using observations of shift reports using paper SBAR forms then electronic SBAR forms. Although participants may change their behaviour in response to being observed (Hawthorn Effect), overt participant observation remains a valid method to observe participants in their natural setting (Alasuutari, Bickman and Brannen, 2009). The study observed (n=36) registered nurses in a hospital setting and found that regarding shift reports: post-SBAR, time to complete shift report decreased with paper and electronic SBAR (p<0.01). Higher volume of information was also provided (p<0.01) and patient reviews were more consistent and shorter (p<0.01). A larger-scale study involved a pre- and post-study of 16 medical/surgical wards and five intensive care units, totalling 491 beds, in a hospital in Belgium (De Meester et al., 2013). Data was collected from 425 questionnaires to nursing staff and 207 serious adverse event patient reviews or nurse physician reviews. The findings revealed that Post-SBAR implementation, unplanned ICU admissions increased (p=<0.001) and unexpected deaths decreased (p<0.001). Interestingly, the study found no difference in cardiac arrest team calls. Using the SBAR mnemonic, nurses identified patient changes earlier and were more willing to call physicians, resulting in an increase in

unplanned ICU admissions and leading to fewer unexpected deaths. This study highlights the importance of the SBAR mnemonic and how having a memory hook of enabled nurses to be more willing to relay concerns around patent deterioration to doctors. By having information at the forefront of their minds, they ensured that no vital clinical information was omitted from these conversations.

A study involving SBAR and (n=9) nursing students was conducted by Fay-Hillier, Regan and Gallagher Gordon (2012). Students used the SBAR mnemonic in a simulated setting, in which they assessed a patient then reported to each other. The results indicated that students considered their simulation experience with SBAR beneficial in improving their communication, collaboration skills and focus on patient safety. It may be asserted that simply providing the mnemonic in its visual format does not ensure effectiveness of its use. Joffe at al. (2013) carried out a randomised controlled trial involving 22 nurse/physician pairs in a simulated on-call setting. Nurses contacted physicians regarding six adapted cases. Three were handed over without using SBAR (control) and three with SBAR. The communication regarding specific situation cues and background cues revealed that in the 92 telephone calls reviewed, most nurses reported situation cues (SBAR group 88%; control group 84%, p=0.6), but not background cues. Fewer background cues were provided in SBAR cases (SBAR group 14%; control group 31%, p=0.08). The study concluded that providing SBAR forms did not ensure communication of key information in after-hours telephone calls and that the mnemonic required embedding into nurse training. Stewart and Hand (2017), in their integrated literature review, indicate that the transferable and structured nature of the SBAR mnemonic is an effective intervention for patient safety through

improved communication, reducing the number of sentinel events associated with poor, omitted or miscommunication.

In conclusion, the literature surrounding SBAR indicates that it is highly effective at adding structure, improving individual and team communication efficiency, and enhancing patient safety. However, some literature indicates that to achieve this, the SBAR mnemonic must be embedded into training and healthcare education in a meaningful and appropriate manner if these desired outcomes are to be achieved. Carney, and Levin, (1998) suggests that this supports the priming of visual cues in the clinical environment. It could be articulated that these cues not only act as external mnemonic prompts but also foster a culture within healthcare environments that embed more “clinically valued” mnemonics such as SBAR within a culture of nursing and medicine.

2.4.4.2 Mnemonics - pain assessment

Effective pain assessment is an area of nursing that requires prompt treatment (Baillie, 2009) and has number of associated mnemonic strategies. For example, PQRST (Provokes/Palliates/Precipitating factors; Quality; Region/Radiation; Severity and Time) is often used within the acute care setting. Initial treatment of chest pain associated with myocardial infarction may use MONA (Morphine, Oxygen, Nitrates, and Aspirin). Newberry, Barnett and Ballard (2005) noted that using the PQRST mnemonic to assess for chest pain associated with myocardial infarction omitted the assessment of risk factors associated with the condition. As a practice initiative, the mnemonic CHEST PAIN was created, with each letter representing a trigger word linked to an assessment component of factors associated with a myocardial infarction (Commenced, History, Extra symptoms, Stays/radiates, Timings, Place, Alleviates/ Aggravates, Intensity, Nature). Newberry, Barnett and Ballard describe the rationale

for the mnemonic development and its use, but not detail any evaluation of its effectiveness. Craig and Smyth (2002) observe that professional discussion articles inform academic and professional discourse, but evidence-based practice in healthcare also requires detailed and robust research methodology.

The CHEST PAIN mnemonic was evaluated in a subsequent longitudinal, quasi-experimental quantitative study by the same authors; their focus was on using the mnemonic in door-to-ECG time (Ballard et al., 2011). Alasuutari, Bickman and Brannen (2009) indicate that a quasi-experimental design is used when independent variables cannot be randomly assigned, due to an innate characteristic of the participants involved, in this case, chest pain. In this study, nurses' knowledge related to identification of acute myocardial infarction before and after instruction on the mnemonic education (intervention) was evaluated. The sample included 26 nurses from four emergency departments/hospitals. A national registry database for patients with myocardial infarction arriving by self-transport to the emergency department to examined door-to-ECG (DTE) before and after intervention. Pre-tests and post-tests of the nurses were analysed using a paired t-test, and the pre- and post-intervention DTE times were analysed using log-linear modelling. The results indicated that evaluation of nurses' knowledge before and after the mnemonic education indicated an improvement in DTE time, but this was not statistically significant. There was a significant improvement in DTE time for two hospitals from the four, although this was somewhat negated in the aggregate data. However, there was an acknowledged trend, which showed an advantage in DTE time associated with male patients. However, the authors acknowledge the limitations of their study: extraneous variables may have contributed to changes in DTE times; the sample size was small (15% of

the total RN staff working in the emergency department) and site-specific staffing variations and clinical experience were not collected in the demographic data. As this study's design was quasi-experimental, following a quantitative paradigm, the implications of the CHEST PAIN mnemonic for all nurses working in an emergency department and assessing myocardial infarction, cannot be made. The authors concluded that a larger scale study might yield greater generalisability.

Although the above study is concerned with mnemonic use in the acute clinical setting, primary research in community settings is lacking, and focuses more on discussion papers. Duckworth (2019) discusses the need for community nurses to adopt a systematic approach to pain assessment, as chronic (longer-term) pain can be a challenge in the community setting and nurses play a key role in assessing and managing pain. Duckworth focuses on the importance of pain assessment, noting that using a recognised mnemonic can support nurses working in the community to effectively and holistically assess, treat and manage pain. The ABCDE mnemonic (Jacox et al, 1994) is cited: Ask about pain; Believe the patient; Choose appropriate pain control options; Deliver interventions in a timely manner; and Empower patients. The mnemonic ensures that all elements of pain assessment are addressed, to deliver effective pain management. Although not specifically designed for the community setting, the ABCDE pain mnemonic, like many others used in healthcare, is transferable into the focused clinical context. However, when using acronyms the lettering should be contextualised, as ABCDE mnemonic structures are also used within acute and pre-hospital settings by paramedics and nurses in accident and emergency departments. Where the focus reflecting the acronym is not pain but emergency/ primary survey assessment of the patient, (example Airway, Breathing,

Circulation, Disability and Exposure). Therefore, an important point to consider here is the context in which the acronym is used in, if not to anticipate a misrepresentation of its meaning.

2.4.4.3 Mnemonics - student nurse recall

Nursing education has both an epistemological and ontological purpose. Fostering the development of clinical reasoning and decision-making skills to assist graduates to respond efficiently and effectively to clients who have complicated health issues within a complex healthcare system often reflects the epistemological nature of nursing (Maykut and Hung, 2017). Maykut and Hung (2017) studied the application of an acronym mnemonic, (AEIOU), the mnemonic framework guided the analysis and application of practical and disciplinary knowledge of a case study in a theory course and laboratory component to enhance nursing students' continued progression of clinical-reasoning and decision-making skills. Each letter represented a key concept: Assessment, Education, Implementation of a care plan, Outcomes and Understanding. The mnemonic promotes the concept of inclusiveness as a vital perspective, challenging students to think beyond reducing and objectifying the patient by focusing solely on psychomotor skills development within a purely medical paradigm. In the study, the mnemonic became a map for the relationship between the nursing student and their patient to chart a shared journey of discovery. The study concluded that nursing students should transition into practice fluidly and competently, understanding and responding as appropriate to context. As students struggle with remembering, applying and prioritising learning experiences, creative strategies assisting in new learning experiences are crucial, not only for their success in training but also for transitioning into practice. However, the study does not describe the

sample population in any detail, which could be a potential limitation. Nevertheless, it highlights the importance of mnemonic strategies on the student's future learning, in addition to the value placed on current learning goals.

As discussed, mnemonic usage does appear in the nursing and healthcare education literature. The rationale provided is that mnemonics aid recall and improvement in the retention of information for more effective communication of clinical information, for example, handovers.

Mnemonics have been used by medical students to aid recall of factual information. (Yousaf and Chaudhry, 2006). Memory retention strategies in nurse education mirrors a similar approach. An experimental cohort control study by Koksal et al. (2013) explored the impact of the letter/phonetic method on recall of basic knowledge about healthcare systems, roles of nurses and health teams. From a sample of 76 first year student nurses, 39 were assigned to the experimental group, receiving mnemonics linked to information about healthcare systems, roles of nurses and health teams. The control group received the same information without the mnemonics. The results indicated that there was a statistical difference in recall in the experimental group and that the letter/phonetic method was highly effective in boosting learners' recall. By comparison, the control group's recall of the same information was not as high. Mastropieri and Scruggs (1998) argue that when the acronym technique is used, it the meaning behind each letter which is effective for recall. As reinforcement principles, proposed by Skinner help students understand the process of effective participation in understanding what each letter stands for, rather than simply recalling a letter. The study by Koksal et al. (2013) used reinforcement; getting students to repeat the

mnemonic and the linked information. Although the mnemonics were in Turkish, UYE YAP, they helped students remember non-clinical information, for example, the roles of nurses: Practitioner, Administrator, Educator, Creative, Researcher and Professional.

2.4.4.4 Mnemonics - providing information to patients

A pilot study by Page, Cordon and Wong (2019) considered the effectiveness of a mnemonic to facilitate nurses in providing information to hematopoietic stem cell transplant patients. The mnemonic, CARE, consisted of Checking understanding, Adapting education, Reassessing comprehension and Electronic documentation or paper documentation. The sample of 76 participants were all qualified nursing staff working in oncology day services or inpatient haematology. Self-reported Likert scales were used to assess the usefulness of the CARE mnemonic to knowledge and behaviours, resulting in noticeable but statistically insignificant changes. Over a three to six week post-test period, the self-reported value of the CARE mnemonic remained high. The study acknowledges limitations in terms of the lack of a pre- and post-intervention concerning electronic and paper-based outpatient charting methods at the time of audit.

2.4.4.5 Mnemonics – nurse educators

A discussion article by Vogelsang and Besse (2019) focused on the significance of preparing students prior to clinical placements. The paper elucidates the value of using the PREP (Purpose, Realistic, Evaluation and Performance) mnemonic, aimed at assisting academic staff working in nurse education to ensure that preparation

assignments are meaningful and learner-centred. Preparing of nursing students positively influenced patient safety, by having the student arrive at their clinical placement with an understanding of the patient's condition (Vogelsang and Besse, 2019). The authors acknowledge that although PREP may assist educators in curricula design, evaluation of the mnemonic framework is required to assess its effectiveness in the clinical setting from both student and instructor perspectives.

2.4.4.6 Mnemonics and public health – information to the public

Public Health England's (PHE) "Safe to Sleep" campaign, formerly known as "Back to Sleep", has been adopted in the United States, where it is called "Safer Sleep" and is backed by the US National Institute of Child Health and Human Development (NICHD). The initiative encourages parents to have their infants sleep on their backs (supine position) to reduce the risk of Sudden Infant Death Syndrome, or SIDS. Since "Safe to Sleep" was launched in 1994, the incidence of SIDS has declined by more than 50% in the United States (NICHD, 2020, online). However, within the United Kingdom, the Office for National Statistics (ONS) indicates that overall deaths from SIDS have declined over the last 10 years, although an increase of 11% was seen in the UK in 2016 (Lullaby Trust, 2020). Possible risk factors such as maternal smoking and overheating have been cited (ONS, 2019a). These campaigns used a method of loci and an acronym. The method of loci, or journey method, is created by the "Back to Sleep" visualisation of parents being instructed by the mnemonic. This campaign used a double mnemonic approach, in that its focus, SIDS, is also a mnemonic, in this case, an acronym.

PHE's Act FAST campaign, begun in 2009, was aimed at those who may be at risk of a stroke. Stroke is a treatable condition and continues to be the third leading cause of death in England and the largest cause of adult disability, with 32,000 deaths annually (ONS, 2019b). Televised advertisements used a mnemonic to relay the important public health message, imploring the public to "Act FAST". The mnemonic components represent: Facial weakness - can the person smile? Has their mouth or eye drooped? Arm weakness - can the person raise both arms? Speech problems - can the person speak clearly and understand what you say? Time to call 999. The Act FAST campaign was re-launched in 2018 (PHE, 2020a). In addition to the television campaign, an additional strand of activity aimed to convey the message specifically towards the black and minority ethnic (BAME) community and those in the middle age bracket. The rationale for this is that people of African and South Asian origins are twice as likely to have a stroke as people of European origin, and risk factors associated with a middle-aged sedentary lifestyle increased cardiovascular disease associated with stroke (PHE, 2020b). The benefit of using a mnemonic in this instance is its effect on aiding retention of information. The advertisements used audio and visual factors to relay information, which can influence storage into short-term memory and long-term memory if significant attention is focused. The television advertisement used the visual metaphor of a fire in the brain of the person experiencing the stroke, which made for compelling viewing. This is coupled with the empowering public health message, that the person witnessing the event can phone emergency services for help.

The television advertisements aimed to capture a large audience and to focus their attention on the computer-generated fire occurring in brain of the actor. This added an emotional element but emphasised that time was a significant factor in acknowledging

the condition, referring to emergency services and initiating prompt treatment. The main tag-line to the campaign, in addition to the mnemonic, was “the faster you act, the more of the person you save.” There is a parallel here between the Act FAST campaign and the sepsis six care bundles in the acute treatment of sepsis. With sepsis mortality rates being higher than stroke, and almost half of the ICU bed days in the UK used for severe sepsis, there is a need for timely diagnosis and treatment to reduce complications, decrease ICU length of stay and improve the prognosis for patients with a sepsis diagnosis (EPG online, 2018). Although sepsis has higher mortality rates than stroke, there is yet to be a public health campaign using television to spread the message to a wider audience. These campaigns highlight that mnemonics are used to enhance public health messages using the accessible and familiar medium of television.

2.5 Sepsis mnemonics

To help improve compliance to the Sepsis Six, the mnemonic BUFALO was created (Sepsis Trust Campaign, 2006). The acronym stands for three diagnostic and three therapeutic interventions initiated in suspected cases of sepsis: Blood cultures, Urine output, Fluids, Antibiotics, Lactate, Oxygen. Although these bundles are simplistic and seemingly easy to implement, worldwide compliance is weak with only around a quarter of hospitals successfully apply these guidelines (EPG online, 2018). Critics have also argued that the Sepsis Six does nothing to promote early identification and is frequently used after septic shock has been diagnosed.

2.5.1 Mnemonics – other clinical conditions and clinical settings

Mnemonics have been used for other conditions, but as with other literature discussed in this chapter this appears to focus on author`s designing a mnemonic concerned

with a clinical condition, without it being tested as part of a primary research study. A discussion article by McCrudden and Hull (2015) used American Diabetes Association management guidelines to formulate the mnemonic GLUCOSE BAD (Glycaemic control, Lipids, Urine microalbuminuria, Cigarettes, Ophthalmology, Sexual dysfunction, Extremities, Blood pressure, Aspirin, Dental checks). The acronym mnemonic advocates using this to assess all the complex points of care to improve health outcomes for the diabetic patients. Although the literature surrounding the clinical information is evidence-based, the public health decision to support the use of the GLUCOSE BAD mnemonic is opinion driven.

As discussed earlier in this section the mnemonic ABCDE was used to structure pain assessment (Jacox et al., 1994). Similar first letter acronym mnemonics also appear in primary patient surveys and skin assessments. For example, the Skin Cancer Foundation (2014) advocates using an ABCDE mnemonic for assessing skin conditions (Appearance/asymmetry, Border, Colour, Diameter, Evolving/exposure). The mnemonic is a clinical guide to “effective” practice, to ensure all aspects of skin assessment are addressed, based on consensus data compiled from risk factors associated with skin cancers, rather than a study concerning the effectiveness of the mnemonic itself.

There appears to be a dearth of studies involving mnemonics and care bundles in nursing. However, Tang et al. (2019) conducted an observational, prospective, single-site quality improvement pilot study in a hospital intensive care department in Canada, which aimed to assess the feasibility and outcomes of a designed mnemonic implementation. The study had three phases: pre-mnemonic implementation (n=36

patients), training and education, and post-mnemonic implementation (46 patients). The mnemonic had been developed as a standardized nursing tool to help improve patient sleep quality in the ICU setting. As a patient care bundle, SLEEP-MAD stands for Sedatives and stimulants, Lights, Earplugs, Environmental disturbances, Pain assessment, Medications, Activity and Delirium. The Richards-Campbell Sleep Questionnaire (RCSQ) was completed by nurses and patients to assess the quality of sleep. Data was analysed using descriptive statistics; unpaired t-tests and Mann-Whitney tests were used for continuous variables, while the Pearson's Chi-squared test was used for binomial variables. The study demonstrated that implementing the SLEEP-MAD mnemonic improved patient sleep quality but overall there was no statistical significance. However, two statistically significant differences were observed; the use of sedatives were less prior to the patient's ICU stay (20.8% post- versus 50% pre-) and more mechanical ventilation was used overnight (57.9% post- versus 39.4% pre-) in the post-mnemonic phase than in the pre-mnemonic phase. The authors did indicate a high compliance rate (72%) and that the mnemonic appeared to improve patient sleep quality in the ICU. However, they reflected on the need for a larger scale study to confirm statistical significance and larger validation studies to confirm this observation. Welford, Murphy and Casey (2011) acknowledge that small sample sizes in observational prospective studies can be a limitation. As the Tang et al. (2019) study was only a small-scale single site pilot; this could be a further limitation to external validity. That said, Alasuutari, Bickman and Brannen (2009) assert that pilot studies can be useful to test the validity of a data collection tool.

Within community settings, mnemonic studies are limited and as stated previously, the main literature on mnemonics comprises discussion articles rather than primary

research. A discussion article by Griffiths (2017) describes the professional value of a communication skills model (mnemonic) that addresses district nurses' concerns about time and skills. SAGE and THYME is a person-centred, evidence-based communication skills model that stands for: Setting, Ask, Gather, Emphasise and Talked, Helped, You think, Me, End/exit. This provides a structure for conversations about concerns and empowers patients to work with district nurses to find solutions. The model has been evaluated as to its effectiveness in enhancing communication skills (Connolly, 2010; 2014). The article concludes that, compared to other person-centred communication skills models, SAGE and THYME is appropriate to district nursing because the structure is clear and simple, which can save time. The authors acknowledge that further research is needed on whether the communication skills learned in the three-hour training workshop is sustained or whether more training is required.

2.6 Paradigm shift in the use of mnemonics in healthcare

The value and use of mnemonics in clinical practice and education has undergone a paradigm shift: from a traditional view, that they are a useful memory aid or learning tool but actually do little apart from develop rote and surface learning. To their resurgence, driven in part by the patient safety agenda, which has highlighted their usefulness in complex clinical settings for ensuring appropriate recognition, communication and response. Mnemonics in the public consciousness have been driven by the public health agenda and media campaigns. Supporting studies of mnemonics in nursing have discussed their benefits in supporting learning and helping to commit important information to memory (Koksal et al., 2013; Gibney et al., 2017; Gleadall et al., 2018; Vogelsang and Besse, 2019). The shift within healthcare

education has been away from the more generalist use of mnemonics it simply improve rote learning. In education, learners appear to use mnemonics to “chunk” and retrieve information for an examination, a relatively infrequent event considering the entire learning journey. Healthcare has a more consistent time-dependent context, where learners may use information not only to pass examinations but also in their day to day professional role, where the pressure of a time-dependent examination may not exist but a time dependent situation may, for example, clinically managing a patient with a sepsis diagnosis.

2.7 Research Question

To ascertain new knowledge a research question must first be asked (Rosenberg and Donald, 1995). To facilitate this, the existing research surrounding this topic (chapter two) formed part of the supporting rationale for using an evidence-based approach to formulating the research question (Craig and Smyth, 2002). This study’s research questions were derived from gaps in the current literature. According to Cutcliffe and Ward (2007), research is a rigorous and systematic enquiry using methods designed to make a contribution of knowledge. Dawes et al. (2005) observe that strong research follows a logical pattern of processes to arrive at the decisions; this audit trail should be clear and not ambiguous. Each question must be answered by a “best fit” approach in terms of the methodology used to answer it. Therefore, the focus of this study was:

To undertake an exploratory study; to examine mnemonics among student nurses and factors that support the retrieval of clinical information.

Having identified the study’s focus, it was then possible to formulate and refine a study aim and research question.

2.7.1 Research aim and questions

The aim of this study was to explore the factors that influence the retrieval of clinical knowledge and in particular, to examine the role, if any, that mnemonics play in this process. From this broad aim, it was possible to design a series of research questions, which related to either the quantitative or the qualitative strand of the study. The research questions were:

1. To what extent do students use a mnemonic to structure their answer when communicating the management of sepsis during the communication station of a clinical examination? (Quantitative Strand).

2. To what degree does a structured approach of using a mnemonic decay over time? (Quantitative Strand).

3. What factors do students perceive as being important influences in the use of mnemonics in their learning? (Qualitative Strand).

4. Do students utilise their own or other mnemonics to enhance their own learning outside of an assessment process? (Qualitative Strand).

5. To what extent do students use mnemonics to structure their future learning and professional development? (Qualitative Strand).

2.8 Chapter two summary

In this chapter, the literature on mnemonics, attention and memory has been reviewed. Cognitive neuroscience and educational psychology studies have revealed theories that support how memory works in terms of processing and retrieval concepts, and how attention shifts, from the perceived unimportant to important information, to be committed to long-term memory. The literature surrounding mnemonic use in a healthcare context has highlighted how although mnemonics have been used within education historically, their value on retrieving clinical information in a time-dependent situation appears to be a core theme emerging from the literature reviewed. Mnemonic use in time-dependant situations such as student assessment has been highlighted in the studies and discussion articles reviewed. Mnemonic use in nurse education exists, for example, in assessment and communication. However, there is a dearth of primary research studies surrounding their use among student nurses to retain key clinical information. Key literature focuses on retaining information which has little value to mnemonics used to facilitate information for structuring nursing handovers (hand offs) As discussed in Chapters one and two, sepsis has high mortality and morbidity rates. Therefore, using sepsis as a clinical condition to explore mnemonic use by students further supports the rationale for this research study. Current nursing literature highlights that mnemonics appear to be of substantial benefit, but primary research supporting this is not substantial and does not account for the factors surrounding the retrieval of clinical information. Exploring these issues from a practical application perspective during examinations and then in the real world of clinical context and how stunddent nurses are using these mnemonics and their experiences on this could provide a new perspective on a controversial viewed learning tool (mnemonics).

The existing supporting literature, coupled with the biomechanics and cognitive architecture of memory, suggest that student nurses are in a key position to recognise, respond and be involved in the treatment and management of sepsis to prevent further patient deterioration. Therefore, a memory recall device or mnemonic, for example O_2 FLUID, which aids recall of large chunks of clinical information associated with reducing mortality and morbidity is worth exploring to ascertain the factors associated with its value to nurse education and healthcare. The key focus of this thesis is to ascertain what the factors are surrounding the retrieval of mnemonic bound clinical information, to what degree do student nurses retain, utilise and value mnemonics. From the literature discussed in this chapter, the imperative when exploring mnemonics within the nursing context, in particular student nurses. Is supported by the patient safety agenda, that student nurses are often the least qualified to undertake and recognise clinical deterioration and during emergencies when time is a crucial factor their attention may be focused on other nursing tasks. Therefore, exploring mnemonics in this context to ascertain which factors influence the retrieval of clinical mnemonics, is worthy of further investigation. Particularly when considering an educational context to their use (university) and a real world (clinical context).

The dearth in both quantitative and qualitative studies focusing on particular factors effecting recall or retrieval over time is a further driver to undertake primary research in this area. As postulated by Cryer (2000), when discussing the originality of doctoral research, one way to do this is by exploring the unknown. This study proposes to answer questions that will not only add to the body of knowledge supporting nurse education but also explore that, which is not yet known, i.e. factors that affect retrieval of the mnemonic and consequent retrieval of vital sepsis management/treatment

information. The next chapter focuses on the philosophical underpinnings of this study and its methodological considerations; the formulation of the research aim; and questions emerging from the literature reviewed.

CHAPTER 3 PHILOSOPHY

3.1 Introduction

The previous chapter discussed the current literature on memory and mnemonics, providing a basis for this study and highlighting gaps in primary research and contemporary thinking on the use of mnemonics within nurse education. This chapter explores the main philosophical and epistemological influences that have shaped and supported this research. Pragmatism, as a philosophy and a methodology to conduct research, will be defined and articulated. Central theorists in the pragmatist movement will be discussed; the merits and limitations of this approach to knowledge generation will be explored; and the rationale for choosing this stance will be described.

3.2 A paradigm shift in contemporary research

Kuhn (1962 cited in Kuhn 2012) argued that scientific knowledge does not progress in a linear fashion, but rather that “paradigm shifts” open up new concepts and ways of conducting research by developing new theory and theoretical approaches. A paradigm is defined as a cluster of beliefs about the proper conduct of science. This concerns the nature of knowledge (epistemological position) and the nature of being (ontological position). Kuhn argued that different paradigms or stances within a branch cannot be reconciled, as there was no common ground as a result of differences in the underlying tenets of epistemology and ontology (Hairston, 2009).

The earliest paradigm related to scientific method where there was a single version of truth, and cause and effect could be measured. Positivists claim that the world can be explored, explained in scientific and measurable parts, deconstructed mathematically and quantified in numerical and statistical presentation (Bryman, 2001). This positivist view of the natural sciences has been the bedrock of the scientific community from the

conception of the scientific movement. Indeed, a “purist” positivist stance holds that that hypothesis testing and using empirical data to explain phenomena is the only way in which research should be undertaken. It is concerned with variable manipulation and measurement to prove or disprove the hypothesis in question, thus answering the research question to yield new knowledge. Conversely, interpretivism is concerned with making sense or interpreting the “world view” using subjective and “rich” experiences, thoughts and views to answer research questions (Alasuutari, Bickman and Brannen, 2009). These paradigms differ in both epistemology and ontology.

It is worth defining these terms: Epistemology is the theory of knowledge, how knowledge is gained, by which methods, its validity, and separating one’s justified belief from opinion (Bryman, 2001). Ontology is concerned with the nature of reality and the nature of being. Quantitative research has its roots in positivism, believing in the quantification of data (Parahoo, 2006). For example, quantitative studies might aim to measure improvements in outcomes by comparing control and intervention groups. The drive behind using a quantitative approach is to produce results that can be generalised to a wider population with some degree of accuracy. Hek and Moule (2006) state that external validity is the extent to which the results may be generalised to other contexts or populations. This implies that the findings are objective and free from bias. Indeed, subjectivity and objectivity are polarised concepts and it is possible to glean richer, albeit more subjective, data from the experiences of those participants recalling them. Beresford (2003) asserts that there is no one singular truth within the social sciences; only the perception of truths – collective agreed facts that change over time. Moreover, these truths have a definitive “half-life”; new knowledge must be generated if informed decisions are to be made.

In the 1970s, the debunking of positivism ended with the emergence of post-positivism and research designs that used both quantitative and qualitative methods, gaining ground for constructivists during the late 1980s. The discrediting of positivist approaches to research sparked critical debate and academic discourse. A range of "isms" flourished, for example constructivism, naturalism, interpretivism, feminism, and poststructuralism (Lather, 2007). Within healthcare research, other paradigms flourished, such as structural functionalism, political economy theory, social interaction theory, poststructuralism and critical realism (McDonnell, Lohan and Porter, 2009). Teddlie and Tashakkori (2003) observe that during this phase (war two), "paradigm purity" gave rise to disputes between individuals concerning their own paradigm position and the superiority of these claims were challenged. This incompatibility debate gave rise to the first paradigm war, due to paradigm assumptions. Teddlie and Tashakkori (2003) challenged these assumptions, invoking triangulation as an answer to combing multiple methods to study the same phenomenon. It was from this stance that the emergence of mixed methods designs started to emerge. The third war saw pragmatism emerge as a "what works" ethos with earlier pragmatic researchers arguing for its inclusion within the debate (Howe 1988, Maxcy, 2003). The validation of mixed methods research from paradigm war two gave a "green light" for researchers to adopt this "third way", with more than one method producing stronger inferences (Denzin, 2010). Advocates for mixed multiple methods, such as Teddlie and Tashakkori (2003), extol the virtues of cooperation and collaboration within methodologies.

3.2.1 Reconciling methodological acrobatics

The major issue with presenting positivism and interpretivism as polar opposites is at ontological standpoints. The social realm waiting to be discovered by the researcher, conversely a domain that is in constant flux being recreated by its participants (Alasuutari, Bickman and Brannen, 2009). The objectivist and constructionist, the nature of society explored by positivist and experimental approaches, with one reality and the human experience for example detailed by interpretivist researchers, constructivist explaining multiple realities. Quasi-experimental designs arise from the blurring of methodological boundaries that resulted from the fallout of the paradigm wars. Triangulation offers a potential reconciliation of quantitative and qualitative research, thereby resolving some of their weaknesses. Although post-positivism has moved beyond the rigidity of pure science and aims to understand phenomena, there still exist unmovable tenets underpinning the movement, for example, recognising that there cannot be theory-neutral observation (Wacquant, 2003). Historically, within healthcare research, a positivist stance has been favoured and few published articles draw on mixed methods study designs, with variable methodological components (Wisdom et al., 2012). Lincoln and Guba (1985) assert that both paradigms of quantitative and qualitative stances have their traditions. In healthcare research, there exists a bias towards conducting empirical research based around a “hierarchy of evidence” that reflects a positivist stance. Indeed, NICE guidelines (2018) are based around such a hierarchy, with randomised controlled trials and systematic reviews of RCTs at the top. However, the paradigm wars have paved the way for new thinking and subsequent paradigms, and triangulation of methods can increase scope, depth and consistency (Flick, 2014) – although Silverman (2005) acknowledges research must still operate according to ground rules. This research study will therefore follow

strict methodological procedures concerning mixed methods research, including when the mixing of “strands” occurs and the rationale for this approach (see sections 3.4 and 3.5).

3.2.2 The fallacy of objectivity

Howe (1985) argues that no research endeavour is free from judgement and that attempting to bracket researcher bias compounds further bias. This must take precedence over the researcher’s own bias towards favouring one paradigm over another. The nature of research carries with it a subjective element, which cannot be completely removed, although methodological considerations attempt to remove many subjective biases. However, a third way has emerged. Mixed methods acknowledge the value of the subjectivity of participants (Creswell, 2003). Denzin (2010) concludes that there are no ironclad criteria regulating the production of knowledge generation, echoing that a moral and methodological community, which honours and celebrates paradigmatic and methodological diversity, is required to move inquiry forward. Dewey (1938) notes that the objective/subjective nature of inquiry undergoes temporal modification; it is altered by the researcher through the passage and process of time, viewing events objectively and the researcher processing these subjectively. Even scientific data processed by a computer undergoes subjective interpretation when it meets a human researcher. For this reason, the scientific method should also be reflected in results outside of the laboratory for a more holistic answer to research questions. It is not the intention of this research to be contentious, or to deliberately challenge the orthodoxy of either current educational thinking or methodological paradigms. Rather, the aim is to answer the research questions using the most appropriate methods and methodology available. This meant using a mixed methods

approach to draw on the strengths of both paradigms. The study will use quantitative methods, followed by a qualitative phase to fully answer the research aims.

It could be considered an objective researcher is one who considers other methodologies and approaches to conducting research (Bryman, 2004). Indeed, before selecting pragmatism as an underpinning philosophy and methodology. Other methods were considered before rejecting these, in favour of a “best fit” to answer the research aims and objectives. Phenomenology or the lived experience is a valid research method, which draws on qualitative principles to give meaning to this lived experience (Alasuutari, Bickman and Brennen (2009). This approach as a research method has many benefits such as rather than the phenomenon be studied in a vacuum, the perception of the event yields rich, subjective data. This approach has been used with success in phonological approaches concerning health related studies for example living with diseases or illness. Although there are positive, approaches to using this approach there are disadvantages such as defining what a “typical” experience is to derive meaning (Flick, 2014). Furthermore, when considering why this approach was not chosen for this study, the methods of collecting data such as participant observation could have been used covertly with the OSCE examination setting without effecting student performance during the examination. However, in clinical practice conducting overt or covert participant observation during clinical placements would have been logistically impossible to conduct due to not being able to predict when students who use the mnemonic, for example O_2 FLUID.

Ethnographic approaches were discounted due to the potential of the researcher`s own personal experiences of using mnemonics. Borneman and Hammoundi (2009) state that ethnography is concerned with being there, observing events and processes as they occur. A major tenant of ethnography is the participation, writing about the

field and facts that have been observed (Flick, 2009). If this was the chosen approach for this study then observing facts concerning mnemonics would have yielded some data in terms of observable behaviour exhibited by the students (participants) in this study but not the cognitive processes and reality created by the students concerning mnemonics that were occurring cognitively, in the learner`s mind.

3.3 Pragmatism as a philosophy

Three American philosophers are considered the founding fathers of pragmatism; natural scientist and philosopher, Charles Peirce (1839-1914); psychologist and philosopher, William James (1842-1910); and educationalist, John Dewey (1859-1951). Other theorists have further added to the movement, such as George Herbert Mead (1863-1931) and Clarence Irving Lewis (1883-1964). Consequently, there are a number of different classifications of pragmatism, each with its own distinct philosophical theme. The amalgamation of divergent philosophies and the scientific approach to reasoning gave rise to the pragmatists of the eighteenth and nineteenth centuries. Pragmatism is based on the premise that (practical) actions are separate and situational, in which knowledge and action are closely combined (pragmatic) (Kant, cited in Mohanty and Shahan, 1982). The pragmatists of the early nineteenth century, heavily influenced by western philosophy, developed their pragmatic view in direct contrast to positivists. However, pragmatism differs in one major aspect; that philosophy should take the methods and insights of modern science into account. Biesta and Burbules (2003) argue that it was this pioneering spirit of early American culture and the emancipation of American citizens from both British rule and ideology that enabled the move to a more free-thinking a social consciousness. This in turn led to the development of new ways of viewing society, politics, religion and scientific

enquiry, resulting in the philosophical birth of the early pragmatists such as Peirce, James and Dewey.

Peirce first published his attempts at formulating pragmatism in the 1870s, developing the maxim that would later become a precursor of the verification principle, proposed by logical positivists of the early twentieth century. This early work influenced William James who, within twenty years, publicly declared the doctrine of pragmatism. Peirce introduced a principle known as the “third grade of clarity”, which developed the rationalist notion of “clear and distinct ideas”. For Peirce, attaining truth comes from taking investigation and inquiry as far as it can go (Peirce, 1878, cited in Houser and Kloesel, 1992). These beliefs we accept as the limit of inquiry, representing the truth, which Peirce defined through the adoption of a scientific method. Hookway (2000) details Peirce’s later concern with attempting to “prove” his own pragmatic maxim, by discussing the structure that such a proof should take. It is the mixing of philosophical stances and the scientific tenet of proof, which partly classifies the epistemological stance of pragmatism.

William James acknowledged the work of Peirce and developed his pragmatic epistemology, which considered the meaning of ideas and the truth of beliefs in terms of the practical difference they could make in people’s lives. His exploration covered a number of theoretical and metaphysical topics including: religious belief, metaphysics, human freedom, moral values and social philosophy (James, 1970). His theorems and philosophical discourse covered his stance on freedom vs. determinism, phenomenological understanding of the self and consciousness, a “forward-looking”

conception of truth, and connection with communal and social concerns (Gale, 2005). From here, James and other pragmatists took Peirce's pragmatic maxim and moved it in new directions. For example, in the work of John Dewey, which provides this study's underpinning philosophy.

3.3.1 A Deweyan approach – underpinning philosophy for this study

Hickman, Neubert, Reich, (2009) observe that individual experience, according to Dewey, can be viewed as a transaction between the living organism and the environment. This double relationship, with the individual acting in response to its own surroundings and subsequently being influenced by them, can be seen to demonstrate Dewey's behaviourist influences. However, Morse (2011) notes that Dewey viewed objects (people) in the world being reshaped by our interactions with them, they do not exist simply in isolation. This highlights a constructivist stance where an individual 'socially constructs' meaning and truth within the context in which a phenomenon is experienced. Hickman, Neubert, Reich (2009) argue that there is a distinction between constructivism and pragmatism; the former seeking to explain that humans are both observers and active participants in transforming the patterns which construct reality. Therefore, it may be argued that constructivism and pragmatism share some common philosophical elements, as experience shapes subjectivity within the natural world. However, they are different, in how the individual interacts with the environment and that the environment is not a passive conduit for the individual`s experience (Dewey, 1938). It is active and part of this social construction of knowledge, experience and meaning.

For Dewey, these domains of knowledge and human action are inherently linked. It is this fallibility of human nature, which for Dewey could not be captured using modern scientific methods alone. Not with absolute certainty, in the method but in defining the link between knowledge and action, theorising “intelligent action” (Dewey, 1903). In this regard, Dewey might not be considered a positivist from a modern perspective. In some respects, he may have been considered the founding father of a mixed methods approach. He argued that modern science had stripped the world of its beauty and qualities, with everyday or “common sense” reality being interpreted by the worldview of the scientific approach in accounting for “reality” (Dewey, 1929). A Deweyan perspective considers “reality” to be a construct of knowledge and actions, defined not just by the individual’s mind but also by the organism-environment. This was deemed “transactional realism”, a dynamic balance between organism and environment, resulting in changes in the environment and in the pattern of action of the organism (Sleeper, 1986). Individuals actively engage with and transform the environment, and these transactions produce knowledge through experience, so thus have the ability to reconstruct reality continuously (Garrison, 1994). According to Garrison, this worldview closely aligns pragmatism with constructivism and has been called “transactional constructivism”. Transactional constructivism is a critical concept in the philosophy underpinning this study’s design, which focuses on the “transactional realism” between the participant (student) and their environment (OSCE examination and students’ experiences on clinical placement), and subsequent changes in actions (concerning mnemonics).

Knowledge is understood in terms of its connection and considerations to time and temporal position (Dewey, 1916, cited in Biesta and Burbules, 2003). Here, Dewey is

arguing that research is both time and is context dependent; that one can never revisit a previous situation and there is a sequential nature to inquiry. For this study, data collection occurred over four sequential time points and, as the cohort advanced with their nursing programme, so did the research study. From this perspective, the pragmatic approach draws a constructivist veil, in that the nature of the participants' reality is unique and can never be repeated. A positivist critique of the study's methodology would question what value the results have to educational research, if experience is unique and cannot be repeated. However, a logical development to the act of inquiry shapes the research, the "conflicting habits" or situation in which we do not know (Dewey, 1903). These indeterminate situations, transformation of situations into cognitive experience, to see that a situation needs inquiry is the first step in inquiry (Dewey, 1938). To draw a parallel, the literature for this study has revealed that although mnemonics have been used within education to some extent, their application to nursing research is not understood in terms of the cognitive experience as it happens in both the laboratory (in the university environment) and in the real word (on clinical placement). This is worthy of investigation if it provides new knowledge that might challenge the superficial, unidimensional thinking concerning mnemonic use in nurse education. The un-thinking of false dichotomies, assumptions, traditional practices, thus make the research activities more reflective or, to use Dewey's words, more intelligent.

Biesta and Burbules (2003) say that Dewey argued for rationality to be included in the scientific approach, whereby morals, feelings and values are ascribed to the scientific reality just as much as "hard facts". Dewey asserted that the common-sense worldview of everyday life is a result of science in the common-sense world (Dewey, 1938). A

contemporary perspective may argue that the pragmatic, Deweyan, view of science in the social context holds no relevance in modern research methods, which are too conflicting to decipher in the real world. Educational research has historically been confronted with questions surrounding its relevance and practical meaning; this was a central concern of authors such as Pestalozzi, Herbart and Schleirmacher (Biesta and Burbules, 2003) and is a philosophical standpoint of many educationalists. Is it the role of such research to promote a general truth or to provide illumination of issues within education more generally? Conversely, is it for educational practitioners to use these different interpretations of reality and to analyse the educational situations they are in? The question of 'what is truth?' and the nature of knowledge is one that has perplexed and intrigued scholars, educationalists and philosophers alike. The construct application of research has, dominated the scientific community since the early eighteenth century. More recent qualitative directions in research have changed this perspective, particularly in education and healthcare research (Flick, 2014). In exploring knowledge in healthcare practice the quality of knowledge and how far removed from this direct experience the researcher and researched are from one another, is a complex juxtaposition for researchers. Beresford (2003) asserts that there is no one singular truth, only the perception of truths; collectively agreed facts, which may change over time. Paradoxically disproven by further research studies, over the time it takes research to expand its knowledge base of a topic. Conversely, the "knowledge claims" of participants have been considered the weakest, in terms of hierarchical structures of evaluating research methodologies but these claims or research results have to fit into the real world to explain it.

One of the most significant issues in educational research is that it is often difficult to replicate what happens in an individual classroom, meaning that education and the lived experience of being “educated” cannot be objectively measured. Controlling the variables between classes is difficult, as education relies on the interaction in a natural setting between a teacher and a student. Many issues in education simply cannot be researched using a positivist approach, as controlling variables, such as providing equal student support, can be challenging in modern teaching and learning situations. That is not to say that education cannot be measured, but that measurement only provides one interpretation of what happens in the natural setting. This is one of the reasons why Dewey sought a different, pragmatic approach to educational research.

3.4 Chapter Summary

This chapter has explored the rationale for the underpinning philosophy of pragmatism. Defining this as postulated by Dewey. Reality being viewed as a construct of actions and interactions. This philosophy supports the overarching framework for this study, as it sought to explore mnemonics not only in a controlled learning environment, such as a university but also externally in clinical practice. Whereby participants would be perceiving the significance of mnemonics to their learning and in a “real world” clinical context. The next chapter will detail the methodology undertaken for the study.

CHAPTER 4 METHODOLOGY

The previous chapter has discussed the underpinning philosophy used for this study and explored some alternative stances and the supporting rationale why these were not chosen. The following chapter will discuss the methodology used to undertake the study. This study used a mixed methods approach with distinct qualitative and quantitative phases. The chapter discusses the merits and challenges of these different epistemological stances and their cohesion. The contentious nature of mixed methods research is also explored. The chapter will conclude with the rationale for the chosen design.

4.1 Pragmatism as a research methodology – mixed methods

The historical context of a mixed methods approach demonstrates a paradigm shift. Steckler et al. (1992) describe a blended or combined research, which results in the combination of methods and methodology. It is this hybrid approach (Ragin, Nagel and White, 2004), which yields methodological triangulation (Morse, 1991) not only mixing methods but also methodology. Tashakkorri and Teddlie (1998) acknowledge that for this reason, it is both a method and a philosophical worldview. As mixed methods approaches have evolved, so has academic discourse surrounding their development, and methodological concerns surrounding their validity within academic disciplines. The two separate paradigms for knowledge generation – the positivist quantitative stance and the qualitative stance – are brought together in mixed methods, raising inevitable questions about fit between these seemingly diametrically opposing paradigms. Academic debate focused on the differences between the fundamental philosophical assumptions of both quantitative and qualitative research being untenable (Smith, 1983). Those who subscribed to the perspective that combining both approaches was not possible due to the conflicting philosophical

paradigms became the purists of the debate (Rossman and Wilson, 1985). Other perspectives include 'situationalists', who adapt the methods to the situation, or the pragmatists, who believe that multiple paradigms can be used (Rossman and Wilson, 1985). Many scholars believe that pragmatism should be considered the most appropriate philosophical basis for mixed methods (Tashakkori and Teddlie, 2003).

To distil pragmatism into its simplest sense, it is the practical consideration of the problem. Greene and Caracelli (2003) see it as an interface between the philosophical and the methodological. Cameron (2011) argues that the mixed methods approach is now an accepted approach to research inquiry and is a "de facto" third approach, or third methodological stance. It is the research design and philosophical stance, coupled with the methods of inquiry, which constitute the underpinnings of mixed methods research (MMR). Central to this premise is the belief that both quantitative and qualitative approaches, when combined, aid a deeper understanding than a single method used in isolation (Cresswell and Plano Clark, 2011). However, this "third approach" has not always been the accepted view in research communities. Indeed, the paradigm wars have seen competing methodological biases shape the conducting, publishing and use of not only the favouring of quantitative research over qualitative historically, but that during the late 1980`s mixed methods research was still on the peripheries of methodological acceptance (Ross and Wilson, 1985). Contemporary appraisals of this methodological standpoint have highlighted the barriers and drivers for mixed methods research (discussed in section 3.5.1).

4.2 The five Ps of mixed methods research (MMR)

Conducting MMR has been identified as a challenge. Cameron (2011) discusses a conceptual framework approach to conducting mixed methods research, called the five Ps. These are: Paradigms, Pragmatism, Praxis, Proficiency and Publishing. Table 4.0 outlines some of the challenges and barriers highlighted by the five Ps model.

Table 4.0 The five Ps of mixed methods research explained

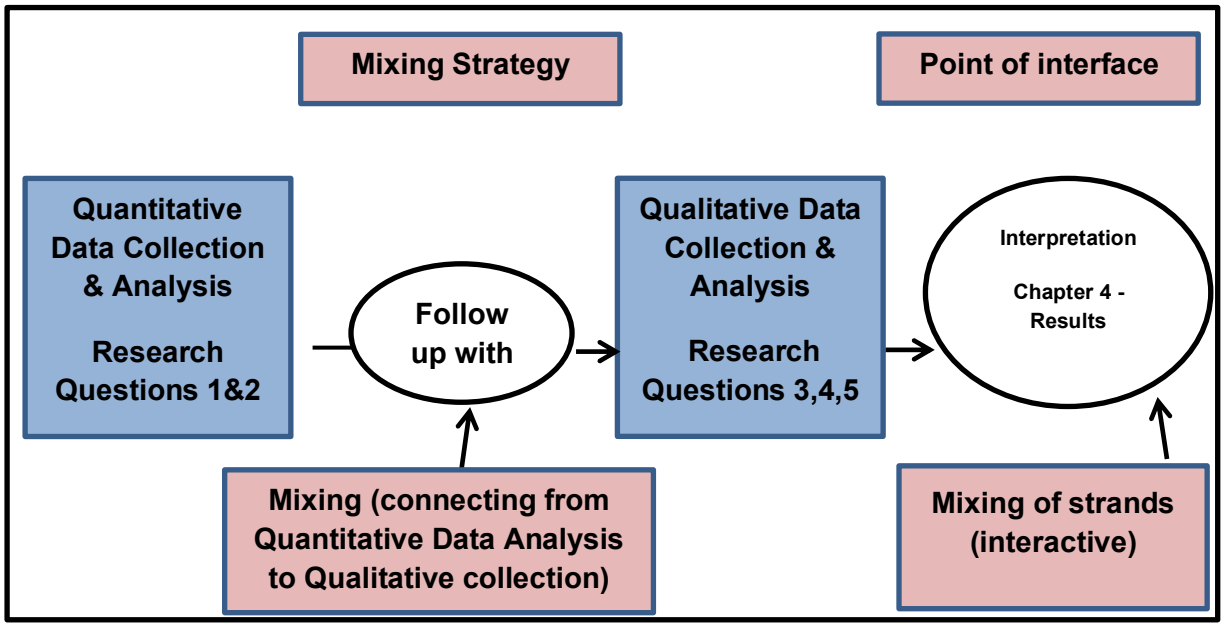
Five Ps	Thesis Challenge	Resolution
P1 Paradigms	Claims of eclecticism.	Explore the philosophical bases of the research approach. Explore if any differences in paradigms might influence the thesis. Chapter 3.
P2 Pragmatism	To defend the stance between philosophy and methods	Dewey`s worldview selected from the many types of pragmatist theorists. Chapter 3.3 and 3.4
P3 Praxis	Making informed choices, utilising, and applying MMR approaches to design, methods and analysis.	Question the data; explain through knowledge any deviance from the norm in statistical tests.
P4 Proficiency	To become skilled in both quantitative & qualitative methods, integration of data analysis.	To build on the knowledge gained form conducting qualitative systematic review. Question the data presented, recognise patterns from the statistical testing.
P5 Publishing	To produce studies that are capable of being published.	Post-doctoral publications.

The mixed method approach utilises both quantitative and qualitative methods to answer the research questions, allowing for breadth and depth of enquiry (Johnson, Onwuegbuzie and Turner, 2007). Brennan (1992) asserts that mixed methods can be an effective approach to research rather than quantitative or qualitative-only methods, when a single data source is not sufficient to understand the topic. This concept further supports the rationale for using pragmatism, which has ultimately shaped this research and its methodological considerations. However, even within this hybrid methodology, different approaches use either fully-mixed or partially-mixed techniques. Such methodological differences are based on the point where the two approaches converge, for example, during data collection, analysis. Cresswell and Plano Clark (2011) outline the importance of following best practice when considering this approach and ultimately best fit of methods.

4.3 Research study design: the explanatory sequential design

Table 4.1 shows a visual representation of the stages of the mixed-methods research, followed by a description of the sequential phases and subsequent rationale.

Table 4.1 Visual representation of study design and stages of mixing



In this study, the quantitative and qualitative methods be undertaken sequentially; a quantitative phase will be followed by a qualitative phase, with the results being combined in an analysis stage. This is referred to as the “point of interface”, which Morse and Niehaus (2009) describe as the stage of integration of mixing the quantitative and qualitative strands. It is this mixed analysis that addresses the aim of the study and answers the research questions and objectives. By making clear the approach from the outset, the trustworthiness of the research is enhanced because the approach is open to scrutiny (Cresswell and Plano Clark, 2011). An important aspect of mixed methods research is that neither the quantitative nor the qualitative methodology is considered superior (Johnson and Onwuegbuzie, 2004). Indeed, contemporary researchers are required to be reflexive in its broadest sense, in that the most appropriate design is the one that addresses the research issue, thus answering questions in the most appropriate ways (Niglas, 2008). The rationale for using a sequential design in my study is further supported in that the research is an exploration of the focused research questions using the design sequentially. Thus hoping to explaining the phenomenon under investigation both from a within the classroom setting and the relevance of the phenomenon within the practice setting. The quantitative data collection and analysis will inform the semi-structured interview questions, which are the next sequential strand of data collection and analysis. Research questions one and two will be addressed in the quantitative phase and the remaining questions, three, four and five, are addressed in the qualitative (interviews) phase. The interpretation phase will combine both strands in a “final analysis”. Table 4.2 further indicates the stages and supporting rationale.

Table 4.2 Relationship between an explanatory sequential design and my research from a typology of mixed methods research design

Definition	Explanatory Sequential Design	**Phases of Data collection of my study/ Rationale**
	Quantitative data collection & Analysis Qualitative data collection & Analysis, and the interpretation of the findings	Phases 1, 2, 3 Phase 4 Phases 1-4
Phases of data collection	Data collection	Phase 1 - OSCE Walkthrough Phase 2 - OSCE exam Phase 3 – Post OSCE 12 months Phase 4 – Semi Structured interviews
Design purpose	Need to explain Quantitative results	Need a more complete understanding of a topic to inform
Typical paradigm foundation	Pragmatism as an umbrella philosophy	Pragmatism (Deweyan)
Level of interaction	Interaction	(interpretation stage)
Priority of the strands	Quantitative or Qualitative emphasis	Quantitative then Qualitative
Timing of the strands	Sequential :Quantitative or Qualitative first	Quantitative first

Primary point of interface for mixing	Data Analysis	Data Analysis
Primary mixing strategies	Connecting the two strands: • From Quantitative Data analysis to Qualitative data Collection • Use Quantitative results to make decisions about Qualitative research questions	After primary data analysis (Quantitative descriptive statistics) Quantitative Phases used to inform Qualitative interviews (semi structured)

This study used an inductive approach, or inductive reasoning. Bowling (2009) describes this approach as using observations and differences in the data to explore and formulate new theories or paradigms – as opposed to deductive reasoning, which uses theory to test predictions by using experiments. Mixed methods research paradigms posits that pragmatism supports the use of different research methods and that a continuous cycle of inductive, deductive and when appropriate, abductive reasoning, produces a triangulated worldview of the research problem (Hall, 2013). Abductive reasoning being defined as an observation or set of observations, seeking to find the most likely explanation for the observations (Blaikie, 1993). This process, unlike deductive reasoning, yields a plausible conclusion but does not positively verify it.

4.4 Typology of mixed methods – strengths and limitations

The literature review in my study has revealed that there is a dearth of cohort studies and much is still to be uncovered on mnemonics within nursing education. There is little information about the factors that influence retrieval of information and the extent to which mnemonics influence learning within nursing education. The dearth of evidence is true of mnemonics in general but especially within the proposed study group of nursing students. Indeed, this study seeks to challenge educational orthodoxy in terms of its view that mnemonic use results in surface or superficial learning, adding little to the education of future nursing and healthcare professionals or to the professional discipline.

It could be argued that the selection and processes of a research design must be open and non-biased (Cryer, 2000). Both qualitative and quantitative designs have their merits and should not be seen as conflicting paradigms, but instead, complementing each other, both with different methods and philosophies (Appleton and King, 2002). Within healthcare, primary research has seen a heavy affinity towards quantitative research (Rosenberg and Donald, 1995). Perhaps this is due to the nature of science within healthcare, wishing to define phenomena by numerical measurement and attempting to find evidence that can be generalised across populations. However, exploring the subjective nature of an individual's perceptions, their use of mnemonics and the significance of this in relation to orthodox practice, matched to their performance in the clinical examination, may provide deeper insight to the research aim. The rationale for undertaking a separate strand of qualitative data collection is based on the argument that rich data with depth could yield more in the way of understanding phenomena by contextualising it.

Lincoln and Guba (1990) propose that generalisations decay over time and that the empirical proposition has a definitive half-life. In this respect, qualitative research findings are meaningful to the reader in the context in which they are presented. This may be viewed as equally valuable in the eyes of the reader and strengthens qualitative research.

To fully answer the research question, outcomes must be presented, defined and clearly stated (Parahoo, 2006). Although Polit and Beck (2008) assert that not all concepts relevant to nursing literature can be operationalized simply.

Indeed, positivist approaches seek to measure interventions or issues (Khan et al., 2003) and as such, my study uses a quantitative approach to compliment the qualitative richness. Combining objective and subjective data to provide a final analysis enables insight into the factors that influence the recall of information relevant to clinical practice. The challenge for any research is to explain the data presented from a numerical pattern analysis or defining concepts often from the individual's lived experience. These concepts support the rationale for choosing a mixed methods approach.

Mesel (2012) argues that there has been a methodological dichotomy between qualitative and quantitative methods, which presents unnecessary obstacles for effective research design and is methodologically and philosophically unsustainable. The issue of incommensurability is not a question of method but rather a question of the philosophical premises underpinning a given method. Thus, transparency on the philosophical level is important for validity and consistency. Therefore, it is not a question of simply "what works?" Hall (2013) discusses how a critique levelled at mixed methods researchers has used a "what works?" approach to focus on doing what was efficient to advance their own research agendas. Such findings suggest the current use of the term 'pragmatism' has been trivialized and that an a-paradigmatic (Greene, 2007) approach to mixed methods evaluation has emerged.

4.5 Quantitative focus

This study will use a repeated measures cohort design. This can involve multiple measures of the same variable taken from the same participants either under different conditions or over two or more time periods. For instance, repeated measurements are collected in a longitudinal study in which change over time is assessed. For this study, participants would undertake the OSCE examination, and data would be collected at preceding and subsequent time points. Alasuutari, Bickman and Brannen (2009) assert that there can be problems with “drop out” or attrition, if there are multiple stages of prospective data collection. However, for this study, as the OSCE was not additional but was part of the students’ programmes, it was felt that attrition numbers would be low. Furthermore, this quantitative strand did not require numbers for power calculations. The two interventions tested were:

a) Learning and retrieval using the mnemonic O_2 FLUID, which forms the basis of the examination assessment.
b) Learning and retrieval using an additional mnemonics (ROME), taught during the participants’ nursing course but not assessed.

It is essential that both of these variables are included in this study to avoid the assertion that learning and retrieval of information is not related to the mnemonic but instead is connected with the students being assessed as part of a practical examination. The inclusion of the additional mnemonics (ROME) taught during the course will enabled further analysis. Irrespective of whether students took part in the research or not, the content was part of the validated

programme. All students received instruction on the pathophysiology of sepsis, the sepsis six, acid base balance and respiratory assessment of blood gasses. Teaching and presentation of the mnemonics was in the format of a static O_2 FLUID and ROME mnemonic on a power point slide, used in the lectures. Although statistics on sepsis morbidity rates were presented this was in the format of a negative analogy of an aircraft disaster, rather than how many lives could be saved as a result or early intervention and rescue of a deteriorating patient due to sepsis. Seminar activities used question and answer activities to aid student learning and practical sessions focused on OSCE examination practice, using the following mnemonics:

SBAR – structured patient handover (Situation, Background, Assessment and Recommendation)

ROME – blood gasses interpretation re: acidosis (Respiratory Opposite, Metabolic Equal)

O_2 FLUID – Sepsis six immediate patient management (Oxygen, Fluid, Lactate measurement, Urine output, Infection screen, Drugs). In addition to recalling each category, students were expected to know the appropriate interventions related to each category. These are listed in the table below:

Table 4.3 O_2 FLUID/ Sepsis six mnemonic

Sepsis six mnemonic	**Category**	**Specific intervention**
O_2	Oxygen	15 litres of oxygen via a non-rebreather mask (100% oxygen)
F	Fluid	30ml of crystalloid per kilogram of body weight per hour
L	Lactate	Measure serum lactate level
U	Urine output	Measure hourly urine output – 0.5ml per kilogram of body weight per hour
I	Infection	Screen for infection – swabs, specimens for culture and sensitivity and blood cultures
D	Drugs	Commence a broad-spectrum antibiotic

Irrespective of whether participants took part in the research or not, they received teaching and were encouraged to engage in learning as part of a nursing module. This teaching included the mnemonics outlined above. As part of the module, all students had the opportunity to participate in an OSCE 'walk through'. This is a practical session to familiarise the student with the various elements of the theory surrounding sepsis and the format of the OSCE. During the walk through, students undertook a 'mock' viva, discussing what they thought was wrong with the patient and their rationale. This formed the first phase of quantitative data collection.

4.6 Choosing a quantitative method

Due to the sample size, it will not be possible to generalise the findings of this research study. The aim of using a quantitative strand was to provide data-

based inferences, which informed the direction of the qualitative strand. From a positivist perspective, it may be argued that randomized experiments provide a “gold standard” for answering causal questions, more so than quasi-experimental designs, due to the former having a greater effect size compared to the latter using the same research question (Bloom, Michalopoulos and Hill, 2005). In addition, quasi-experimental designs are often used because it is difficult to control the effects of some variables. Cook and Wong (2008) argue that conducting randomised experiments is not always possible and that quasi-experimental designs are an appropriate design, and that researchers should not be closed to their application as a viable research method. However, even the quasi-experimental design is still causal in its underpinning methodology, ascertaining cause and effect. In this research study, a “within-study” or “within-cohort” approach was deemed the most appropriate design. The rationale for utilising this approach was due to the ethical constraints associated with the participant group. The core experimental topics; sepsis and respiratory acidosis, are part of the validated module content and it would have been unethical to deliver this material to a control group but not the experimental group. Therefore, a purely experimental approach was not deemed viable. The small cohort numbers associated with the Master of Nursing programme further compounded this. Each cohort is approximately 30 students per year, so there would be insufficient numbers to generate an appropriate power calculation.

4.6.1 Non-participant observation

Stanwick (1994) defines that to maintain objectivity in observation, the observer must remain apart from the situation being observed, so that data may be collected as objectivity as possible; uncontaminated by the observer's value system or presence. This was the rationale behind video recording the participants during the data collection. Video recording of OSCE examinations is required for summative assessment at this level of academic study to ensure internal consistency of scoring for examination purposes. Therefore, by using non-participant observation, the videos were scored while watching the SMOTS^{tm} video footage of participant responses, using the OSCE scoring tool. This did not influence the participant responses or behaviour, as the researcher was not present during the data collection, thus providing a greater degree of objectivity (Pretzlik, 1994). Participants were not subjected to undue duress by being recorded, as they would have been recorded as part of the OSCE examination anyway and consent was gained for the footage to be used for this study.

The OSCE scoring tool was piloted first to check its inter-observer reliability (Stanwick, 1994). Sample footage of phase one was scored independently by three colleagues. Rater agreement was reached in terms of the OSCE scoring tool's ability to capture the data. Although statistical reliability cannot be attributed to this tool, as it was designed for this study rather than to have a universally agreed scoring result, for example Cronbach's alpha. This could limit the replicability of the study. Cohen's Kappa coefficient of agreement measures the proportions of the times raters agree against the maximum

number of times raters could agree (Seigal, and Castellan, 1988). The results of the Cohen`s Kappa coefficient for this scoring system was K=1, meaning there was agreement between raters. However, in this study, only the researcher would be scoring the remaining videos and consistency is deemed an important factor when using non-direct observation (Flick, 2014), as no recognised tool existed to score the data.

4.6.2 Independent and dependent variables in the study

The independent variable in this study is time. Specifically, the time points of the collection phases for the quantitative strand (phases one, two and three). Saks and Allsop (2007) describe the independent variable as a variation, which does not depend on another variable. The dependent variable is what is being studied and measured in the study. It is what changes due to changes in the independent variable. The quantitative research questions were concerned with the extent to which students use a mnemonic to structure their answer when communicating the management of sepsis during the communication station of a clinical examination. In addition, to what degree does a structured approach of using a mnemonic decay over time? In this study, the dependent variable is the OSCE scores at the viva station, as defined by the data observation tool (OSCE scoring tool). The study's quantitative focus was on the effect time would have on the OSCE scores in terms of retrieving key sepsis information; not simply immediately after being taught it or for a summative examination, but twelve months after the examination. This design tested the retrieval of scores across all three time points and tests both mnemonics. Data tests were run using Bonferroni, a

statistical test that accounts for multiple phases of data collection. The Bonferroni correction is used to reduce the chances of obtaining false-positive results (or type-1 errors), when multiple pairwise tests are performed on a single set of data. As the study used three distinct quantitative data collection phases, the probability of identifying at least one significant result due to chance increases as more test phases are ran. The Bonferroni correction accounts and corrects for this in SPSS (Statistical Software package for Social Sciences).

4.6.3 Rationale for multiple data collection points (quantitative strand)- strengths and limitations

An interrupted time series design is one approach to a within-study design and used for the quantitative strand of the study. This was used to track student test scores over several time periods. This design requires repeated measures to be made on the same variable over time. For this study, OSCE scores were captured at three distinct time points alongside the student's recollection of another mnemonic related to respiratory acid base balance (ROME). The first was immediately following a lecture in which key information (O_2 FLUID and ROME mnemonics) was given to students. The rationale for capturing this data at such an early time point is linked to the neuroscientific literature focusing on attention and its effects on stimulus processing (Cherry, 1953; Deutsch and Deutsch, 1963; Moray, 1959). The second was during the OSCE examination, as part of a 'viva' knowledge test station. The rationale for this was to ascertain if assessment was a catalyst for learning and subsequently driving the use of the O_2 FLUID mnemonic over the ROME mnemonic (Price et al., 2012). This data collection point would also explore if a summative assessment was a

factor in the retrieval of key clinical information (Brotle, 2011) and if attention was guided towards one mnemonic more than the other. The third time point repeated the OSCE scoring using the same tool as the previous two time points. This was conducted twelve months from the second time point. The rationale for this was supported by the theory of semantic memory (or Long-Term Memory) (Warrington and Weiskrantz, 1968). This also formulated part of the research questions, as a possible factor could have been retrieval of stored factual (clinical information) and the retrieval of the mnemonic.

4.6.4 Choosing a qualitative approach

Qualitative research values certain fundamental principles. Subjectivity is valued; the research is context dependent and the researcher is part of the research process (Streubert and Carpenter, 1995). Qualitative research seeks to provide rich interpretation of a concept or experience. Such findings are context-bound and may not be generalisable to a wider population. Qualitative research is often regarded as subjective, as it is founded on a belief that there are multiple versions of the truth, often constructed by the individuals experiencing a phenomenon (Denzin and Lincoln, 2000). Constructivism was born from the alternative to the scientific positivist approach to conducting research. Naturalistic inquiry lends itself to qualitative methods, in aiming to explore the participant's world, within a real-world setting. Constructivism is concerned with the nature of reality and the constructive processes involved in this relationship (Flick, 2014). Seminal constructivist theorists such as Piaget, and his cognitive development theory of how knowledge is generated of the world through childhood interactions, is one such example of a

constructivism approach. According to Schutz, (1962) these sets of constructions, abstractions, generalisations are selected and structured by the individual.

The qualitative strand of this research focused on the factors associated with retrieval of clinical information; exploring participants' use, understanding and value of mnemonics in the "real world" of clinical practice in their role as a student nurse. Therefore, a naturalistic inquiry approach, in which the researcher observes, describes, and interprets the experiences and actions of specific people and groups in social and cultural contexts (Lincoln and Guba, 1985), was deemed the "best fit" for this strand of the mixed methods study. As semi-structured interviews were used to ascertain participants' realities in relation to mnemonics, the researcher also constructs his or her reality in relation to this interaction with participants (Lincoln and Guba, 1985). The instrument in data collection may be a human instrument (Lincoln and Guba, 1985). In this respect relativism acknowledges that there are many realities and meanings and may impossible to differentiate from another`s understanding of the world (Crotty, 1988). This is also acknowledged in relativist ontology. The dove-tailing research methodology to pragmatism, in that its design is valuable for exploratory research, is particularly useful when relevant theoretical frameworks are not available or when little is known about the subject. Dewey`s transactional realism enables the exploration of the impact the participant has on their environment and consequently on their construction of reality (Sleeper, 1986). However, a limitation of a constructionist approach is that it may be open to criticism due to its subjective

element. Interpreting the participant's reality is subjective, but science should be value-free and as objective as possible (Bryman, 2004). This may be a paradoxical debate; as indicated at the start of the chapter, there is fallacy in objectivity.

4.7 Trustworthiness in qualitative research

Phase four of the data collection consisted of semi-structured interviews. These were informed by the direction of the three quantitative phases of data collection. The findings do not attempt to generalise to larger populations but instead seek a more holistic perspective. The transcriptions were checked with the participants, to ensure their accuracy as interpreted and understood by the researcher. McNiff (1988) argues that this is sound research practice. Tuckett (2005) calls this 'member checking', which aims to ensure greater accuracy, credibility, and trustworthiness of the data. Mabuza, et al. (2014) observe that credibility is concerned with the validity of the conclusions drawn from the data and how these match the reality being reported on. Lincoln and Guba (1985) identify certain operational techniques and strategies available to the qualitative researcher, which can be used to ensure and enhance trustworthiness, such as the use of "thick" description. Thick description should include the research setting, information about participants and in-context data. The burden of proof for transferability of this study is on the consumer (reader) (Guba and Lincoln, 1989) of the study. The transferability determined by the reader to apply the new knowledge to familiar contexts (Wehlage, 1981 cited in Peshkin, 1993). Ultimately, it is the knowledge that comes from the study that is to be transferable (Morse, 1991). The research methods should

be described in sufficient detail that someone else could replicate them (a systematic 'audit trail') and any limitations are discussed. Triangulation of methods may also improve the dependability of the findings (Mabuza et al., 2014). Confirmability refers to the degree of objectivity of the researcher in data collection and reporting and is demonstrated by reducing bias through reflexivity and using self-awareness as a research instrument (Flick, 2014).

4.8 Ethical Considerations and voluntary informed consent

This research adhered to the British Educational Research Association's Guidelines for Educational Research (BERA, 2011). These guidelines were followed while developing the study`s protocol. University Faculty Ethics approval was also required. Students were recruited from the March 2014 intake of the Master of Nursing Programme. This is an integrated 2-year Masters programme (with 2 years accreditation of prior academic and experiential learning from a related first degree and healthcare experience).

As the researcher, I met with potential participants in their Guidance Tutor Groups and invited them to participate in the study. A letter of invitation was issued via e-mail prior to this initial meeting. During the face-to-face meeting, potential participants were given a copy of the participant information sheet and the study was explained to them. They had 2-3 days to decide if they wished to participate in the study or not. Students who indicated they were willing to take part in the study signed a consent form. Participants were given a copy of the information sheet for future reference, which also listed the researcher's work contact details and the process for withdrawing from the

study should they wish to do so. Irrespective of whether they wished to take part in the research project, students were expected to take part in the theory and practical components of the module as part of their structured programme. Participants were free to withdraw from the study at any time without incurring any penalty. This was expressly set out in the consent forms and information sheets for this study. Participants could withdraw via the researcher or if they preferred, via the programme team (see Appendices section for example forms).

Reed and Proctor (1995) assert that the role of the researcher can be potentially conflicting from an ethical perspective, due to the preconception that research should be depersonalised, standing apart from social and political issues. As a researcher and as a member of the programme team, I was cognisant of this when designing the study. At the point of student recruitment, I had not met or taught the students, nor was I involved in teaching or assessing the module that delivered the interventions in this study. Although I deliver other modules later in the programme, I maintained a separation between teaching and research at all times, recognising that my primary responsibility was to adhere to the ethical principles that underpin the BERA guidelines (2011). No incentives or inducements were offered to participants in this study.

The study methodology was designed to minimise the potential detrimental effect of teaching an additional mnemonic to participants (ROME mnemonic).

It was felt that that omitting the teaching of the O_2 FLUID mnemonic from the curriculum would not be ethical, as the module in which sepsis was taught had this as a core component. The omission of core teaching would have disadvantaged students in terms of key information and knowledge generation for their summative assessment. This would have been unethical. The ROME mnemonic as discussed was not a summatively assessed component.

Confidentiality was maintained by assigning a unique identifying number to each participant. This was only known to the researcher and was locked away securely at the University. The benefit to the participant is that their name would not appear in the final data presented, thus maintaining confidentiality. Communicating this to participants is key, as some may refuse to consent if they feel that the researcher will not protect their anonymity. The researcher has a legal, ethical and moral duty of care to protect or reduce psychological risk to the participants (Reed and Proctor, 1995). No data about an individual would be disclosed in this thesis or any publication connected with it. In addition, research data was not shared with the programme team. All documentation, data tapes, questionnaires and papers relating to this research study were stored in a locked cupboard in accordance with the relevant data protection policies. Once this thesis has been completed, all data will be retained for one year, after which the tapes will be wiped and any documentation relating to data collection will be destroyed as confidential waste. This is to ensure that data is not kept for longer than is necessary (Data Protection Act 1998, superseded by GDPR, 2018).

4.9 Reflexivity and maintaining an ethical stance

There are some challenges associated with depersonalising research. For example, the researcher may have their own particular view on anticipating the outcomes of their study. As a researcher and educator, this could be a conflicted role. I had previous experience of using mnemonics as both a student and as a teaching method. This could bias the design of the study, the conducting of interviews and interpretation of research findings. Each chapter addresses how research bias was accounted for and mitigated against as much as possible. Vis a vis ethical research, pragmatism and mixed methodology could be equally conflicted, due to a design from total immersion in a purely qualitative paradigm. Scott (1997) attests that self-reflection is one way that researchers can acknowledge their own thoughts and feelings concerning the research topic or focus. If this is achieved, then the researcher's emotional element can be acknowledged, and its impact bracketed, or put to one side, so as not to taint the interpretation of results. Reflexivity, as discussed by Carolan (2003) in qualitative research terminology, is a lens through which to view one's own philosophy. Although I had previous positive experiences of using mnemonics, these were not being tested or sought in this research study. Therefore, by using the underpinning principles associated with reflexivity, it was possible to acknowledge, and be cognisant and self-aware of such experiences. It was important to acknowledge this at various stages of the study, to ensure reflexivity was maintained for example, when designing the data collection tool this was trialled with colleagues first to gain some feedback. In addition, I was not part of the teaching team, although my educational interest was in the application of mnemonics. Teaching the participants about these, then collecting the data

and analysing could have potentially biased the study in that participants may have answered interview questions positively if I had been the person who had taught then the mnemonic. To ensure greater reflexivity this had to be considered during the methodology (as I did not teach the participants/ students any taught content connected with this study). Raven (2006) attests that researchers require the critical eyes of others to point out biases, blind spots and assumptions, if as researchers we are to develop beyond these limitations. Therefore, the importance of PhD supervision, ensuring the methodological audit trail is followed has been an important factor in this thesis.

4.10 Sampling - Recruitment of participants

The following section will detail the sample size and sampling strategy for both strands of the study design. The section will cover the rationale used and will link this to the methodological approach.

4.10.1 Sample size

This study used a sample of 47 students: all enrolled on either the adult, mental health and child branch of their nursing programme, a Master of Nursing programme at a university in Northeast England. The postgraduate students had a degree in a science subject (and were not registered with the NMC). The sample excluded 'return to practice' and overseas nursing students, to reduce the chances of the mnemonics having been learned on previous nursing programmes. Students were at year three of their nursing programme during the data collection phases (by virtue of accreditation of prior academic and experiential learning). Master of Nursing students were used for this study because they are taught and assessed using a mnemonic at the

start of the taught component of their programme. Whereas the undergraduate (BSc) students are taught the same mnemonic in their final year and would not be available to test recall at one-year post-intervention, as their programme would have been completed.

4.10.2 Sampling strategy

Purposeful sampling was used in this study. Polit and Beck (2008) observe that a purposeful sampling method involves using non-probability methods to select participants who have specific attributes or qualities. Higginbottom (2004) observes that this lacks the strict and non-bias approach of probability sampling methods, in that there is an equal and representative chance of participants being recruited, rather than a purposeful sample. Using probability sampling methods, such as randomisation of participants, can reduce selection bias on the part of the researcher (Saks and Allsop, 2007). It could be argued that utilising a probability sampling method could have reduced selection bias; this was not practical as the total sample population was relatively small. Therefore, a more homogenous sample was targeted (i.e. all students on the Masters programme), who had the shared attribute (Onwuegbuzie and Collins, 2007) of all having to undertake an examination viva station and be specifically exposed to all elements of the assessment.

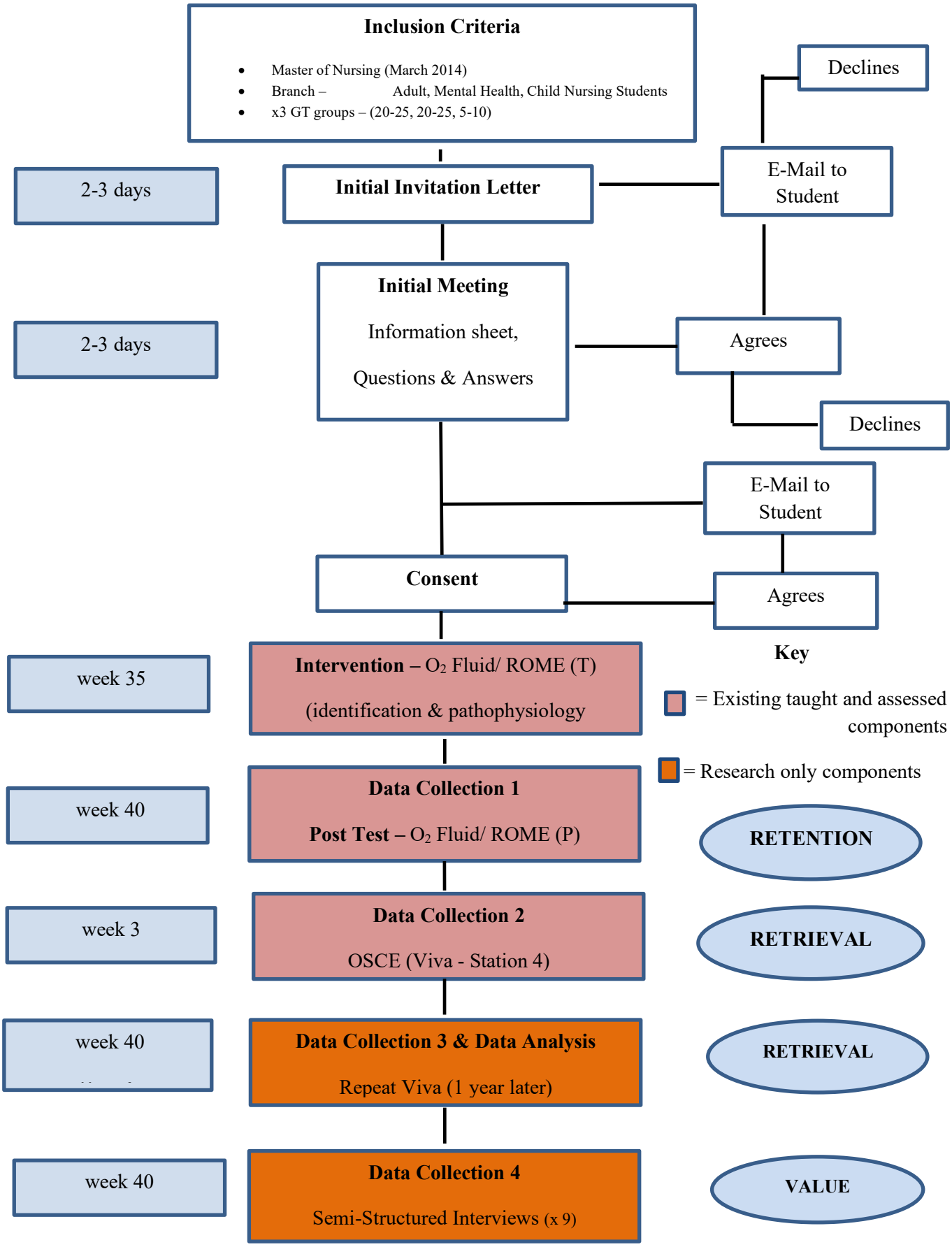
Purposeful sampling was also used for the qualitative element. Rubinstein (1994) observes that there are no hard and fast rules concerning numbers, and the number of participants in qualitative studies varies from 12-20. Miles

and Huberman (1994) argue that sampling methods in qualitative research are more concerned with yielding information that is rich and using population specific data. Murphy et al. (1998) observes that qualitative research typically uses non-probability sampling methods, as the findings will not usually be generalisable due to the small sample numbers. This non-random technique has been criticised by positivists, as it does not conform to whole population predictions of phenomena. A quota sample was used to recruit from the main student sample for the semi-structured interviews. Fowler, Jarvis and Chevannes (2002) discuss that this method is used to obtain a quota (amount) from each sub-group and that this approach is non-random. This sampling method enabled a quota to be taken from each branch – adult, mental health and child – of the overall target population (all students on the module). For example, the adult nursing group was larger, having more students, so the quota was larger in comparison to the child student group. Diagram 3.1 shows the recruitment and data collection stages. In a within cohort design, using a non-probability sampling technique is considered appropriate due to a lack of a separate control group, as this design attempts to measure outcomes (Cook and Wong, 2008).

In this study, the outcome measures of interest were OSCE scores at various time points (pre-OSCE/ walk through; OSCE examination; and twelve months post-OSCE). Newell (1996) observes that representativeness is central to sampling and that it is arguable whether such a small sample can be used to represent the greater whole population. In terms of the study sample being representative of the whole population of Masters of Nursing students in the

Northeast of England or even England, this sample size does not have sufficient power to be deemed generalisable to the wider population (Hillier and Gibbs, 1996). In terms of sampling validity, in that all members of the chosen population have a fair chance of being represented in the sample chosen, this also cannot be claimed, due to a purposeful sampling method being used. However, regarding external validity, it could be argued that the similarity to other Masters students, for example, by age, gender and previous entry requirements, is more homogenous. External sampling similarity between the participants (students in this study) and the population they represent (Masters students in general) is high.

Diagram 4.0 Visual representation of the recruitment & data collection stages



4.11 Data collection

Quantitative data was collected at three time points and qualitative data at a fourth time point. These are referred to in Diagram 4.0 (above) as Phases 1-4.

4.11.1 Data collection - phase one: post-lecture retention

The OSCE scoring tool provided the scores, which were manually inputted into SPSS. A maximum score of 45 was available for the first four questions (broken down into 6, 18, 18 and 3 points), which dealt with sepsis and the O_2 FLUID mnemonic. The remaining two questions dealt with the ROME mnemonic, for a maximum of 15 points (12 + 3 points). Participants who did not answer a question scored zero. This was important when identifying missing data (see Appendix A, OSCE scoring tool – example). For this study, missing data has been defined as participants who did not attend the OSCE or participate in each/any phase of data collection for this study. Munro (2001) observes the importance of missing data, in that it can be significant to the study and must be addressed prior to running the data analysis, so as not to skew results, for example, lowering the group mean. This was not an issue in this study, as non-attendance was not considered a factor in relation to the study's aims. Missing data was inputted into SPSS as the numerical figure ninety-nine (99). This is a method used by SPSS to recognise and include or not include missing data strands. In addition to missing data, attrition during data collection phases may also be problematic (Flick, 2014).

Phase one (knowledge total) was immediately following the lecture on sepsis and the introduction to the two mnemonics (ROME and O_2 FLUID). Phase two,

the OSCE, was the summative OSCE examination, with viva station being used to record the responses on the OSCE scoring tool. Phase three, repeat total, was the OSCE viva station, repeated twelve months after phase two (OSCE) data collection. This was collected under the same conditions as phases one and two, using the same scoring tool. There was some loss of participants in phase three, due to this being in addition to the taught component of the module (and therefore voluntary), compared with the other two phases of data collection, which related to compulsory components of the module. Although ethically, all participants had the right to withdraw from the study at any time, data collection phases one and two coincided with their attendance in class, therefore their participation was higher.

Immediately following the teaching of the mnemonics, students took part in an OSCE walkthrough. As part of this, they completed a 10-minute mock viva station (knowledge station). Here, students were asked to identify the immediate treatment of a patient who was suspected to have sepsis. Following this, students participating in the research were asked a short question on the differences between respiratory and metabolic acidosis. The score included the main differences in oxygen, carbon dioxide, pH and bicarbonate levels in the two conditions. The detail and the structure of the students' responses were matched against a detailed expected response answer derived from referenced sources. From this, it was possible to ascertain whether the O_2 FLUID or ROME mnemonics were used to structure their answers. This mock viva was video recorded, using an unobtrusive camera system, capturing audio and video. Data was extracted using a structured observation recording

sheet, which was designed for the study. This identified if the student utilised the structured mnemonic to provide their answer and enabled the scoring of responses (see Appendix 1 OSCE scoring tool).

4.11.2 Data collection – phase two: OSCE examination - retrieval

When the module was completed and students returned from their clinical placement, they undertook an OSCE assessment. This forms the summative assessment for the programme. The OSCE provided an opportunity to collect phase two data. Students undertaking the OSCE completed four assessed stations. Station four is a viva, where students' knowledge of pathophysiology and patient management was assessed. All OSCE assessments were recorded using the SMOTS^{TM} system for moderation and quality assurance purposes. These recordings allowed consented students' responses to be scored using the data collection tool and to ascertain if the mnemonic was used to provide structure to the answer. The same data collection observation scoring tool was used in phase one. Following the OSCE, participants were asked the differences between respiratory and metabolic acidosis. The researcher scored them using the observation score sheet. The score included the main differences in oxygen, carbon dioxide, pH and bicarbonate levels in the two conditions. Depending on the detail and the structure of the responses, it was possible to ascertain whether the ROME mnemonic was used.

4.11.3 Data collection - phase three: twelve months post-OSCE (repeat OSCE viva station) – retrieval

During the repeat viva, students were asked to identify the immediate treatment of a patient who is suspected to have sepsis. This repeat viva was

recorded for each research participant and the researcher extracted data using a structured observation recording sheet, which allows for the scoring of responses. This structured observation recording sheet also allowed the researcher to identify if the student used the structure the mnemonic provided, in their answer. The statistical significance of this was ascertained once all quantitative data was analysed using SPSS. During the twelve-month study five participants “dropped out” of the study due to sickness, withdrawing from their studies or taking a leave of absence from their programme of study.

4.11.4 Data collection – phase four: qualitative (semi-structured) interviews

This stage of data collection commenced shortly after the repeat viva (phase three). The significance of this is linked to key educational theory surrounding memory and retention. As the data was collected in ‘real life’, the researcher attempts understand the perceptions of the person being researched. Streubert and Carpenter (1995) observe that with qualitative methods, there are a number of ways to collect data. An interview schedule was devised from research questions three, four and five, and informed by the inferences from the quantitative data (Appendix B, semi-structured interview schedule). This qualitative strand explored factors in relation to, and value of, mnemonics and their use in learning, teaching and clinical practice. There were nine interviews in total, each lasting approximately 30 minutes. Walford (2001) discusses the merits of audio recording interviews in qualitative research, in terms of accuracy of the spoken word. However, he notes that interviewees will select their words with care, due to the formality of the occasion. Therefore,

interviews were conducted at University premises and on placement but in a relaxed manner with an unobtrusive audio recording device.

Twelve months after students were taught about sepsis management and acid base balance using the mnemonics, participants were asked to take part in a repeat viva to identify to what extent they retained their original knowledge and whether they were continuing to remember and use the mnemonics taught during the study. While some researchers (Caguioa et al., 2012) looking at retrieval of mnemonic devices, have repeated their assessments at three months, the rationale supporting a twelve-month repeat of data collection was considered a more realistic view of any decay in knowledge and memory which may occur over time (Worthen and Hunt, 2011).

4.12 Data Analysis – phases 1-3 descriptive statistics

Data from phases one, two and three (quantitative strands) were entered into SPSS so that descriptive statistics and non-parametric statistical testing could be performed. Gravetter and Wallnau (2005) note that computer software packages such as SPSS can support the inputting and representation of large amounts of quantitative data, and that mathematical formulae can be run to produce statistical data in graph, tabular and numerical forms. Table 4.4 (below) provides a visual representation of the quantitative stages.

4.12.1 Checking for normality in SPSS

For parametric data, assumptions must be made about the data's distribution and that this is approximately normally distributed (Munro, 2001). This means that data is distributed around the mean. If data were presented graphically, for example in a histogram, the normal distribution "peaks" would be central and the graph would look symmetrical around the mean (average) – a normal bell shape is seen. However, for small sample sizes, this graph may be misleading. A more appropriate graphical representation was considered for analysing the study's data. The Normal Q-Q plot presents that the scatter (averages) should lie as close to the line as possible, with no obvious patterns moving away from the line (normally distributed).

The scores from phases 1-3 were entered into SPSS. Those data collection phases being phase one (post sepsis teaching session), phase two (OSCE station / viva) and phase three (twelve month post OSCE repeat/station viva) was entered into SPSS for analysis. As non-parametric data is being used, the results of the quantitative strand cannot provide statistical generalisability. This is due to the sample size not having significant "power" to generalise to a wider population (Hillier and Gibbs, 1996). The Master of Nursing cohort size is consistent with previous years. It was never the intention of using quantitative data in my study to support a claim for generalisability. The statistical data was used comparatively and to demonstrate patterns in the data, thus informing the qualitative direction of the semi-structured interviews (phase four of data collection).

The continuous data from the OSCE scoring tool produced a mean score in SPSS. The mean is calculated by dividing the sum of a set of observations by the number of observations (Fowler, Jarvis and Chevannes, 2002). Data can be extracted from an overall population mean, a guidance tutor group (adult, mental health or child branch), or an individual participant. These averages can be useful for data analysis, as they can be compared across time phases one to three, with the variables under investigation being selected for comparison. Further statistical tests may be selected, for example standard deviation. Munro (2001) explains that standard deviation is a numerical value placed on how far the results differ from the mean or average score. There is a degree of freedom involved; according to Chebyshev's theorem for a normally distributed bell curve, 95% of the values are within two SDs of the mean. Even in oddly shaped distributions, 75% will fall within two SDs of the average (Freund, 1988).

Table 4.4 Visual representation of phases of data analysis and level of measurement

Quantitative Strand/	**Overview**	**Example from my study**	**Statistical test Parametric/ Non parametric**	**Analysis**
Nominal Data	No sense of order, numbers do not imply order/ hierarchy	• Gender • Branch or group • Placement Type • Subject of pre-entry degree • Passed/ Failed OSCE	Non-Parametric	Descriptive Stats/ Frequencies, Percentages
Ordinal Data	Meaningful order, distance between measures not equal	• Degree Classification	Non parametric – Friedman Test – to test when the DV is Ordinal	Descriptive Stats / ranks
Interval Data	Data can be measured as a whole number	• Age • OSCE scores	Parametric - ANOVA with repeated measures	Mean, Median Standard Deviation

4.12.2 ANOVA repeated measures test

Munro (2001) states that an ANOVA with repeated measures approach is used to compare three or more group means where the participants are the same in each group. As Table 4.4 shows, the participants were the same in each group and tested at each phase of the quantitative data collection process. The rationale for using this statistical test over an ANCOVA is that there were three distinct phases of data collection within the overall group, with three subgroups or branches (adult, mental health and child nursing students). The ANCOVA test ignores the pre-test phase. In relation to this study, the pre-test phase is aligned with phase one (OSCE walkthrough), when participants had just been introduced to the taught material in relation to sepsis and the O_2 FLUID and ROME mnemonics. This was considered an important stage of data collection and the statistical method chosen should reflect the data being analysed (Fowler, Jarvis and Chevannes, 2002).

4.12.3 Data assumptions explained

The sample was homogenous in that all participants were student nurses, although the group consisted of three sub-groups: adult, mental health and child nursing students. The rationale for including participants from different nursing specialism was to ascertain if there were any differences in the manner of mnemonic use. For example, how sepsis information was utilised in an acute adult setting, would this be similar for students working in mental health areas, as sepsis could potentially be presented clinically in all disciplines. The frequency of it occurring could be a factor linked to the three branches. Saks and Allsop (2007) suggest that research studies must pass several assumptions to ensure they conform to using the repeated measures ANOVA

test. These assumptions are summarised in Table 4.5, summary of data type matched to ANOVA requirements. The OSCE scoring tool measured the participants' retrieval of key information on sepsis and the use of the two mnemonics with each question having a maximum score or model "text book response", measured against an evidence-based sepsis practice. These were repeated at each phase of data collection.

Table 4.5 Summary of data type matched to ANOVA requirements

	Description of theoretical assumption	**Description of assumption within my study**	**Assumption met in my study**
Assumption 1	DV measured at continuous level.	OSCE scoring measured at interval (*Continuous* data e.g. 0-18 points).	Yes
Assumption 2	IV consist of at least 2 categorical related/ matched pair groups.	Same participants in each group and tested at each phase i.e. 1, 2, and 3. A related group.	Yes
Assumption 3	There should be no significant outliers in the related groups. Single data points that do not follow the usual pattern.	Only a small variation between scores rather than a large variation (an outlier). Therefore no distortion between the groups.	Yes – using SPSS to ascertain.
Assumption 4	Distribution of DV in the related groups should be normally distributed.	Test for normality using the Shapiro-Wilk test of normality in SPSS.	Using SPSS to ascertain.
Assumption 5	Sphericity – variances of the differences between all related groups must be equal.	Preform Mauchly's test of Sphericity in SPSS.	Using SPSS to ascertain.

4.12.4 Hierarchical cluster analysis

To draw further inferences from the data, hierarchical cluster analysis was used. Yim and Ramdeen (2015) acknowledge that although this is an appealing technique, it is open to misinterpretation, as groups may cluster regardless of the true nature of the data. Cluster analysis is a type of data reduction; its aim is to reduce the number of cases or observations into homogenous groups or clusters (Almeida et al., 2007). There are two main forms of cluster analysis, hierarchical and non-hierarchical. Hierarchical cluster analysis combines cases into homogeneous clusters by merging them together one at a time in a sequence (Blei and Lafferty, 2009). Hierarchical cluster analysis allows for the comparison of the clustering result with an increasing number of clusters; no decision of numbers of clusters needs to be made prior (Yim and Ramdeen, 2015). This technique was used to ascertain if there were any clusters forming within groups (adult, mental health and child nursing) and between cases (in this study, cases were defined as participants). Using agglomerative hierarchical clustering separates each case into its own individual cluster, then similar cases are merged together until every case is grouped into one single cluster (Norusis, 2010). The distance of similarity measures how close the clusters are together. This depends on whether the data is dichotomous (for example, male or female) or continuous (for example, age or score). For this study, most data was continuous, Euclidean distance being the most commonly used distance measure between two data points. Average linkage was used in my study as a proxy measure of distance between pairs of cases. As other methods can be problematic as single linkage can chain pairs together because one is close to or further away, as in complete linkage (Sokal and Michener, 1958). These distances and cases are presented in a proximity matrix and visual representation can be presented in a dendrogram. Eventually, if clustering is taken to its logical conclusion, the cluster may reveal clustering of homogenous demographic

data, for example, cases may cluster participants who are both from the adult nursing group. This “cut off point” is a feature of SPSS software packages when running a hierarchical cluster analysis test.

4.13 Chapter 4 Summary

This chapter has discussed the procedures, methods and methodology of both the quantitative and qualitative strands of this mixed methods study. It has explored the underpinning philosophy and methodology of pragmatism. This is to ensure that an audit trail for the research decisions can be followed. The next chapter presents the quantitative and qualitative results.

CHAPTER 5 FINDINGS/RESULTS (quantitative)

5.0 Introduction

The previous chapter discussed the underpinning philosophical context of this thesis, introducing the mixed methods approach, and the supporting literature and rationale for using it. Supported by pragmatism as the underpinning philosophy, the mixed methods staging is a sequential explanatory design. The first stage is quantitative, addressing the first two research questions of the study; the second stage addresses the remaining three research questions using a qualitative approach. This sequential mixed methods design supported the methodological rigour and cohesion of the data. The point of interface "mixing" is at the overall analysis in the discussion chapter, which upholds the epistemological principles of the paradigms, answering all the research aims and questions holistically.

This chapter focuses on the presentation of the quantitative data from the OSCE scoring tool at the three time points (pre-OSCE/walkthrough; OSCE examination; and post-OSCE/12 months later). Descriptive statistics, statistical tests, ANOVA and hierarchical cluster analysis techniques were used within the quantitative approach, while qualitative data from participant interviews is presented using thematic analysis; presenting categories and themes with direct participant quotes.

The table 5.0 below is to aid the reader in understanding the complexity of the methods and staging of data collection and analysis phases; the table provides an overview of these to facilitate the results section.

Quantitative data	*Table 5.0 – Data collection, scoring and analysis to assist the reader in interpreting the results chapter (chapter 4)*			
Who	**When**	**How**	**Rationale**	**Further scoring information**
Pre-Registration nurses	Phase 1 OSCE walkthrough (April 2014) Phase 2 OSCE (after 6 months) Phase 3 OSCE Repeat (1 year)	OSCE scoring tool used to detail participants responses to model answer questions. Same questions asked at all 3 phases. This was videoed for rater consistency, in addition to the OSCE scoring tool sheet (Appendix A of thesis). Max. score for O_2 FLUID = 45 (Based on Questions 1 – 4) Max. score for ROME = 15 (Based on Questions A & B)	Each component scored:	Total score for each question
			Question 1 A: What do you think is wrong with your Patient?	1 point awarded for each part of the model answer (fully answered 6 points)
			Question 2 B: What are the likely medical / nursing interventions in the next 30 mins to 1 hour?	1 point for 1st letter of O_2 FLUID mnemonic 1 point for word of mnemonic 1 point for details of mnemonic (fully answered 18 points)
			Question 3 C: Did the participant use all of the O_2 FLUID Mnemonic (Sepsis 6) to demonstrate management of Sepsis?	1 point for 1st letter of O_2 FLUID mnemonic 1 point for word of mnemonic 1 point for details of mnemonic (fully answered 18 points)
			Question 4 D: Did the participant use the O_2 FLUID Mnemonic (Sepsis 6) in a sequential way?	1 point = yes 1 point = in full 1 point = following each previous letter (fully answered 3 points)
			ROME Question A: Could the participant recall the ROME Mnemonic?	1 point for 1st letter of ROME mnemonic 1 point for word of mnemonic 1 point for details of mnemonic (fully answered 12 points)
			ROME Question B: Did the participant use the ROME Mnemonic in a sequential way?	1 point = yes 1 point = in full 1 point = following each previous letter (fully answered 3 points)
	Data Analysis (phases 1-3)	Using SPSS. descriptive statistics, p-values, Standard Deviation ANNOVA test, Hierarchical Cluster analysis.		
			scores (mean, mode, median)	
			Demonstrating any statistical probability of effect.	
			Variation of set of values, how spread out	
			Repeated measures test indicating any differences in results over phases 1-3.	
			Demonstrating the clustering of participants attributes against scores.	
Qualitative data				
n= 9 participants (made up of 6 Adult, 2 Mental Health and 1 Child)	Interviews conducted	Semi Structured interview schedule (Appendix B thesis), conducted with the cohort of participants. Audio recorded.	To capture the precise words participants used to respond to interview question.	
	Interviews transcribed	x1 interview has transcribed by G Tucker. x8 transcribed by a research assistant.	To undertake the coding process, to experience immersion in the process. To reduce interpretation bias, transcriber not part of the data collection team.	
	Data analysis	Burnard`s thematic coding using Nvivo software.	Audio files and transcripts were uploaded to NIVO as a repository but also to conduct thematic dendograms once coding was completed.	

5.1 Participant demographic data

47 participants were recruited (Table 5.1 below). Students who did not attend the viva taught component session (data collection phase 1) were not able to consent and were therefore not recruited. For these students data collection did not occur for the following quantitative stages, as this could would skew the subsequent data analysis. As with any study, some data loss occurred; some students chose not to participate in phase 3, or left or interrupted their nursing programme. However, there was still sufficient data to draw inferences from, supporting the mixed methods design.

Table 5.1 Participant numbers by group and phase of study

		Quantitative Data Collection			**Qualitative**	
GT Number	**Branch**	**phase 1**	**phase 2**	**phase 3**	**phase 4**	**Attrition**
GT 23	Adult Branch	16/17	16/17	13/17	6/17	1 on sick leave
GT 24	Mental Health Branch	21/21	21/21/	15/19	2/17	3 left, x1 on sick leave
GT 25	Child Branch	9/9	9/9	4/9	1/9	n/a

Table 5.2 below lists details relating to the sample's demographic data. The ages ranged from 24-51 with a mean age of 30. Table 5.2 shows that the demographic split for guidance tutor group size by total number of students in each group. The adult nursing group was 35.4%; the mental health group was largest at 43.8%; and the child branch group was the smallest at 20.8%. The Master of Nursing programme requires that students should have a relevant health/sciences-related degree. The table shows that the sample group for this study has a roughly equal split in terms of science-

related degrees (52.3%) among the whole group (adult, mental health and child groups) as opposed to 47.7% having social science or practice-based degrees. This independent variable was part of the cluster analysis, designed to ascertain the significance of degree type to this study's aims. The most frequent pre-entry degree classification for the Master of Nursing programme is a 2:1 (47.9%), then 2:2 (18.8%), then first class honours (14.6%).

Table 5.2 Demographic data for the sample

Cohort Demographic	**Range**	**Percentage of total study cohort**	**Details**
Age	24-51	20 - 30 = 72.7% 30 - 40 = 16.8% 40 - 50 = 6.3% 50 - 60 = 4.2%	mean = 30 years
GT group size	Across all 3 groups	Mental Health = 43.8% Adult = 35.4% Child = 20.8%	Mental Health is the largest GT group.
Subject pre-entry to the programme	Across all 3 groups	Science based = 52.3% Social Science based = 47.7%	Science-based degree more frequent.
Degree classification pre-entry	1st - 2:2	1st class Hons = 14.6% 2:1 = 47.9% 2:2 = 18.8%	2:1 is the most frequent degree classification.

5.2 Descriptive statistics – overall scores

Table 5.3 shows the overall mean of phases 1-3, confirming what the literature suggests; that overall retrieval of information appears to reduce over time, after the summative assessment. There were higher levels of retrieval across all branches at phase 2 (OSCE examination), with a mean score of 22.8. This is higher than the other two phases. Interestingly, phase 1 (walkthrough) indicates a group mean of 18.1.

Compared to phase 3 (12 months later), the score is significantly lower (10.0). The maximum possible score would have been 45. A highest score of 40 was achieved at OSCE exam, compared to 17 after 12 months. This descriptive evidence suggests that overall, for the three GT groups, retrieval of the key sepsis and mnemonics information (viva) is higher during the examination (OSCE) than at phase 1 (immediately after they have been taught this information) and at phase 3 (12 months post-examination). Standard deviation is higher for phase 2, demonstrating that the average scores are centring on the mean for phase 1 (SD 4.7) and phase 2 (SD 5.6) and phase 3 having a much lower standard deviation than the other two phases at 3.5.

Table 5.3 Showing minimum, maximum and mean OSCE scores for all 3 Groups combined *(Adult, Mental Health and Child, from OSCE Scoring Tool); phases 1,2,3.*

Phases 1,2,3	**n**	**Min**	**Max**	**Mean**	**Std. Deviation**
Phase 1Knowledge Total score max = 45	41	4	28	18.15	4.704
Phase 2 OSCE Total score max = 45	45	13	40	22.78	5.660
Phase 3 Repeat Total Score max = 45	32	0	17	10.06	3.501
Valid N (listwise)	28				

5.3 Recognising sepsis - what do you think is wrong with the patient and why?

Question A focused on what was wrong with the patient and why (the student's rationale). In the scoring tool, six key factors were associated with recognising sepsis and participants scored one point for each correct component (maximum six). Table 5.4 shows the total mean score for phases 1 (pre-OSCE), 2 (OSCE exam) and 3 (post-OSCE, twelve months later). The mean scores were: 3.98, 3.96 and 3.13 at each phase. Phase 3 showed a slight decrease.

Table 5.4 Question A – recognising sepsis: Total maximum scores at phases 1, 2 and 3 (mean, median and mode) for all groups.

		phase 1 Q:A Total max score 6	**phase 2 Q:A Total max score 6**	**phase 3 Q:A Total max score 6**
N	Valid	41	45	32
	Missing	7	3	16
Mean		3.98	3.96	3.13
Std. Deviation		1.635	1.413	1.454
a. Multiple modes exist. The smallest value is shown				

Table 5.5 below shows that 11 students gained four points and 11 students gained six points. These were the most frequent scores for phase 1 (Pre-OSCE). Excluding missing data, the valid percentages were 26.8 for both four and six points.

Table 5.5 phase 1 – Question A - Maximum score – by Frequency and Percentage

phase 1 (walkthrough) Q:A Total max score 6					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	1	4	8.3	9.8	9.8
	2	4	8.3	9.8	19.5
	3	7	14.6	17.1	36.6
	4	11	22.9	26.8	63.4
	5	4	8.3	9.8	73.2
	6	11	22.9	26.8	100.0
	Total	41	85.4	100.0	
Missing	99	7	14.6		
Total		48	100.0		

Table 5.6 shows how the frequency changed for phase 2, Question A. The frequency increased from 11 students gaining four points to 18 students gaining four points, with only six students gaining six points compared to 11 in phase 1. This equates to 40% of the three groups gaining four points.

Table 5.6 phase 2 – Question A - Maximum score – by Frequency and Percentage

phase 2 (OSCE) Q:A Total max score 6					
		Frequency	**Percent**	**Valid %**	**Cumulative Percent**
Valid	1	5	10.4	11.1	11.1
	2	1	2.1	2.2	13.3
	3	6	12.5	13.3	26.7
	4	18	37.5	40.0	66.7
	5	9	18.8	20.0	86.7
	6	6	12.5	13.3	100.0
	Total	45	93.8	100.0	
Missing	99	3	6.3		
Total		48	100.0		

Table 5.7 below shows how the frequency changed for phase 3, Question A. The frequency decreased from 18 students gaining four points to 11 students gaining four points, with only one student gaining six points compared to six in phase 2 (OSCE exam). This equates to 34.4% of the three groups gaining four points.

Table 5.7 phase 3 – Question A - Maximum score – by Frequency and Percentage

phase 3 (12 months post OSCE) Q:A Total max score 6/ participant					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	0	2	4.2	6.3	6.3
	1	3	6.3	9.4	15.6
	2	4	8.3	12.5	28.1
	3	8	16.7	25.0	53.1
	4	11	22.9	34.4	87.5
	5	3	6.3	9.4	96.9
	6	1	2.1	3.1	100.0
	Total	32	66.7	100.0	
Missing	99	16	33.3		
Total		48	100.0		

5.3.1 Summary: Question A, recognising sepsis, phases 1, 2 and 3

Tables 5.3 to 5.7 refer to question A (what do you think is wrong with the patient and why?) present overall performance using the scoring tool across all phases. The average scores out of six points are higher at phase 2 (OSCE exam) than at phase 1 (pre-OSCE) and phase 3 (12 months later), with both having much lower average scores. However, when looking at the phases for question A (recognising sepsis), a striking pattern emerges: percentages for scoring 6/6 points are highest pre-OSCE

(26.8%), fall during the OSCE exam (13.3%), then drop to 3.1% at 12 months post-OSCE.

Question B relates to the initial management and treatment of sepsis. As outlined in Chapter one, prompt invention within the first thirty to sixty minutes of recognising the signs and symptoms of sepsis is associated with reduced mortality and morbidity rates. These interventions are broken down into the 'sepsis six' or 'sepsis care bundles', which are medical interventions undertaken by nurses and doctors. There are a maximum of 18 points to be scored for Question B. Each letter in the O_2 FLUID mnemonic scores one point from a maximum of six; each word (for example, Oxygen) scores one point from a maximum of six; and each detail (for example, 15 litres via a non-rebreather mask) scores one point from a maximum of six.

5.4 Knowledge intervention of the sepsis six – what are the likely medical/ nursing interventions in the next hour?

Table 5.8 shows the overall mean scores for phases 1-3 and indicates that overall retrieval of the sepsis six treatment intervention information appears to reduce over time, following the summative assessment. Higher levels of retrieval are seen across all branches at phase 2 (OSCE examination), with a mean score of 9.18. This is higher than the other two phases. Phase 1 (Pre-OSCE/walkthrough) indicates a group mean of 7.15. Phase 3 (12 months later), indicates a significantly lower score of 5.25.

Table 5.8 Question B – interventions required to manage sepsis initially. Total scores for phases 1, 2 and 3 (mean) for all groups.

		phase 1 QB Total max score 18	phase 2 QB Total max score 18	phase 3 QB Total max score 18
N	Valid	41	45	32
	Missing	7	3	16
Mean		7.15	9.18	5.25
Std. Deviation		1.878	3.062	2.410

Table 5.9 below shows that 11 students gained six points, the most frequent scores for phase 1 (Pre-OSCE). Excluding missing data, the valid percentages were 26.8 for six points from a maximum score of 18 points, occurring 11 times.

Table 5.9 phase 1 Question B - Maximum score by Frequency and Percentage

phase 1 (Walkthrough) QB Total max score 18					
		Frequency	Percent	Valid %	Cumulative Percent
Valid	3	1	2.1	2.4	2.4
	4	1	2.1	2.4	4.9
	5	4	8.3	9.8	14.6
	6	11	22.9	26.8	41.5
	7	9	18.8	22.0	63.4
	8	6	12.5	14.6	78.0
	9	4	8.3	9.8	87.8
	10	3	6.3	7.3	95.1
	11	1	2.1	2.4	97.6
	12	1	2.1	2.4	100.0
	Total	41	85.4	100.0	
Missing	99	7	14.6		
Total		48	100.0		

Table 5.10 below shows the frequency for phase 2 question Eight students gained nine points, (17.8%), while only two students gained 18 points (4.4% across all three GT groups).

Table 5.10 phase 2 Question B - Maximum score by Frequency and Percentage

phase 2 (OSCE) QB Total max score 18					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	0	1	2.1	2.2	2.2
	5	1	2.1	2.2	4.4
	6	5	10.4	11.1	15.6
	7	5	10.4	11.1	26.7
	8	6	12.5	13.3	40.0
	9	8	16.7	17.8	57.8
	10	6	12.5	13.3	71.1
	11	7	14.6	15.6	86.7
	12	2	4.2	4.4	91.1
	13	2	4.2	4.4	95.6
	18	2	4.2	4.4	100.0
	Total	45	93.8	100.0	
Missing	99	3	6.3		
Total		48	100.0		

Table 5.11 below shows how the frequency has changed for phase 3 Question B. 11 students scored six points; no students gained nine points and no students gained 18 points (compared to two students in phase 2). This equates to 34.4% of the three GT groups gaining six points from a possible 18.

Table 5.11 phase 3 – Question B - Maximum score – by Frequency and Percentage

phase 3 (12 months post OSCE) QB Total max score 18					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	0	2	4.2	6.3	6.3
	2	1	2.1	3.1	9.4
	4	9	18.8	28.1	37.5
	5	5	10.4	15.6	53.1
	6	11	22.9	34.4	87.5
	7	1	2.1	3.1	90.6
	10	2	4.2	6.3	96.9
	12	1	2.1	3.1	100.0
	Total	32	66.7	100.0	
Missing	99	16	33.3		
Total		48	100.0		

5.4.1 Summary: Question B, intervention - the sepsis six - phases 1-3

The descriptive statistics suggest that overall for the three groups, retrieval of the key sepsis six information (using the O_2 FLUID mnemonic) is higher during the OSCE examination (phase 2) compared with immediately after students have been taught this information (phase 1) and at twelve months post- examination (phase 3). The spread of distribution of frequencies by percentage is higher for the low scores at phase 1. There is a much more evenly distributed spread across all mid-range scores (eight to 11) at phase 2. Knowledge retrieval is significantly lower at phase 3.

5.5 First letter usage of the O_2 FLUID mnemonic

Descriptive statistics of phases 1-3 confirm what the literature suggests; that overall, assessment appears to be driving the use of the O_2 FLUID mnemonic, with high levels of retrieval across all branches. Table 5.12 below shows the mean scores for students recalling the first letter of the O_2 FLUID mnemonic across all three phases, with a maximum score of six. Surprisingly, the averages are consistently low. Despite some slight variance, none of the averages score above 1.0. This is due to the low score average across the groups. When considering the maximum scores, a slightly different pattern emerges. The maximum score at OSCE exam is six compared to a maximum score of three at 12 months post-OSCE exam, in relation to first letter O_2 FLUID recall.

Table 5.12 Use of 1st letter of O_2 FLUID mnemonic across adult, mental health and child groups

Descriptive Statistics					
	N	**Min**	**Max**	**Mean**	**Std. Deviation**
phase 1 Q:C 1st letter of Mnemonic	41	0	4	0.54	1.286
phase 2 Q:C 1st letter of Mnemonic	45	0	6	0.44	1.324
phase 3 Q:C 1st letter of Mnemonic	32	0	3	0.19	0.592

This contrasts with Table 5.13 below, which demonstrates that across the whole group, the mean score for O_2 FLUID mnemonic word recall (Oxygen, Fluid, Lactate Urine, Infection screening and Drugs) is much higher at all stages, especially at phase 2, which had a mean score of 4.64 words out of a maximum of six. The score for each word, e.g. Oxygen, is much higher (4.3-4.6) than the score for the first letter e.g. O (<1) across all phases respectively. Phase 2 had a much lower standard deviation (SD

0.883), as the mean scores are all very similar; around 4/6. This is interesting in terms of the data, the reasons for this was explored in the qualitative interviews.

Table 5.13 word recall in O_2 FLUID mnemonic across adult, mental health and child groups for minimum, maximum, mean and standard deviation

	N	Minimum	Maximum	Mean	SD
phase 1 Q:C word	41	0	6	4.61	1.115
phase 2 Q:C word	45	2	6	4.64	0.883
phase 3 Q:C word	32	0	6	4.31	1.615

Table 5.14 below indicates that at phase 2 (OSCE exam), students have a higher level of retrieval for the details associated with the O_2 FLUID mnemonic. For example, 15-litre non-rebreather mask would score one point for this level of detail. There are six associated interventions, so the maximum score is six. This is significantly higher at OSCE (4.2) than the other 2 phases. Therefore, the average score was four points associated with the details of the O_2 FLUID mnemonic from a maximum of six points (six details are associated with six sepsis interventions). The highest level of standard deviation is in phase 2, with a standard deviation of 1.845. This is significantly higher than for phases 1 and 3.

Table 5.14 Use of details of O_2 FLUID mnemonic across adult, mental health and child groups; minimum, maximum, mean and standard deviation

	N	Minimum	Maximum	Mean	SD
phase 1 Q:C details	41	0	6	1.83	1.498
phase 2 Q:C details	45	0	6	4.22	1.845
phase 3 Q:C details	32	0	6	1.09	1.279
Valid N (listwise)	28				

Table 5.15 below indicates the total OSCE score for the Masters of Nursing Programme cohort. The mean scores were 18.1 for Phase 1, 22.8 for phase 2, and 10.1 for phase 3. The average OSCE scores for each group reflects a similar trend. The adult nursing group scored the highest average score of 24.1, followed by the mental health nursing group with 23.5, then the child branch with 19.3. The adult nursing group scored above the cohort average across all three phases. Mental health scored highly for phases 1 and 2. The child branch below average across all three phases. Group sizes were accounted for when presenting the statistic. Standard deviation reflects the trend.

Table 5.15 Total OSCE score by group

	phase 1 – Walkthrough/ Mock Viva		**phase 2 – OSCE Exam (Viva)**		**phase 3 – 12 months post-OSCE**	
Data Presented	**Mean**	**Std. Deviation**	**Mean**	**Std. Deviation**	**Mean**	**Std. Deviation**
OSCE Score Total for Master of Nursing programme **Cohort**	18.1	4.704	22.8	5.660	10.1	3.501
OSCE score Total **Adult** nursing group	20.1	4.828	24.1	7.338	11.1	1.405
OSCE score Total **Mental health nursing group**	18.2	4.131	23.5	4.019	9.5	4.734
OSCE score Total **Child** nursing group	15.1	4.512	19.3	4.111	8.5	2.082

Table 5.16 shows the average scores from the first letter, word and detail categories for the O_2 FLUID mnemonic (six points per category). The adult nursing group scored 1.06 for the first letter category. As the average scores are across the three nursing groups and whole groups, the average numbers are small and the standard deviation clusters around the mean for phases 1-3 concerning the first letter usage of the O_2 FLUID mnemonic. First letter usage of the O_2 FLUID mnemonic was low across all three nursing groups in phase 3.

For word recall, at the OSCE phase, there are significantly higher averages across all three nursing groups. The child nursing group scored an average of 5.0 from a maximum of six; the mental health group scored 4.74 and the adult group 4.31. All groups had higher average scores at OSCE than at the pre-OSCE phase. However, recall of the O_2 FLUID mnemonic details pre-OSCE is slightly higher across all three groups compared to post-OSCE. At OSCE, the adult nursing group scored the highest with a mean of 5.13. Standard deviations across the groups reflect the spread of scores, with SD at OSCE for the adult group at 0.957.

Table 5.16 O_2 FLUID mnemonic 1st letter, word and details by group – for mean, mode, median and standard deviation.

	Phase 1 (Pre OSCE)		Phase 2 (OSCE)		Phase 3 (Post OSCE)	
Data Presented **Yellow = Highest** **Red Underline = highest group score**	**Mean**	**Std. Deviation**	**Mean**	**Std. Deviation**	**Mean**	**Std. Deviation**
Score O_2 FLUID Mnemonic 1st letter	Max score 6 points					
adult nursing group	0.77	1.536	1.06	2.048	0.00	0.00
mental health nursing group	0.63	1.383	0.16	0.501	0.33	0.816
child nursing group	0.00	0.000	0.00	0.500	0.25	0.500
Score O_2 FLUID Mnemonic word	Max score 6 points					
adult nursing group	4.08	1.320	4.31	1.138	4.92	1.320
mental health nursing group	4.84	0.898	4.74	0.806	3.93	1.831
child nursing group	4.89	1.054	5.00	0.000	3.75	1.258
Score O_2 FLUID Mnemonic details	Max score 6 points					
adult nursing group	2.62	1.710	5.13	0.957	1.00	1.080
mental health nursing group	1.47	1.264	4.26	1.968	1.27	1.534
child nursing group	1.44	1.333	2.70	1.829	0.75	0.957

Table 5.17 shows that immediately after the theory session, when students were introduced to both the O_2 FLUID and ROME mnemonics, retrieval of the ROME mnemonic in full is significantly higher for two groups pre-OSCE, with the child nursing group scoring the highest (2/6 points), compared to 1.3/6 during the OSCE and 1/6 12 months post-OSCE.

Table 5.17 ROME mnemonic usage by group – for mean and standard deviation

	phase 1 –Post Lecture/ Mock Viva		phase 2 – OSCE Viva		phase 3 –12 months post OSCE	
Data Presented Yellow = Highest Red Underline = highest GT score	**Mean**	**Std. Deviation**	**Mean**	**Std. Deviation**	**Mean**	**Std. Deviation**
(QA) ROME Score Mnemonic full	**Max score 6 points**					
adult nursing group	1.69	2.323	1.50	2.338	0.77	0.439
mental health nursing group	0.00	0.000	1.05	0.705	0.60	0.507
child nursing group	2.00	1.500	1.30	0.675	1	0.000
(QB) ROME Score sequence	**Max score 3 points**					
adult nursing group	0.80	0.277	0.13	0.500	0.00	0.000
mental health nursing group	0.00	0.000	0.00	0.000	0.00	0.000
child nursing group	0.11	0.333	0.20	0.632	0.00	0.000

The Dependent Variable (DV = Total OSCE Scores) at the three phase points (IV = phases/time points); phase 1 (Pre-OSCE/walkthrough), phase 2 (OSCE exam) and phase 3 (12 months post-OSCE) was inputted into SPSS using ANOVA (repeated measures test). Total OSCE scores (DV) and the participant`s age as an (IV), was also inputted into SPSS using ANOVA. The results are shown in Table 5.18 below.

Table 5.18 OSCE scores by total and by age; summary of statistical test ANOVA – Quantitative Strand (Yellow = Statistically significant)

Question/ Analysis	**OSCE Total score phases: 1 2 3**			**OSCE Total Score & Age**		
Measurement	Recognition of sepsis and use of O_2 FLUID Mnemonic			Total OSCE score & between subjects and Age		
Data	Interval			Interval		
Statistical Test	ANOVA (repeated measures)			ANOVA (repeated measures)		
Results p =<0.05 pairwise comparison	1-2 p= <0.001	2-3 p= <0.001	1-3 p= <0.001	Overall ANOVA **not significant** – Pairwise comparison not made		
Mauchly`s Sphericity	0.795 sig. (0.05)			0.798 sig. (0.259)		
Sphericity Assumed	<0.001			0.829		
Mean* scores	18	23	10	18	23	10
Std. Deviation (Mean)	5.329	6.730	3.589	5.329	6.730	3.589

Table 5.18 indicates that between all phases 1-2, 2-3 and 1-3, the results of the differences between the OSCE scores are statistically significant (p=<0.001). There are statistically significance changes over the three time points or phases However, when using the age of participants and total scores using the repeated measures test (ANOVA), the results were not statistically significant. Age related memory decay would have been unlikely in this cohort due to the age range of the participants being 20-30 years old. However, data assumptions could not be made prior to running the test. Pairwise differences were detected in the data and not always overall. Hierarchical cluster analysis was therefore used to explore individual demographic data sets and the impact there may have been on performance over time. As the statistical differences may have been too small to detect when using ANOVA tests and nuances in the data could have been overlooked.

When using the ANOVA test to explore the data in relation to the OSCE scores, the first letters and words in relation to the O_2 FLUID mnemonic were not statistically significant. However, Table 5.18 shows the scores in relation to the *details* associated with the O_2 FLUID mnemonic. Between phases 1-2 (p=<0.001) and 2-3 (p=<0.001), the OSCE scores and detail retrieval are statistically significant. Between phases 1-3, the results are not statically significant (p=0.377). When looking at the Standard Deviation, this may explain the spread of mean scores being much closer (SD=1.307) in comparison to phases 1-2 (SD=1.624) and phases 2-3 (SD=2.061).

Table 5.19 O2 FLUID mnemonic – repeated ANOVA results - OSCE scores by 1st letter, word and details of mnemonic

Question/ Analysis	**OSCE Score 1st letter of O_2 FLUID Mnemonic**			**OSCE Score word of O_2 FLUID Mnemonic**			**OSCE Score details of O_2 FLUID Mnemonic**		
Measurement	OSCE score **1st letter** of mnemonic			OSCE score **word** of Mnemonic			OSCE score **details** of Mnemonic		
Data	Interval			Interval			Interval		
Statistical Test	ANOVA (repeated measures)			ANOVA (repeated measures)			ANOVA (repeated measures)		
Results p =<0.05 pairwise comparison	Overall ANOVA **not significant** – Pairwise comparison not made			Overall ANOVA **not significant** – Pairwise comparison not made			1-2 p= 0.001	2-3 p= 0.001	1-3 p= 0.377
Mauchly`s Sphericity	0.867 sig. (0.157)			0.820 sig. (0.076)			0.983 Sig. (0.796)		
Sphericity Assumed	0.173			0.139			0.000		
Mean* scores	Ph1 0.79	Ph2 0.68	Ph3 0.21	Ph1 4.57	Ph2 4.75	Ph3 4.14	Ph1 1.75	Ph2 4.11	Ph3 1.18
Standard Deviation (Mean)	1.500	1.634	0.630	0.844	1.627	1.634	1.624	2.061	1.307

OSCE scores and the sequence of the O_2 FLUID mnemonic were explored using the ANOVA repeated measures test in SPSS. The results were statistically significant (for ANOVA test) between phases 1 and 2 (p=0.004). Table 5.19 shows a significant difference between the score attained immediately post-lecture and at the time of the OSCE examination. However, the scores between phases 2 and 3 were not statistically significant in terms of variance (p=0.979). Between phases 1, 2 and 3, the results were not statistically significant (p=0.151). The OSCE score O_2 FLUID mnemonic used in full is not statistically significant using the ANOVA test.

Table 5.20 below shows the sequencing as following each letter; participants were scored for using the mnemonic following the preceding letter. The scores indicated that retrieval was not statistically significant between phases 1 and 2 (p=0.310) but is statistically significant between phases 2 and 3 and between phases 1 and 3. The results indicate that using the O_2 FLUID mnemonic in full is not statistically significant when comparing across all three phases. However, when comparing the variation between scores from participants' first introduction to the O_2 FLUID mnemonic and being tested in their OSCE examination, a small variance was observed This can also be seen in the mean scores in phase 1 (0.64) compared to phase 2 (0.96).

Table 5.20 O_2 FLUID mnemonic sequence, used in its entirety and following each letter – repeated ANOVA results

Question/ Analysis	OSCE Score Sequence of O_2 FLUID Mnemonic			OSCE Score O_2 FLUID Mnemonic used in full			OSCE Score O_2 FLUID Mnemonic following each letter		
Measurement	OSCE score **Sequence of Retrieval order**			OSCE score **Retrieved in full**			OSCE score **Retrieved following letter**		
Data	Interval			Interval			Interval		
Statistical Test	ANOVA (repeated measures)			ANOVA (repeated measures)			ANOVA (repeated measures)		
Results p =<0.05 Pairwise comparison	1-2 p= 0.004	2-3 p= 0.979	1-3 p= 0.151	Overall ANOVA **not significant** – Pairwise comparison not made			1-2 p= 0.310	2-3 p= 0.000	1-3 p= 0.000
Mauchly`s Sphericity	0.617 sig (0.002)			0.640 sig (0.003)			0.899 sig (0.252)		
Sphericity Assumed	0.004			0.375			0.000		
Mean* scores	Ph1 0.64	Ph2 0.96	Ph3 0.89	Ph1 0.00	PH2 0.07	P3 0.04	Ph1 0.21	Ph2 0.07	PH3 0.75
Standard Deviation	0.488	0.189	0.315	0.000	0.262	0.189	0.418	0.262	0.441

Table 5.21 demonstrates the ROME mnemonic score in full and its sequence. The statistical tests of ANOVA and p value reveal that the findings are not statistically significant. This may be due to the mean scores being so low (<1) across the group, with the exception of phase 2 (OSCE), which had a mean score of 1.14.

Table 5.21 ROME mnemonic – Repeated ANOVA results

Question/ Analysis	**ROME Mnemonic Score In full**			**Sequence of ROME Mnemonic**		
Measurement	**Number** of Mnemonic details Retrieved			Number of Mnemonic details **retrieved in sequence**		
Data	Interval			Interval		
Statistical Test	ANOVA (repeated measures)			ANOVA (repeated measures)		
Results p =<0.05 Pairwise comparison	Overall ANOVA **not significant** – Pairwise comparison not made			Overall ANOVA **not significant** – Pairwise comparison not made		
Mauchly`s Sphericity	0.788 sig (0.450)			0.465 sig (0.000)		
Sphericity Assumed	0.246			0.557		
Mean* scores	Ph1 0.79	Ph2 1.14	Ph3 0.68	Ph1 0.4	PH2 0.7	P3 0.0
Standard Deviation (Mean)	1.500	1.079	0.476	0.189	0.378	0.00

Table 5.22 shows how data lines were clustered together using Hierarchical Cluster analysis in SPSS. Participants were clustered. For example, cluster 1 (23) refers to line 23 from the SPSS data table (GT group 24, mental health nursing, group 06). 25 cases were clustered using this process but only 11 cases were extracted and summarised presenting the associated variables from the quantitative data (see chapter 3 for rationale). Clusters 1 and 2 share more in terms of the associations of the variables (clustering) and the hierarchy of those seen in the coefficients. The

dissimilarity measure between cluster 1 and cluster 2 as the cases progress, the distance between the cases increase. For the first two pairs joined, which are the closest, this is 11.000. This was line 23 (mental health nursing group/06) and line 27 (mental health nursing group/10). As the cases progress, the clustering may include other cases. The next stage column refers to where these cases (lines), indeed unique participant numbers and their data join. This is highlighted in green in the column. For example, next stage 4, case 4 line 23 appears again. Table 5.23 summarises the individual nursing group participant data matched pairs (cluster 1 and 2).

Table 5.22 Hierarchical cluster analysis - Agglomeration Schedule - cluster 1 and cluster 2

	Cluster Combined			Stage Cluster First Appears		
Case	Cluster 1	Cluster 2	Coefficients	Cluster 1	Cluster 2	Next Stage
1	23	27	11.000	0	0	4
2	12	13	15.000	0	0	10
3	46	47	28.000	0	0	5
4	18	23	30.500	0	1	7
5	43	46	38.000	0	3	19
6	4	16	41.000	0	0	25
7	18	31	41.667	4	0	9
8	5	36	50.000	0	0	10
9	18	33	61.750	7	0	13
10	5	12	63.500	8	2	16
11	22	34	66.000	0	0	15
12	1	25	69.000	0	0	17
13	11	18	75.200	0	9	15
14	24	30	82.000	0	0	21
15	11	22	91.500	13	11	16
16	5	11	120.688	10	15	20
17	1	38	121.500	12	0	22
18	19	37	135.000	0	0	20
19	43	45	157.000	5	0	21
20	5	19	181.333	16	18	23
21	24	43	201.000	14	19	23
22	1	21	201.333	17	0	24
23	5	24	303.429	20	21	24
24	1	5	406.425	22	23	25
25	1	4	523.250	24	6	0

Table 5.23 Data extraction summary table of hierarchical cluster analysis

Cluster 1 & 2	CL 1	CL 2	CL 1	CL 2	CL 1	CL 2	CL 1	CL 2	CL 1	CL 2	CL 1	CL 2	CL 1	CL 2	CL 1	CL 2	CL 1	CL 2	CL 1	CL 2	CL 1	CL 2
Case number	MH/ 06	MH/10	Adult / 12	Adult /13	Child / 08	Child/ 09	MH/01	MH/06	Child/ 05	Child/ 08	Adult/ 04	Adult/ 16	MH/ 01	MH/ 14	Adult/ 05	MH/ 19	MH/ 01	MH/ 16	Adult/05	Adult/ 12	MH/ 05	MH/ 17
Knowl RECOG	5	2	6	1	3	4	3	5	3	3	4	6	3	4	6	1	3	4	6	6	4	4
Knowl INTERVENTION	6	7	8	10	6	6	9	6	6	6	10	9	9	6	11	12	9	7	11	8	6	5
Knowl Letter	0	0	4	0	0	0	1	0	0	0	2	4	1	0	0	4	1	0	0	4	0	0
Knowl WORD	4	6	5	0	6	4	5	4	6	6	5	4	5	6	5	6	5	5	5	5	4	4
Knowl DETAILS	2	1	0	5	0	1	3	2	0	0	3	1	3	0	6	2	3	2	6	0	2	1
Knowl SEQUENCE	1	1	0	0	0	1	1	1	0	0	1	0	1	1	0	1	1	1	0	0	1	1
Knowl Full	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Knowl Following M letter	0	1	1	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0
Knowl total	17	16	21	21	15	16	21	17	15	15	24	24	21	16	28	25	21	18	28	21	16	14
Recall 1 ROME	0	0	0	0	4	2	0	0	0	4	4	0	0	0	0	0	0	0	0	0	0	0
Recall 1 ROME seq of M	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
OSCE RECOG	6	3	6	4	4	3	4	6	4	4	4	4	4	5	1	5	4	3	1	6	6	4
OSCE INTERVENTION	10	12	9	9	6	6	12	10	8	6	18	18	12	13	11	10	12	0	11	9	8	9
OSCE LETTER	0	0	0	0	0	0	0	0	0	0	6	6	0	2	0	0	0	0	0	0	0	0
OSCE WORD	5	6	3	4	5	5	6	5	5	5	6	6	6	5	5	5	6	5	5	3	5	5
OSCE DETAILS	5	6	6	5	1	1	6	5	3	1	6	6	6	6	6	5	6	6	6	6	4	4
OSCE Knowl SEQ	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1
OSCE Knowl Full	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
OSCE Knowl Following M letter	1	1	1	0	0	0	1	1	1	0	1	1	1	1	0	1	1	1	0	1	1	1
OSCE Total	26	27	24	22	16	15	28	26	20	16	40	40	28	31	23	25	28	25	23	24	24	22
Recall 2 ROME	1	1	1	0	1	1	2	1	1	1	1	2	2	1	0	2	2	0	0	1	0	1
Recall 2 ROME seq of M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OSCE results (Pass/Fail)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Rpt Know RECOG	3	5	4	4	3	4	3	3	3	3	3	4	3	0	2	1	3	2	2	4	4	4
Rpt know INTERVENTION	7	5	4	6	2	5	4	7	4	2	6	4	4	6	6	6	4	5	6	4	10	4
Rpt know LETTER	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0

Rpt know WORD	5	3	2	5	2	5	4	5	4	2	6	4	4	5	6	5	4	5	6	2	4	3
Rpt Knowl DETAILS	2	2	2	1	0	1	1	2	2	0	0	2	1	1	0	1	1	0	0	2	2	1
Rpt Know SEQUENCE	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Rpt Know Full	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rpt Knol Following M letter	0	1	0	1	0	1	1	0	1	0	1	1	1	1	1	1	1	1	1	0	1	0
Rpt Know Total	10	11	9	12	6	11	9	10	9	6	11	10	9	8	10	9	9	9	10	9	16	9
Recall3 ROME	0	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	0	1	1	1
Recall 3 ROME seq of M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Age	25	27	24	24	28	28	27	25	25	28	32	26	27	28	25	29	27	28	25	24	24	26
Qualifications (Classification)	2	2	2	2	1	1	2	2	2	1	2	2	2	2	2	2	2	2	2	2	1	2
Discipline (undergrad Qualitative)	1	1	1	1	1	2	1	1	2	1	1	2	1	2	1	2	1	2	1	1	1	1
Placement 1 Post intervention	5	5	1	1	7	7	6	5	7	7	2	1	6	3	1	5	6	6	1	1	5	3
Placement 2 Post OSCE 1 month	3	5	3	3	8	8	5	3	8	8	3	3	5	5	3	3	5	3	3	3	5	5
Placement 3 Post OSCE 5 month	6	6	2	2	9	9	6	6	9	9	1	2	6	6	2	3	6	1	2	2	6	6
Placement 4 Post OSCE 1 yr	3	3	2	1	8	8	3	3	8	8	2	1	3	3	2	3	3	6	2	2	3	3
Branch	2	2	1	1	3	3	2	2	3	3	1	1	2	2	1	2	2	2	1	1	2	2

Tables 5.22 and 5.23 show the associations between cases (participants) in yellow highlight. From the analysis, the following clusters emerged:

O_2 FLUID Letter

The cluster shows that at OSCE and post-OSCE, this was a consistently low score across the clustered participants, with many scoring zero. These scores were higher pre-OSCE.

O_2 FLUID Word

The analysis shows that across the 11-clustered participants, retrieval immediately post-lecture and introduction to the O_2 FLUID Mnemonic is higher for the word component. In cluster line 1, participants scored from four to six points from a maximum of six. This is consistent at OSCE, with six out of the seven scoring five or six points. At the repeat stage, 12 months later, the scores have remained static within the cluster (5-6 points) with the exception of one participant.

Knowledge total scores

These are consistent across the seven participants in that they all show a decrease in the scores through the three phases (post-lecture, OSCE and 12-months post-OSCE). This demonstrates that knowledge is consistent between being provided the information and being immediately tested, then at the OSCE. However, at 12 months post-OSCE the scores across all seven clustered participants dropped by over half.

Age

The clustering surrounding age supports the 20s age range, this is reflected in the most frequent ages of 24, 25 and 28.

Qualification (undergraduate degree classification)

A 2:1 degree classification (2) was the highest cluster for six out of the seven participants, with one having a 2:2 classification.

Discipline of undergraduate qualification

Natural science-based undergraduate degrees (1) were more frequent than social sciences (2) among the seven participants in cluster line 1. This is due to the study sample being homogenous. Enrolment onto the Master of Nursing programme requires a science or social science undergraduate degree. However, six of the seven in the cluster had a science-based degree and this clusters with the higher scores for the word retrieval of the O_2 FLUID mnemonic.

Placement 1 – (prior to OSCE examination)

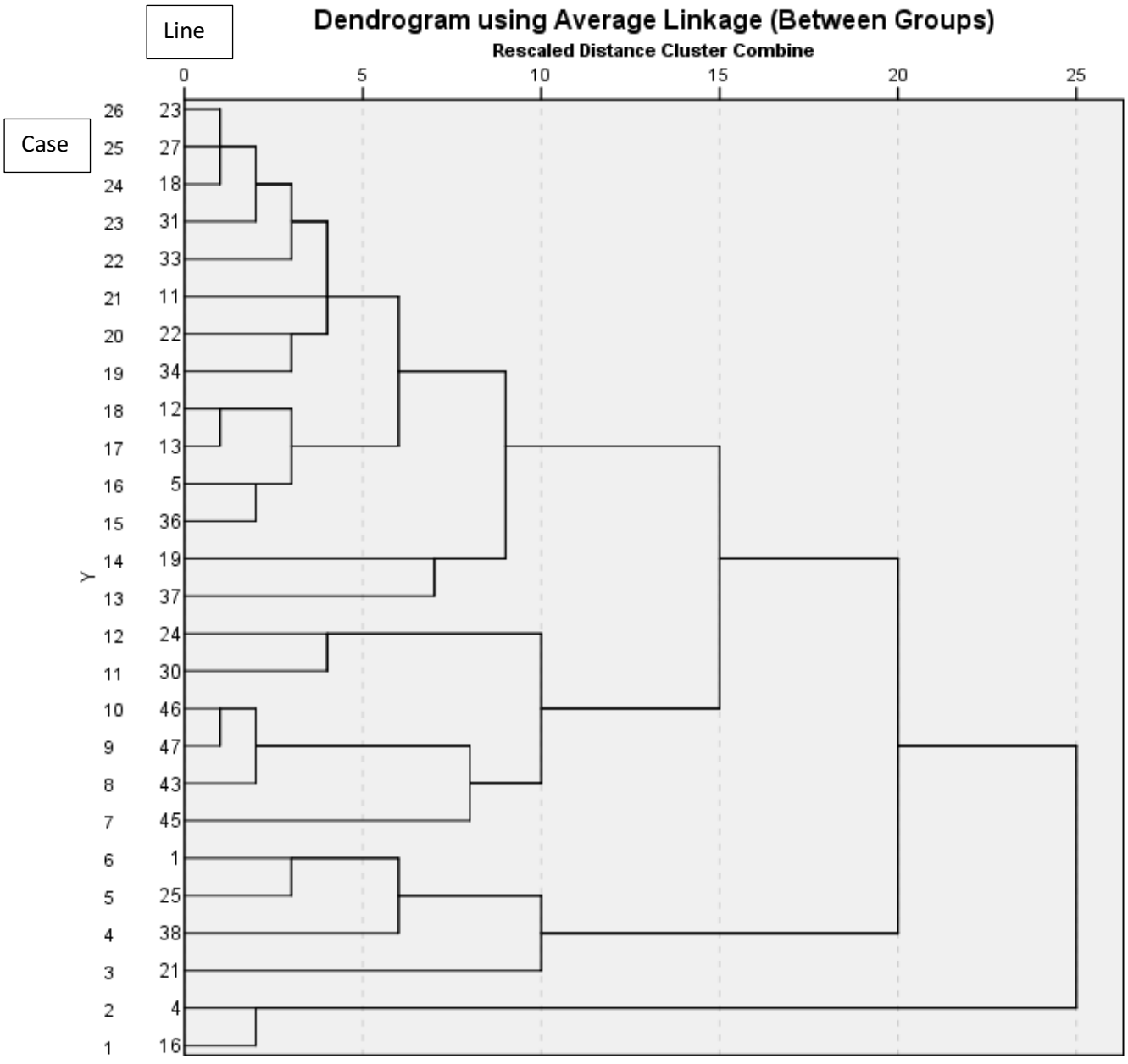
Participants had a placement prior to their OSCE examination. These were: medical (1 participant) Surgical (2) and Paediatric (7). On these placements, exposure to the O_2 FLUID mnemonic would have been higher, due to the increased chances of being in an acute sepsis management situation.

Branch

The branch shows as clustering due to the sample consisting of adult, mental health and child students.

Figure 4.0 shows a dendogram (a visual representation) of the clustered participants (line). These lines were matched to the corresponding participants and the variables (data) in SPSS. The diagram visually shows how participants have been paired. This data was used to construct a comparison table in which participants were clustered according to hierarchy.

Figure 5.0 Dendrogram showing the linkage (Clusters) between participants



5.6 Summary of quantitative findings/ results

Scoring for the ROME mnemonic is consistently low across all three groups for all three phases. This demonstrates lower levels of retrieval of key information comparing with the sepsis management mnemonic. Science-based undergraduate degrees with a 2:1 classification cluster in addition to retrieval scores for the word associated with O_2 FLUID mnemonic across all

three phases of data collection. Retrieval of the *words* associated with the O_2 FLUID mnemonic was higher than retrieval of the *first letter* of the O_2 FLUID mnemonic or its sequencing. Overall, retention of the information associated with the O_2 FLUID mnemonic is lower 12 months post-OSCE compared with immediately post-lecture. This indicates that there is some lack of retention over time. Furthermore, the adult group average scores outperformed both the mental health and the child branch groups across many aspects of the statistical data. The average scores were adjusted to reflect averages proportionate to the varying group sizes.

The p-values are significant when comparing OSCE scores over the three-time phases (pre-OSCE and 12 months post-OSCE). This means that the results have changed over time across the three phases. Overall, scores increase at phase 2 (OSCE). ANOVA tests, which detail the statistical repeated measures test over these phases, were not able to detect significance when comparing overall OSCE score and age, O_2 FLUID and first letter use and word. However, ANOVA comparison between phases 1 to 2 and between phases 2 to 3 were statistically significant, showing changes – but were not significant between phases 1 to 3. The reason for this is that overall comparisons were too small to detect for many of the statistical tests when using average comparison of scores. When considering the scores for sequencing of the O_2 FLUID mnemonic, ANOVA tests for phases 1 to 2 were significant and the mnemonic being used following each letter between phases 2 to 3 and across all three phases was statistically significant. This means that participants appear to be using the mnemonic in sequence for their OSCE

examination and 12 months post-OSCE. The ANOVA tests and p-values showed no statistical significance for the ROME mnemonic. Again, this is due to the averages being too small to detect significance. The descriptive statistic tests conducted on the mean, mode and median scores show changes in performance of higher scores at OSCE and post-OSCE scores drop to 50% of the examination scores.

Hierarchical cluster analysis tests uncover those groupings across the use of the word associated with the O_2 FLUID mnemonic. For example, ‘Fluid’ rather than the first letter of the mnemonic, ‘F’, is a common cluster. Total knowledge is a prominent cluster, showing that total knowledge of sepsis has dropped by over half since the OSCE and is lower than when participants were introduced to key concepts. Placements prior to the OSCE examination (Placement 1) have clustering for medical, surgical, and paediatric placements. The cohort is a homogenous sample, in that many of the traits, such as undergraduate degree classification, are programme requirements. However, the cluster analysis was a key analytical statistical test when viewing the quantitative findings holistically for numerical inferences and the subsequent discussion.

5.7 Qualitative Analysis - thematic analysis

The qualitative method used to analyse the interviews was Burnard`s thematic analysis (1991). This theoretical framework has eight distinct concurrent stages to follow (Table 5.6 Burnard`s Thematic Analysis – step by step). In this method, the researcher uses inductive reasoning to bring new knowledge into view.

Step 1: Transcriptions of the recordings was carried out by the researcher and notes taken during the interviews constituted valuable reflections. Step 2: Immersion in the data; listening to the audio recordings to ensure familiarisation with the data, verbal clues. Step 3: Data analysis involved reading the verbatim transcriptions of the semi-structured interviews, generating initial codes, and searching for sub-categories, categories, and themes among codes. The Nvivo software package was used to assist in the electronic coding process and grouping of emerging themes. Data was coded by first reading through each transcript and assigning a code (or word) from each sentence, for example, ‘thinking’ or ‘recalling’. Step 4: joining similar codes together, which in turn formed categories, thereby reducing the data. Step 5: Reviewing, defining and naming themes, using Nvivo, which held coded data in a secure repository along with the audio recordings, which were used to clarify the written transcripts. Step 6: Independent validation of categories and themes was verified by asking a fellow researcher to peer review these categories and themes. This ensured a type of investigator triangulation; an objective other (Van der Heide, 2001). Uncoded transcripts were sent for peer review and the reviewer comments concurred with the categories and themes, using the same stepped approach (Burnard, 1991).

Step 7: Member checking, which involved taking data back to the participants. Angen (2000) acknowledges that this approach has a “fixed” or “fixed reality”; understandings are open to interpretation over time. Respondent validation, or member checking, does have a value if used in a systematic way (Morse, 1991). In this study, a selection of transcripts that had been coded and analysed for categories was taken back to participants for member checking. Some minor semantic corrections were made but categories were agreed by the participants. Step 8: Once themes had emerged from the data, the data interpretation and analysis can be presented, using verbatim, anonymised quotes to highlight the significance of the findings.

Table 5.6 Burnard`s Thematic Analysis – step by step

Step number	**Details of the step**
1	Memos – keeping note of thoughts during the interview.
2	Immersion in the data – reading and re-reading the transcript before starting the analysis.
3	Open coding – going through the document giving a name 'code' to all the text. Data expansion.
4	Collapsing data / data reduction – joining similar codes together to form categories.
5	Further reduction – further matching and asking questions of the data.
6	Peer coding – asking another researcher to code a transcript (to guard against researcher bias).
7	Member checks – taking the analysed text back to those who supplied it (credibility check)
8	Writing up – re-tell the story, keeping a close link with the original transcript. Use original quotes to illustrate the text.

A particular strength of this method of data analysis is that it follows a structured framework, enabling an audit trail, which ensures greater confirmability (Lincoln and Guba, 1985). With any research design, methodological weaknesses exist. Subjective interpretation is always present, as the researcher is interpreting the data, and the approach is not generalisable. Braun and Clarke (2006, cited in Flick, 2014) suggest that the stripping away of theoretical and methodological contexts brings about the risk of reducing the analysis to a hands-on procedure. However, if issues of trustworthiness can be addressed, then such limitations may be reduced or negated.

CHAPTER 5 FINDINGS/RESULTS (qualitative) thematic analysis

5.8 Introduction

Qualitative data analysis was facilitated using the Nvivo software package. This computer-based data entry, storage and analysis software can assist researchers in organising and storing their data securely. Nvivo enables audio files and written transcripts to be uploaded and filed according to participant number. Codes, categories and ultimately themes can then be generated and analysed from the data. From this analysis, three main themes emerged. The following section details the codes, categories and themes, and anonymised participant quotes have been used to highlight the rich depth, context and nature of the responses to the semi-structured interviews.

5.8.1 Rater comparison - coding

Rater coding of transcripts was independently checked by colleagues from the transcripts, who found their codes to be similar to my own coding. This increases the trustworthiness of the data as previously outlined.

5.8.2 Participants interviewed

Nine qualitative semi-structured interviews were conducted after the OSCE examination phase: six from the adult group, from a possible 17; two from the mental health group, from a possible of 17; and one from the child group, from a possible nine. The raw scoring of the quantitative data was used to design the semi-structured interview schedule. Recruiting interview participants was challenging for two main reasons. First, students were on clinical placement at the time; this was necessary to the study's aim of ascertaining the value of

the teaching of mnemonics in the practice setting, reflecting the underpinning philosophy of pragmatism. Second, it was possible to gain consent and collect large amounts of quantitative data during the OSCE, as this was part of an assessed module component. However, the interviews required an additional contact with students and further consent. This resulted in fewer interviews – but qualitative research is concerned with depth and richness of data from participants rather than volume of interviews conducted.

Table 5.24 below shows demographic data and a number of participant attributes. Although there was only one participant from the child branch, this is proportionate to the mental health group.

Table 5.24 - Demographic data of interviewees

Group	Participant number	Age	Subject pre entry	Pre entry Classification
Adult	Adult nursing/ 04	32	Science Based	2:1
	Adult nursing / 07	37	Social Sciences	2:1
	Adult nursing/ 13	24	Science Based	1st/ Masters
	Adult nursing/ 15	24	Science Based	2:1
	Adult nursing/ 16	26	Social Sciences	2:1
	Adult nursing / 17	28	Social Sciences	2:1
Mental Health	Mental health/ 04	51	Social Sciences	1st/ Masters
	Mental health/ 08	42	Social Sciences	2:1
Child	Child branch/ 07	27	Science Based	2:2

Table 5.25 below shows the number of codes associated with each category and theme, with the corresponding domains of learning attributed to each category. This table was useful in visually representing the number of codes

associated with each category. The number of codes was not used to quantify the significance of one code over another. Moreover, they were used to reflect if there was any significance to the codes linked to domains. This enabled me to identify that the cognitive domain features more frequently. The themes also link to Bloom's domains of learning (2001). The emerging themes were matched to each domain, for example Bloom`s cognitive domain is concerned with cognition (thinking) and the cognitive processes associated with this and learning. Themes associated with the emotional element of learning, for example placing a value on mnemonics and the feelings surrounding this (affective domain). Visual aspects of using mnemonics (visual domain).

Table 5.25 - Overview of Emerging Themes

Theme	Number of Codes	Domain of Learning
Theme one – Prior mnemonics use	**8**	
Category 1.1 - Mnemonic Experience	3	Cognitive Domain
Category 1.2 - Designing own Mnemonic	5	Cognitive Domain
Theme two – Significance of mnemonics	**153**	
Category 2.1 - Facilitating Retrieval of Mnemonic(s)	54	Cognitive Domain
Category 2.2 - Valuing Mnemonic(s)	41	Affective Domain
Category 2.3 - Using ROME Mnemonic in Practice	34	Affective Domain
Category 2.4 - Mnemonics in other taught modules	5	Cognitive Domain
Category 2.5 - Mnemonic for future learning	19	Cognitive Domain
Theme three – Visual learning	**58**	
Category 3.1 - Seeing the Mnemonic	21	Visual Domain
Category 3.2 - Seeing visual prompts in Practice	13	Visual Domain
Category 3.3 - Structuring the Mnemonic(s)	24	Cognitive Domain

Figure 5.1 shows the themes and categories. The larger the area of each box, the more items were coded to the corresponding category. The theme with the largest number of categories is theme two, significance of mnemonics, with five categories. Next is theme three, visual learning, with three categories. Theme one has the lowest number of categories, with two. There is a correlation between the higher number of codes reflecting the higher category numbers.

Figure 5.1 Hierarchy of themes and categories – Nvivo

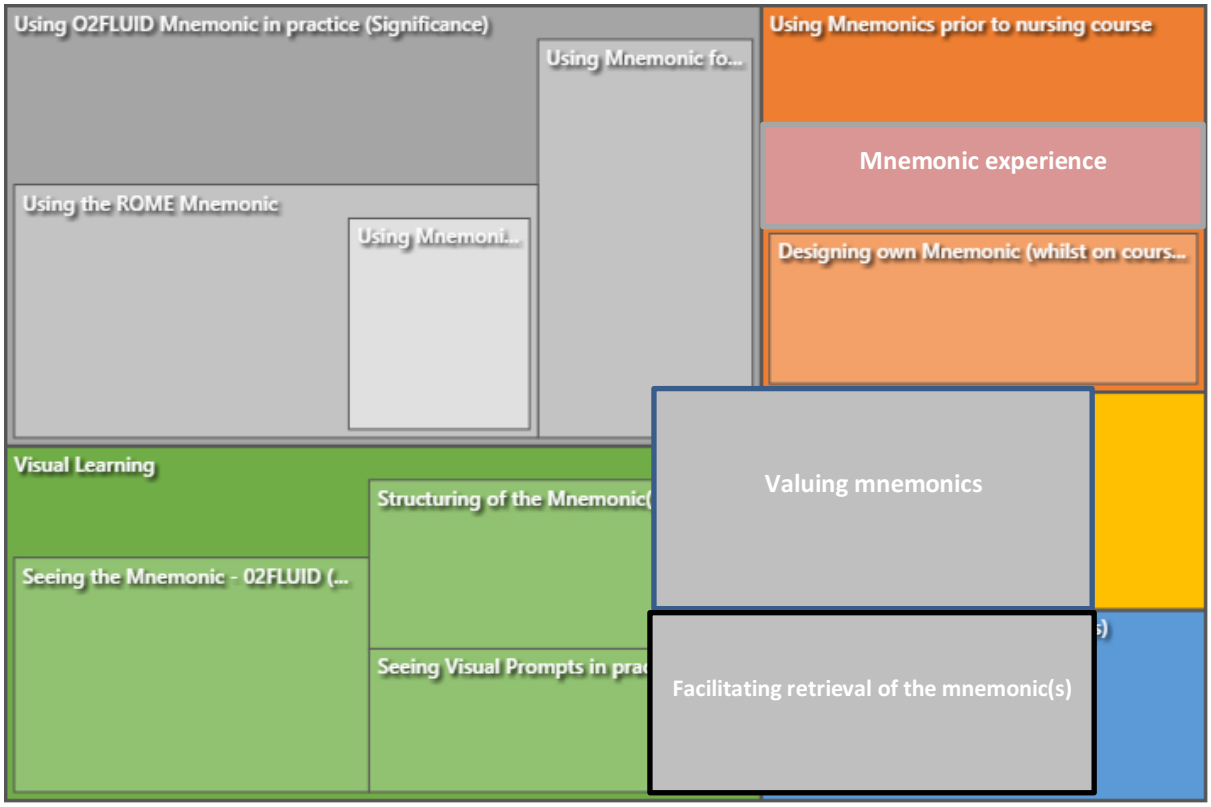


Figure 5.2 is a word cloud of the most commonly occurring words from the qualitative interviews, the larger the words, the more frequently they appear.

Figure 5.2 Word Cloud – 50 most used words from the qualitative interviews

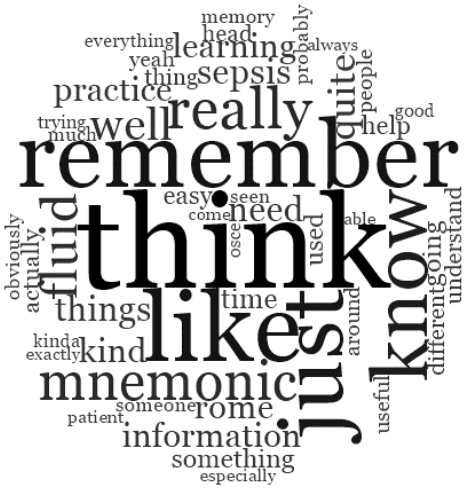


Table 5.26 below shows that the most commonly used word during the interviews was think(ing), appearing 229 times across the nine transcribed interviews. Verbs and adverbs associated with these words are shown in brackets. Interestingly, this also corresponds to the domains of learning in Table 5.25, with the cognitive domain appearing most frequently. The rationale for presenting this was to assist the researcher when analysing the significance participants gave to these words during the interviews.

Table 5.26 Word count – most frequently used words during interviews

Word	**Number of times mentioned (in qualitative interviews)**
Think(ing)	*229*
Mnemonic(s)	*202*
Remember(ing)	*106*
Learn(ing)	*91*
Sepsis	*83*
Information	*60*
See(ing)	*60*
Recall(ing)	*32*
Head	*28*
Structure(ing)	*26*

Figure 5.3 is a representation of the categories that have similar words in the name of the category and how these were clustered visually.

Figure 5.3 – Categories clustered by word similarity

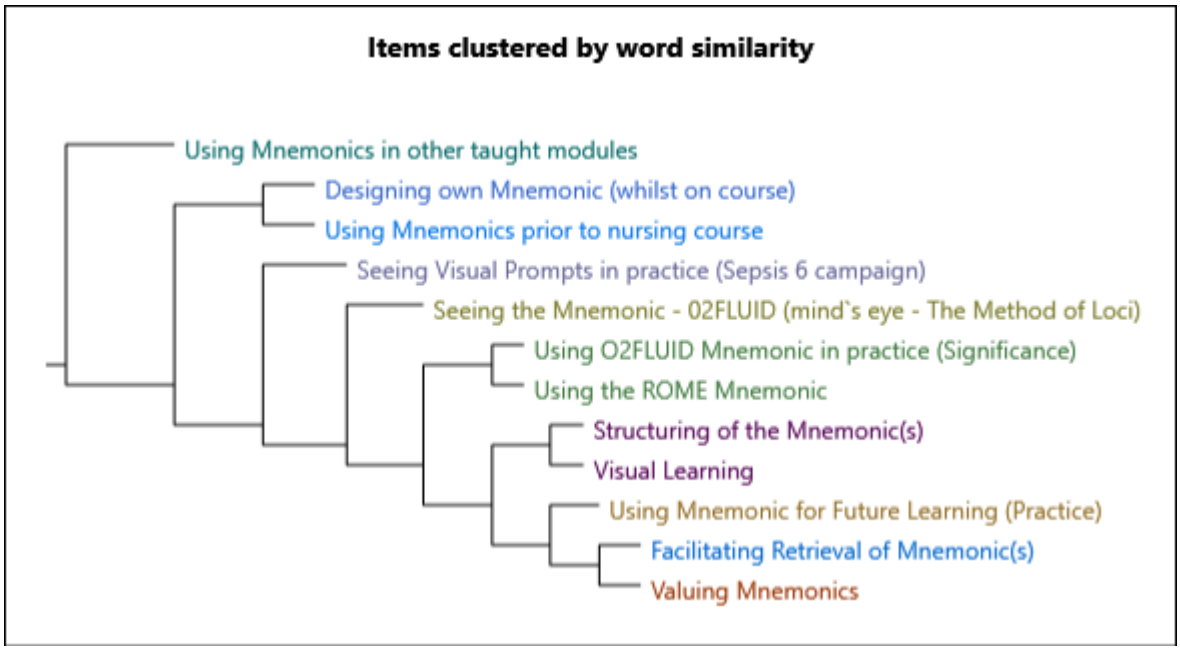
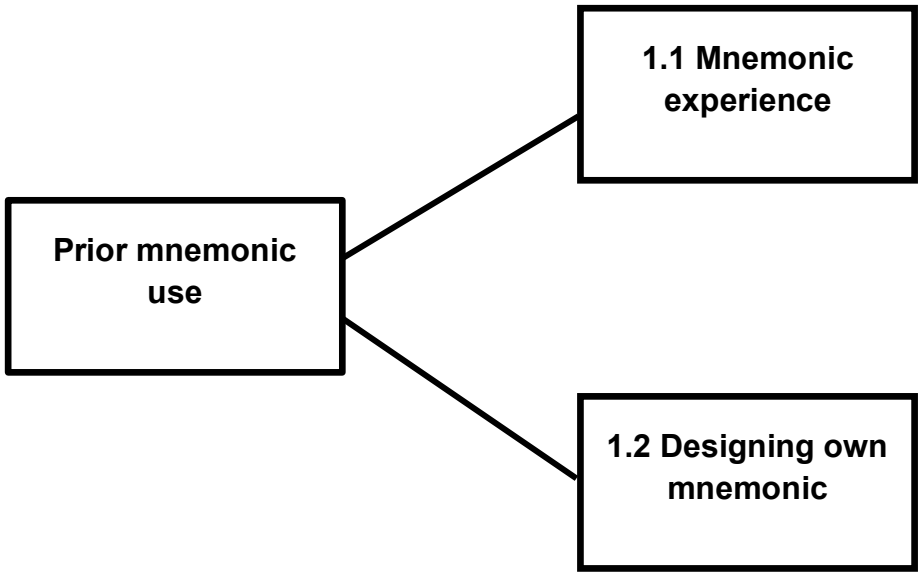


Figure 5.4 Theme one - mnemonic use prior to nursing course and categories (mnemonic experience and designing own mnemonic)



This overarching theme explores one main theme and two sub themes, or categories. Participants stated that they had some experience of using their

own mnemonic. How they had experience of designing or using their own mnemonic prior to or during their nursing course and during the study. The responses were mixed, with a number of interviewees stating that they had no experience of designing their own and preferring the structure of those provided by academic staff on the programme.

5.8.1.1 Mnemonic experience

Category 1.1 Have you ever used mnemonic devices to support your learning prior to this nursing programme?

Military Experience

Mental health nursing group/08

I found in the military it was very useful because in a lot of situations you're under pressure to make quite quick decisions…

This participant described their experiences prior to the Master of Nursing programme, when they worked in the military and where mnemonics are commonly used. They spoke of their exposure to mnemonics and how they used them, from remembering stages of assembling equipment and how military personnel used them. Mental health nursing group/08 spoke of the need to make quick decisions in the role of army soldier. They reflected on the need for time dependent decisions, relying on key information to do this.

5.8.1.2 Designing own mnemonic

Category 1.2 Did you utilise your own mnemonic(s) as part of your own learning in relation to sepsis?

No experience

Adult nursing group/07

I just used that one (O_2 FLUID).

Adult nursing group/13

No I haven't seen any… Other methods I'd looked at online just seemed disorganised and there wasn't as good a structure and kind of just statements rather than having one simple mnemonic so it was much easier to remember.

Both adult nursing group/07 and adult nursing group/13 talked about not using or designing their own mnemonic but rather using the ones given. They cited the O_2 FLUID mnemonic in the interviews but not the ROME mnemonic. They said they had looked at other mnemonics on internet sites connected with nursing and sepsis. Both said that they had viewed and read around some of the other mnemonics. However, adult nursing group/13 felt that these were too confusing, due to overloading of information in the mnemonic structure. It was the lack of structure and loading of numerous texts that made adult nursing group/13 feel that the O_2 FLUID mnemonic, taught on the Master of Nursing programme, was easier due to a simpler structure and representation.

Adult nursing group/15

I remember trying to do one for O_2 FLUID and I learnt it using mine before the OSCE and then somebody asked me "oh what's yours" and I don't even remember and then I ended up using the O_2 FLUID one so I was like, yeah just stick with that it's much easier.

When asked if they had used their own mnemonic, adult nursing group/15 spoke about designing their own for remembering information for the OSCE examination and pertaining to the management of sepsis. A fellow student asked adult nursing group/15 to share this mnemonic with them but the participant recalls that when attempting to relay their self-designed mnemonic to another student, they struggled and could not accurately or confidently remember it. They described how they felt a sense of relief using O_2 FLUID, as provided by the module team, as they felt this was much easier to remember than their own.

5.8.2 Summary of findings - Theme one

In relation to prior mnemonic use, categories of mnemonic experience and designing their own mnemonic, two of the nine participants spoke of their experience of having used mnemonics prior to their nursing programme, in a military setting. Most participants had no prior experience or exposure to using mnemonics to aid their own learning. The quotes above highlight that although some participants had designed their own mnemonic to study key sepsis information, they were not able to retrieve the information when desired. Participants appeared to favour a simplistic mnemonic design, labelling the O_2 FLUID mnemonic easy in terms of its structure. Interestingly, participants cited only the O_2 FLUID mnemonic in their responses, not the ROME mnemonic.

5.9.2 Theme two – significance of mnemonics in practice

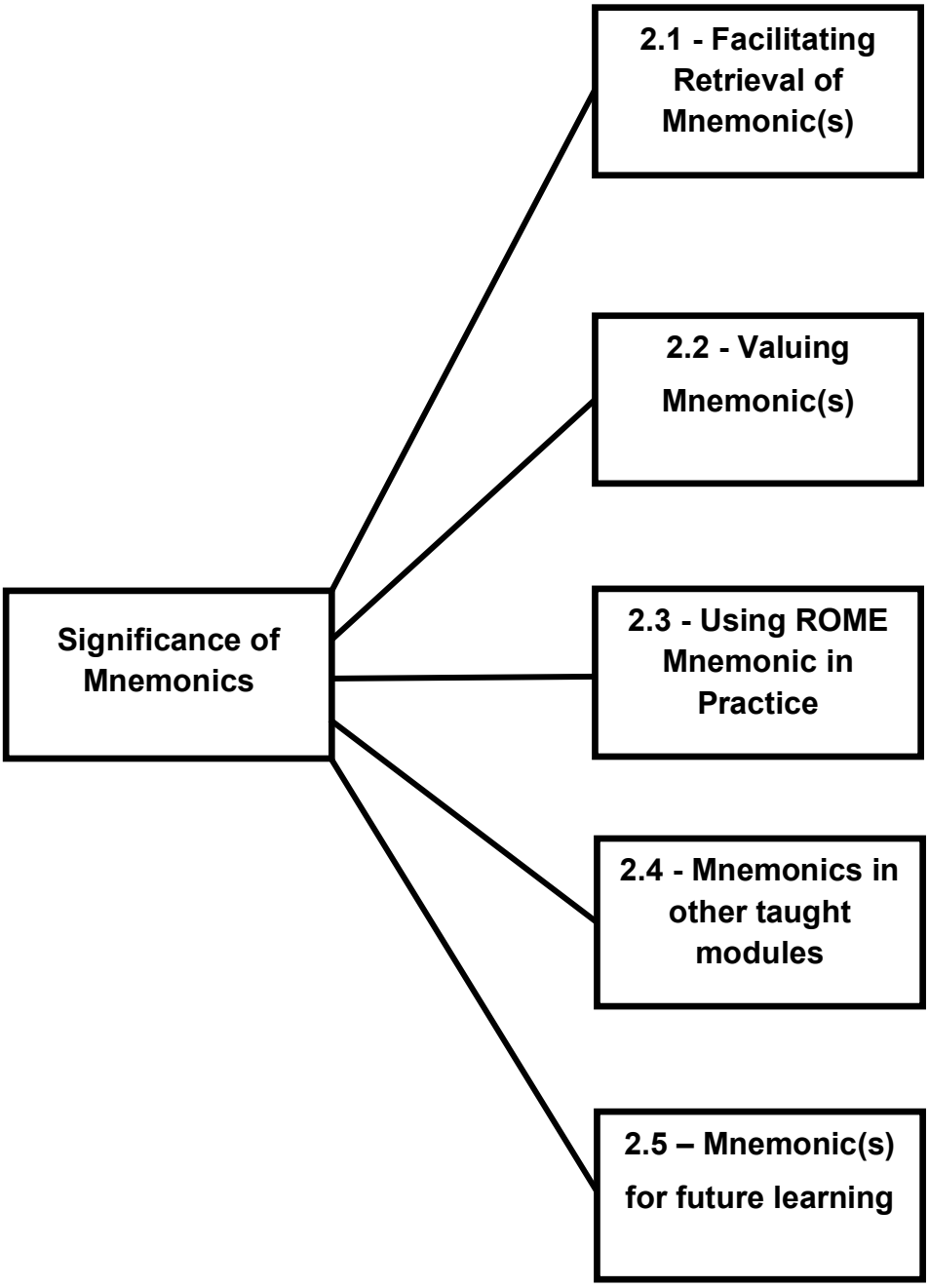


Figure 5.5 Theme 2 – Significance of mnemonics and associated categories (retrieval, valuing, mnemonics in practice, in taught modules, future learning).

This theme defined the significance of mnemonics. The five categories that covered all highlighted the significance to them. Codes were grouped together to formulate categories; some code headings have been used below to further define and provide focus when presenting quotes.

5.9.2.1 Facilitating retrieval of mnemonic(s)

What factors influenced you in helping to retain the mnemonic information?

Length of Mnemonic

Adult nursing group/07

It's just easy to memorise it all, the information's there and if you do need it you just think O_2 FLUID. I memorized it, O_2 FLUID the individual components, it was quite specific, it's not really long as well, which makes a difference.

Adult nursing group/16

Basically just the recall 'cos you remember the letters… When you're on the spot 'cos you can just remember that mnemonic and it all comes flooding back.

Adult nursing group/07 spoke of thinking of the component parts of the mnemmonic (O_2 FLUID) and retrieving the rest of the detailed information attached to it. They spoke of the importance of the length of the mnemonic to their retrieval, making the process of remembering easier. The participant explained that the O_2 FLUID mnemonic was relevant to their practice and they recognised the significance of sepsis as a medical emergency. Adult nursing group/16 also spoke of the letters or parts, making the process of recall a flooding process to describe the retrieval of key information on sepsis.

Speed of Recalling the Mnemonic

Adult nursing group/15

Because it's snappy… if you can remember something that quickly in a life-saving situation, which sepsis can be, like you need to remember it fast and if you can remember it fast then you can save someone's life.

Mental health nursing group/08

Use of a mnemonic, it kinda makes it easier to access the information faster but also quite fully, but if you have the mnemonic, you don't have to sit and think 'have I missed something out' because a mnemonic is a short snippet of a larger concept so it really helps with the speed, so it is quite useful, especially learning new things.

Adult nursing group/13

Learning it as a skill and it's easy to remember. I think it'll always just be used, 'cos in those situations it is transferable.

Speed of retrieval of key information was an important feature of using mnemonics for both adult nursing group/15 and mental health nursing group/08. Adult nursing group/15 described how, to them, responding to sepsis appropriately could be lifesaving; remembering critical sepsis management information fast could save a patient's life. This appears to be an important factor in this participant's value system. Mental health nursing group/08 said that the mnemonic was, for them, something that enabled speed and recall of information, but also represented a small chunk of a larger concept, acting as a mechanism for speedy recall. Adult nursing group/13 felt that using a mnemonic was a skill in itself. They described how they valued using the mnemonic and this was largely due to the speed of recalling large

amounts of information, which could be transferred into other nursing contexts involving sepsis.

Mind's Eye

Adult nursing group/07

I see it out in my head and I will actually see someone as I'm doing it… For me the mnemonic helped with the exam; it's in my head I'm convinced in 10 years' time if someone says to me 'what are we going to do about this septic patient?' I will say 'O_2 FLUID'.

Adult nursing group/16

It's a process that you go through in your head so that you don't miss anything.

Both adult nursing group/07 and adult nursing group/16 spoke of the action of going through a virtual mind's eye in their head. Adult nursing group/07 spoke of seeing a nurse in their head going through the stages of the O_2 FLUID actions. Again, the participant valued the mnemonic for their learning and spoke of using key sepsis management information for their OSCE examination. Adult nursing group/16 described going through the process in their head and counting through the different parts that make up the mnemonic, ensuring that no part or information was missed. This suggests that although during the exmaination, a verbal process was used to recall mnemonics, participants may also use a mind's eye view to recall and see the mnemonic in their mind.

Visual cues

Mental health nursing group/04

I think when we had the Powerpoints, I think that I printed out the Powerpoints; well, I printed out everything. I printed out the Powerpoints, well the whole of the lecture including the one with the information. I probably wrote it down as well actually. I tend to do that and I probably went over it with my friends.

Adult nursing group/16

When you seen people caring for someone with sepsis, you clicked, oh that's that, that's the L, that's the U.

what I do to revise is colour up my headings and in an exam I remember everything that was underneath it, so O_2 FLUID was presented to us in colour, I remember it was purple, I think the O_2 was black and the fluid was purple and that helped.

The above participants spoke of using visual cues or prompts in facilitating the retrival of the mnemonic. Some students, for example mental health nursing group/04, described how they printed out Powerpoint handouts, which acted as a memory hook for them. Adult nursing group/16 spoke of the links they created between the written structure of the O_2 FLUID mnemonic and patients they had cared for with sepsis. They discucsed the moment when they had a significant realisation of the care bundles associated with the sepsis six (O_2 FLUID) and the mnemonic working in practice. They also used colour in realtion to the mnemonic's key words, such as Oxygen. In the exmaination,

they described how they saw this colour and heading, which aided their retreival of the details associated with each stage of the mnemonic.

Auditory cues

Adult nursing group/16

…sepsis and instantly associated it with the O_2 FLUID. Just hearing the word 'sepsis', I instantly associate that with O_2 FLUID now. Then sound it out fluid, you know F, L, U and go through it on my fingers and then, yeah, it's all there.

Mental health nursing group/08

When I think of O_2 FLUID, I'm only having to remember two kinds of components, so the O bit is one component and the fluid is a separate component, so I'm only kinda remembering two parts. I know my memory; I know normal people's memory is like between 4 & 7 or 4 & 8 so it makes it really easy for me to manipulate and handle, and I do see it and I kinda hear it as well I suppose.

Both participants spoke of the importance of the sound of the words associated with the O_2 FLUID mnemonic. For example, adult nursing group/16 said that on hearing the word 'sepsis' they imediately recalled the management of sepsis and the associated treatments. They also described how sounding each word out; F for Fluid, and the action of each finger acting as a key word, aided them in remembering the information. Mental health nursing group/08 had a similar view; they heard the O for Oxygen and the rest of the mnemonic

followed, to spell the remaining treatment. They felt they only needed to remember two of the six items associated with O_2 FLUID to recall all of it.

Practical examinations

Adult nursing group/13

I think just practising it again in practicals, I think it's definitely just ingrained now I think because that's how we were taught from the beginning. It was that direct link between theory and practice, whereas a lot of the other ones they don't have that so I think that one [O_2 FLUID] worked quite well.

Adult nursing group/16

You had to learn it to get through the exam but for it to stay with me, it has definitely been practice and something that you often come across and if I didn't I probably wouldn't remember.

Adult nursing group/15

It came in very very useful during the OSCE and during the practicals when we've had to assess patients who potentially have sepsis. I think having [the mnemonic] made you feel a bit more comfortable in sort of what to expect in the OSCE and just sort of calmed you down a bit. To know that you know something from a mnemonic and remembering the mnemonic and being able to bring it up when you're in that situation, obviously under exam conditions.

These participants spoke of the direct links they made between the mnemonic and their examination (OSCE), and practical sessions. Adult nursing group/16

described the importance for them of practicing using the mnemonic. Adult nursing group/15 spoke of the mnemonic calming them down in stressful practical sessions and the OSCE, and how this gave them confidence.

Reinforcing

Adult nursing group/15

It's probably repetition and just reinforcing it every time you think about it and every time you use it. It just means that you need to keep reinforcing it; I mean a patient anywhere could present with sepsis and just being able to reinforce it and actually remember what the O_2 FLUID stands for and then consolidating learning around it. You read around it to make sure you know exactly what in the Trust and the Trust policies follow that as well and then teaching younger students to use it as well.

Mental health nursing group/04

I suppose you should revise these things quite often; if you haven't it would jog your memory back to the time at university because it isn't necessarily something you would see very often, and so I think it would be quite helpful if you've not thought about it for a while and, like I said, it would be good for stress too if you were in a stressful situation. If you've got a deteriorating patient, I think would help you remember what to do… Suggest what you should do, what to suggest to other people to do.

Adult nursing group/15

I see the sheet we got it on and I can see the O_2 FLUID at the top and then what each thing stands for underneath. I remember exactly the way that I like revise it; that's just the way it imprints in my brain so if I can see it written down then it all just comes back to me.

Adult nursing group/17

I can remember it but not, sort of just apply it; it's like a trigger, like a hypnotic trigger. I need that in front of me, because of the way it's happened in the Trust and University where there's an OSCE and then that's applied. I've seen that in real time and it's brought everything together for me.

Participants described the importance of using visual cues to reinforce their recall and learning. Mental health nursing group/04 spoke of re-learning the O_2 FLUID mnemonic for their OSCE, thinking about it, recalling it and teaching other students how to use it. The participant deemed all this process as reinforcement. The act of revision also helped reinforce the process of remembering for adult nursing group/15, who used visual cues to reinforce their learning during self-study. Reinforcing the mnemonic while on placement was an important aspect for adult nursing group/17; they used the words 'hypnotic trigger' and spoke of being drawn to the visual look and structure of the O_2 FLUID mnemonic. For them, reinforcement came in the form of being exposed to the mnemonic within the University, then using their sepsis management knowledge on their placement and consolidating their learning.

Role of theory

Adult nursing group/17

ROME however, I know the mnemonic, what it stands for but I still don't quite grasp the entire theory behind it cos I know it's respiratory opposite but I'm not entirely sure what that means you know? I get parts of it but then if I don't refresh myself constantly I forget again.

Adult nursing group/17 felt that the role theory has in relation to understanding the mnemonic should be matched. Simply recalling the mnemonic was not sufficient depth. Revisiting the theoretical elements of the mnemonic's content was equally important in helping them to facilitate their retrieval, not just of the mnemonic itself but the information associated with it.

5.9.2.2 Valuing Mnemonic(s)

What factors do you perceive as being important influences in the use of mnemonics and your learning?

Exposure

Adult nursing group/04

I think then to memorise those in a stressful situation, as it is, I found them really useful actually. This is the mnemonic that we use here then everybody can access that and the more you see it the more you are exposed to it the more you're going to learn. Talking about that and prompting students to say what is the sepsis 6, what is the O_2 FLUID, what does it stand for? I think if

you've got more people encouraging its use by repeating it, you're more likely to learn it.

Mental health nursing group/04

I think for something like physical health, it's really useful for me 'cos it's not something I'm confident in, so I think it's really useful. I'm not sure how you'd use it but there would be ways but no we've not used it much.

Child nursing group/07

I think you can't get away from mnemonics; they're everywhere, especially in medicine, everyone is using them all the time and as soon as you pick up a journal article or anything like that they've all got something in; every specialist area has their own special mnemonics that you have to learn and I think they're really good 'cos you can remember them but then I don't know if there's an oversaturation that suddenly everything has to be one.

Adult nursing group/04 discussed their experiences of exposure to mnemonics within university and in clinical practice (placement) in terms of sepsis and the O_2 FLUID mnemonic, which they stated reinforced their own learning. They spoke of their heightened awareness through exposure to posters and reminders from teaching staff during university sessions. Conversely, mental health nursing group/04 described how, as their branch was mental health nursing, they had not had that much exposure to sepsis management on placement or seen patients with a diagnosis of sepsis or used the O_2 FLUID mnemonic in practice. However, they still valued the mnemonic and felt it

would be useful if they encountered sepsis in a clinical situation; they acknowledged they may be unsure of its application but did explain they were aware of its clinical significance regarding deteriorating patients and the need for prompt clinical decision making and escalation. Child nursing group/07 acknowledged that they felt exposure to mnemonics was commonplace in books and journals, as well as in the clinical environment and nursing culture. They valued the use of these for their own learning but felt that oversaturation may lead to lack of recognition of them or lack of use due to them being "everywhere".

Structure

Child nursing group/07

Again, I think they provide a structure the way they provide the necessary information, so you know exactly what you need to know and it's an easy way to learn it. The O_2 FLUID is definitely a good one.

Structure was an important factor influencing the use and application of O_2 FLUID for child nursing group/07. They spoke of how the simple nature of the six component parts helped them assign the details of what to do in the event of having to manage sepsis, for example applying, 15 litres of Oxygen via a non-rebreathe face mask to the patient with sepsis.

Reducing anxiety

Adult nursing group/13

I think they are really useful 'cos you've got to think on your feet really quickly sometimes… I do think there's definitely a place for it in Nursing 'cos it kinda slows your thought process down in a chaotic situation, which is helpful.

Mental health nursing group/08

In the military, there are high pressure situations like in nursing, and when people are under pressure and feeling anxiety because of the pressure, then sometimes information can be lost from memory when you're trying to recall information that is required. So the use of a mnemonic gets around the recall, or large bits of it, especially when you're feeling anxious.

Adult nursing group/17

I think in fast-paced areas where there's a lot of stress, I think they're the perfect things really; like you need triggers rather than directions as long as you learn them.

The above participants spoke of their view that using mnemonics reduces anxiety, due to the streamlining of thought processes and clarity during stressful clinical situations. Mental health nursing group/08 acknowledged that vital information may be lost from memory or not recalled due to the stress of the situation; they spoke of experiences in the military and of how they saw the mnemonic as the recall itself. Adult nursing group/17 spoke of the nature of nursing in some clinical areas like accident and emergency; they perceived this area as fast-paced and stressful. They described how O_2 FLUID was like a memory trigger with other actions following, but only if the trigger was

recalled. They felt that the recall trigger complemented clinical decision-making, being empowering rather than dictating.

Theory/practice gap

Adult nursing group/13

You had the theory and the teaching, so you knew what the structure of it was and then you went into the practical to actually see how it works.

Adult nursing group/16

I think they're a good way to compact information and I think it's really helpful to have something that you know that can just pop up when you're on the ward when you're in that situation.

Adult nursing group/17

Mnemonics probably are for the job of nursing or for any healthcare job [in a] chaotic environment. I'd say they're probably a thing you could use in myriad situations and I'd say the more you can get, it takes up less room.

Mental health nursing group/ 04

I thought it was fab because in mental health, I suppose we don't have that much of a… we have less physical component in our course and it was quite helpful to try and get some of the facts out from behind the anatomy and the physiology of it I suppose.

The above participants acknowledged the links between theory provided in university and being on placement, using the mnemonics provided. Adult nursing group/16 spoke of the clinical value of having learnt the mnemonic and how this could be applied in a clinical context. They saw the use of mnemonics as something to be applied practically in nursing; not just as theory. Adult Nursing group/17 described how they felt using the mnemonic in practice allowed them to keep more room for remembering other clinical information on placement, as they felt overwhelmed at the amount of learning and information, and expectations to retain that clinical information while on placement. Mental health nursing group/04 spoke of the realisation that, as their branch was mental health nursing, this often focused on the emotional wellbeing of patients rather than the physical health, but that sepsis could still affect patients in their care. The usefulness of a mnemonic that focused on physical aspects of health could help them retain vital information, as they may not come across sepsis that often in their branch of nursing.

Remembering

Adult nursing group/15

I think they should be used more because there's so much you have to remember; there's so many different things, especially if you can make it relevant like O_2 FLUID, then it would make a lot of different topics a lot easier to remember.

Mental health nursing group/08

It's always easier to have as many senses involved in that mnemonic to help bring about memory, because a lot of what we learn on the Master of Nursing programme, we are given it once and that's it; a lot of things we're just expected to kind of remember and if we're not revisiting it in placement and we're not revisiting it later on and learning…

Adult nursing group/17

It's condensing your learning but it's a better way to learn… I think you don't need to be bombarded with textbooks or research articles backed up by research you're not going to remember; that you just want to have that summary saying: do this, this and this. I think that's the benefit of mnemonics… But SBAR is something that sticks in my mind because it was again something that I use every single day pretty much… If I've taken handover on the phone for a patient who was coming over, if I didn't have SBAR, I might have broken [the information] down on a piece of paper.

Mental health nursing group/04

I think it jogged your memory, so if you remember the first thing like the oxygen, then you can remember the reason behind it so you can remember the initial. You know, it would kind of help you set on lots of other ideas and it would help you understand it a bit, not just remember it by rote, I suppose.

Mental health nursing group/08 spoke of having many senses involved in the mnemonic; they felt that this would help them recall, as smells, sights and sounds played an important role in their own learning and memories. Other

participants spoke of remembering mnemonics they use regularly, like the SBAR mnemonic. Adult nursing group/17 described that they felt so familiar and comfortable recalling the structure of SBAR, they did not need to write the mnemonic on paper or refer to the SBAR posters in the clinical setting to remember the details of the mnemonic. Mental health nursing group/04 explained that for them, remembering the word acted as a hook to remember the details associated with it, for example Oxygen, 15 litres via a non-rebreathe face mask. They spoke not only of recalling key information but also the importance of understanding the clinical significance of what they had remembered. This was an important factor for what constituted an effective mnemonic and how it supported their learning.

Application to Practice

Adult nursing group/15

It does help reinforce it, especially if you know you're going to be able to use it in theory; you know you're going to be able to use it for assessments, you know you're going to, actually you're learning it for a purpose 'cos you can use it in practice to help save people, I think you pay a lot more attention to it.

Adult nursing group/17

The trigger's in the NEWS, so I would have no idea if I'd seen a NEWS score that would suggest sepsis would occur but I don't know if I could just off the top of my head remember it or if I would need that trigger.

Both participants expressed how they could apply what they had learnt in relation to using mnemonics and sepsis management in particular. Adult nursing group/15 spoke of learning the mnemonics on their programme not simply to pass examinations but to help support their care and decision making in clinical practice. They described that the application of the mnemonic on placement could save lives and that this factor resonated with them, in that their attention was directed to using them more, due the significance of sepsis as a time dependent condition. However, adult nursing group/17 highlighted in their interview that for them, the trigger to act clinically, if sepsis was suspected, was also part of the NEWS score and that they were unsure if they had the clinical experience to make that judgement of patient deterioration without the NEWS score as a prompt.

5.9.2.3 Using the ROME mnemonic in practice

How did you use the ROME mnemonic to structure your future learning and professional development?

Supplemental Learning

Adult nursing group/04

I haven't seen the ROME used in practice but I can kind of see how it would be useful 'cos in terms of knowledge around blood chemistry, when you start to look into that, you kind of recognise what you're looking for. I probably would supplement the ROME mnemonic with more in-depth learning, but I think at this stage particularly in your nursing career, you think there is so much that I need to learn. I do find it useful but again it's kind of like I almost need to do

some further learning to supplement that, so in my mind if someone says it's respiratory opposite, what exactly does that mean?

Child nursing group/07

You spend a lot of the time trying to remember the mnemonic instead of what they're trying to teach you; you're not learning the information first and then given the mnemonic as a tool to aid you. So, I think I found it a bit confusing especially when you use the ROMA one – is it ROME or ROMA? – Blood gases analysis are used on all the wards I've been on, not necessarily all the children's and not all the time, but at least once or twice and I think maybe because it isn't used that often, it's good to be able to recommend the bits that you need to, 'cos obviously if you do it all the time on every patient then you get really used to it but because you're not used to it, the things like ROME help you because you remember what you need to calculate.

Adult nursing group/07

I think with that one, I can remember the mnemonic perfectly: Respiratory Opposite Metabolism Equal. I don't understand it as well, as the background concept requires more reading, whereas the O_2 FLUID one… I know exactly this is what we need to do. I do remember the actual mnemonic in my head, I do remember it but whether I use it as much I don't know.

Adult nursing group/15

I would need to do more reading around it 'cos I remember being confused but obviously it makes sense when you understand it but like I say, it's useful to

remember I think when, later on, like now, when I'm coming to the end of the programme.

Mental health nursing group/04

I thought about revising it, no I did learn it at the time, and I think I half understood it at the time just for the OSCE. I'd completely forgot it by the next year and I haven't revised it and I'm not sure I've got the necessary background knowledge to completely understand and remember it properly. I've tried to at the time but I only kinda half understood it.

The above participants spoke of their lack of understanding of the ROME mnemonic and they all felt that additional in-depth reading would be required to understand the concept of blood gases more. There was mixed exposure to the ROME mnemonic in practice, with adult nursing group/04 stating they had not come across it or used in while on placement. However, child nursing group/07 described how they had seen the ROME mnemonic used and had seen blood gas analysis tests being conducted in clinical areas that were adult as well as child branch. However, they felt they spent more time learning the ROME mnemonic than the clinical information that was associated with it. Adult nursing group/15 explained that at the earlier stage of their training, they struggled with the concepts associated with the ROME mnemonic and blood gases. They felt that now they are further on in their training since their initial exposure to this content and ROME, that they valued it more now, due to their learning on the programme.

Varied clinical exposure

Adult nursing group/13

I don't like that one [ROME]… Because I've learnt about that in my previous degree about acidosis and things 'cos I've got a very different way of learning. The ROME in my head talks about two separate processes, so I didn't find it very helpful, just very confusing – but that's just because of previous experience. I've been quite lucky 'cos I've been in different areas of practice; I've been able to nip off into other areas where you see that either in critical care or in surgery.

Adult nursing group/16

ROME however, I know the mnemonic, what it stands for, but I still don't quite grasp the entire theory behind it 'cos I know it's 'Respiratory Opposite' but I'm not entirely sure what that means, you know? I get parts of it but then if I don't refresh myself constantly, I forget again. I think that made me forget the ROME, 'cos although it was short and sweet, the explanation of it was quite long and very complex. If I was on a respiratory placement, I would've remembered ROME but because I don't really use it as much, I have to keep using stuff or else it just goes. I can recite the mnemonic but I don't understand quite… I can tell you but I don't fully understand it myself; I'm quite visual and, I don't know, I need visually of how actually it all clips together.

Mental health nursing group/04

I've never done it [blood gases]; never come across it. I've never come across any deteriorating patients. Well, there's been one deteriorating patient and that

was delirium and dementia so there's been one but I've only come across one and that's in my placement.

Adult nursing group/17

I hadn't seen it used until I went to a critical care setting and then the first patient was sort of gases and bicarbonate and they said "what do you think happens here?" and I was like "oh, ROME". It sort of all came together and again, that became beneficial because every time I had a blood gas completed or looking at the NEWS charts, I was sort of putting it together and thinking: oh that's what's going on here.

Both adult nursing group/13 and adult nursing group/17 had some clinical exposure on placement to blood gas analysis; they spoke of their learning environments facilitating this exposure by the nature of the placement (medical or surgical). There were more opportunities for learning, as blood gas analysis was more common at the point of care due to patients being at greater risk of deterioration. They spoke of making connections between their placement and their learning surrounding ROME, although they did acknowledge that this was not as in depth as their knowledge surrounding the O_2 FLUID mnemonic and sepsis. Conversely, mental health nursing group/04 had no exposure to blood gas analysis on placement and during the interview did not make connections with respiratory deterioration, explaining that this would not be that common in mental health placements.

5.9.2.4 Mnemonics in other taught modules

Participants discussed how they used mnemonics in other modules.

Limited examples

Adult nursing group/04

Yes, I have actually; it's a SPICES acronym. Don't ask me exactly what it stands for; it's about addressing holistic needs in patients sort of like: spiritual, physical… Oh I've got no idea now. I don't tend to use it, I don't find that hugely accessible but it goes through all of the different holistic needs.

Adult nursing group/15

I don't think so, nothing that springs to mind, it would probably be useful if they did.

Adult nursing group/16

No, I can't remember if I have, it hasn't been ingrained.

The participants spoke of their limited recall of any examples (adult nursing groups 15 and 16). However, they acknowledge the value if these had been taught. Adult nursing group/16 used the word "ingrained", explaining that this meant 'being at the forefront of their thoughts; easy to recall'. Although adult nursing group/04 was able to recall the SPICES mnemonic, they could not retrieve the details of exactly what the mnemonic represented, other than the context of holistic care needs. They said they do not use SPICES much or access the information connected to it.

5.9.2.5 Mnemonic(s) for future learning

Participants were asked how they used O_2 FLUID and mnemonics generally to structure their future learning and professional development.

With others

Adult nursing group/04

When I become a mentor with students… sharing that information with students by newly qualified staff, to say 'well look, this is how I remember the sepsis six so I imagine that's how I would use that' and, you know, again if I'm dealing with medical staff who aren't really familiar with it.

Adult nursing group/04 spoke of their desire to share what they had learnt with other students and staff; they described how their learning had been very deeply affected and changed as a direct result of being exposed to and using mnemonics, in particular O_2 FLUID. They projected to when they had completed their programme of study and how they planned to use their learning experiences of sepsis in a mentoring role with pre-registration nursing students. The participant reflected how this positive learning experience could be shared with others.

In practice

Adult nursing group/13

This year we've had other ones [mnemonics] that are practical-based and again, it's come up in critical care and we're approaching critical care spokes and I think it will kinda play a part there as well.

Adult nursing group/17

I think I'm going to be in areas of practice, in employment/career learning; it seems I'm heading where these mnemonics [are used] and sepsis is going to be a big issue.

Adult nursing group/15

I would need to do more reading around it 'cos I remember being confused but obviously it makes sense when you understand it, but like I say, it's useful to remember I think when, later on like now, when I'm coming to the end of the programme and I feel like I actually understand more. Again, it comes a bit more in to play I think; when we learnt it we were really quite new and it was like: I've no idea what you're on about. And then you read through it, you see it in practice and then you're like: okay, now I understand what I'm doing with it, it's very handy then when you know.

Mental health nursing group/04

I think it's good if you're in a stressful situation as well, so if you're stressed… I know the OSCE is always quite stressful and I think it's kind of like a comfort blanket. Use it as a kind of structure and it stops you going completely blank. That would be true in practice as well I suppose.

The above participants spoke of how they would use their experiences of mnemonics on the programme and generally in practice, or on future placements. Adult nursing group/13 described how the mnemonics that had been taught to them could link to other forthcoming placements. Both adult nursing group/13 and adult nursing group/17 made connections between the

practical applications of the O_2 FLUID or ROME mnemonics to critical care placements. Adult nursing group/15 perceived that their own learning had changed during the programme; the understood complex clinical conditions better and their comprehension of the ROME mnemonic and blood gases had changed as a result of their clinical experience. Their reading of the theory around interpreting blood gases had also aided their own learning. Reduction in stress levels was seen as an important factor to learning by mental health nursing group/04. They spoke of their experiences during the OSCE, when they had utilised the O_2 FLUID mnemonic to support their recall of key sepsis management information. They defined the structure of this mnemonic as being like a 'comfort blanket' and reflected that the stressful OSCE exam situation would be a reflection of nursing practice, in which qualified staff would be expected to make rational, evidence-based decisions under stressful and pressurised situations.

5.9.3 Summary of findings - theme two

From the quotes and categories associated with theme two (significance of mnemonics), length of mnemonic and its simplicity are an important factor to students engaging with the mnemonic and valuing it for their learning. They associated a shorter mnemonic with being able to retrieve the information faster. Clinical relevance and how students understand the theoretical elements associated with the mnemonic also play an important factor in use and engagement. Indeed, participants spoke of their connection to the O_2 FLUID mnemonic more than the ROME mnemonic, as the O_2 FLUID mnemonic was mentioned significantly more times. This may be due to

students having more exposure to the risk of sepsis, care of patients who may have sepsis, and reinforcement of sepsis information for their OSCE examination. Conversely, there was a perceived lack of significance of the ROME mnemonic and lack of exposure to blood gas analysis tests. Many students spoke of their lack of understanding earlier in their programme in relation to understanding blood gases. Visual and auditory cues were also significant, with many students describing how they conceived the mnemonic in audio or visual terms. One student described vividly how, when recalling the O_2 FLUID mnemonic, they could see previous patients they had cared for with sepsis and used this memory as a "hook" to draw on key information associated with sepsis management. Various examples discuss using other mnemonics, such as SBAR and SPICES, however, these were limited and very few students attempted to design their own. They explained that using the ones provided was much easier due to their structure. The 'future learning' question highlighted how students plan to use the mnemonics for their future professional development. This included sharing their experiences of using the O_2 FLUID mnemonic and sepsis knowledge with students when they undertake an educating role as a mentor for pre-registration nursing students. This appears to demonstrate a value principle operating within participant's cognitive schemas. Students appear to recognise the value of passing their knowledge on to future generations of nurses as well as the immediate applications of mnemonic use.

5.10 Theme three – visual learning

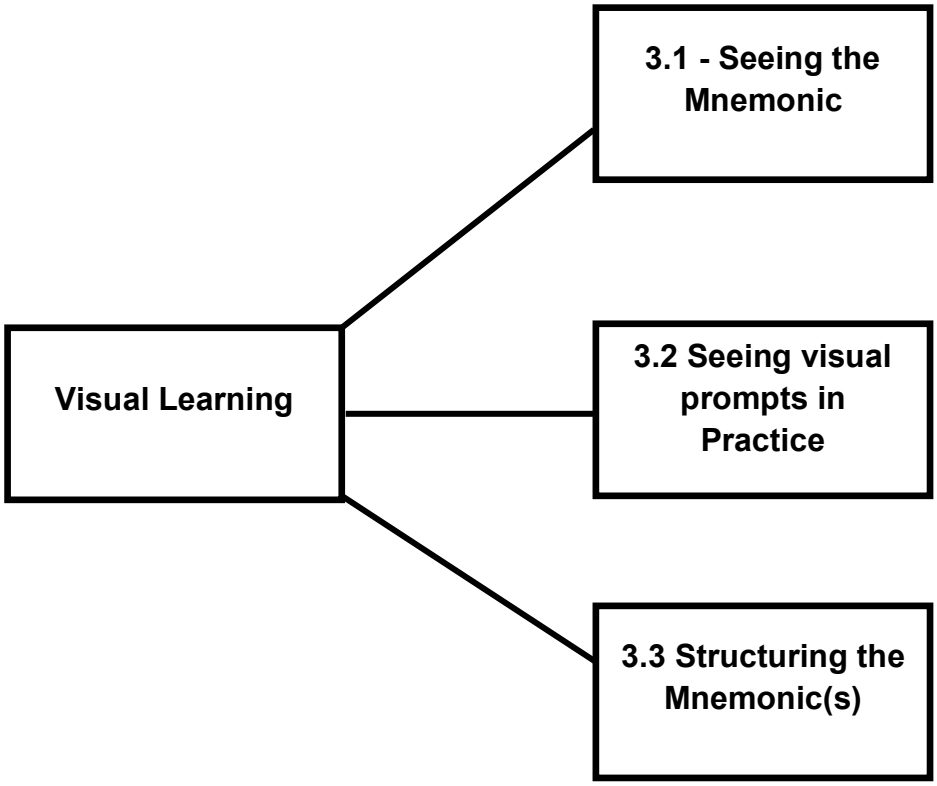


Figure 5.6 Theme 3, visual learning and three associated categories (seeing the mnemonic, seeing visual prompts in practice and structuring the mnemonic(s).

Participants were asked what factors they perceived as being important influences in the use of mnemonics and their learning.

5.10.3.1 Seeing the mnemonic

Seeing in Pictures

Adult nursing group/04

I can almost visualise the O_2 FLUID in my mind and then you can kinda work back from there to say actually, what was the O_2? What does the F mean? What does the L mean? It's almost like I can picture that kind of slide from the

O_2 FLUID mnemonic, which I know seems odd, but it just seems to be how my brain remembers things.

Adult nursing group/13

…just visualise it, so if I see a page or something, I'll pretty much remember where certain bits were, so from those pictures and diagrams I'd remember where they were… Visualise my thoughts and kind of link things together the way I have done during revision.

Adult nursing group/04 explained how they saw the mnemonic as a picture in their head when recalling the parts of the O_2 FLUID mnemonic for their examination or during placement. They described seeing the Powerpoint slide in their mind from a lecture they had on sepsis and how seeing that picture acted as a memory recall mechanism. Using pictures and diagrams for revision was an important learning tool for adult nursing group/13, who used these to represent and visualise the large chunks of text they had read surrounding sepsis.

Compartments, boxes, and headings

Child nursing group/07

If I visualise it or if I put it into different boxes and then, when I'm in the exam, I just think about the different boxes in my head and instead of just writing lists or writing paragraphs, if things are visual then I can remember it. I like different colours as well, 'cos I find it's easy if you can compartmentalise it. So instead of putting it all in the same sepsis box, you put it in the fluid box, the oxygen

box and the drugs box and then you break everything down. Then I guess the mnemonic is the O_2 FLUID that helps you recall all the information from each box that way you remember them.

Adult nursing group/04

I need to almost visualize it in my mind, so I think the O_2 FLUID we were given, it was like a PowerPoint slide; it's got O_2 FLUID written on it, so that each box is marked exactly.

Mental health nursing group/08

You always have a kind of a heading and that's how I visualise it; there's a lot of information, a lot of text under that heading and that heading then goes together with other headings.

Adult nursing group/13

I found it really helpful but I made a diagram out of it 'cos I'm a more visual kind of learner, so I'd set it out with O_2 FLUID across the top and then made little pictures and notes underneath each of them.

Participants child branch /07 and adult nursing group/04 communicated that an important approach to how they used the mnemonic was to place the information in boxes in their mind, breaking the information down into chunks. GT 27/07 said they would have a box for each component part of the O_2 FLUID mnemonic and the corresponding information would go in the box. They would then see each box in their mind and be able to recall the box with the information inside of it. They described themselves as a visual learner, stating that using this approach helped their learning style. They further discussed

how this approach to using the mnemonic enabled them to be able to manipulate large chunks of the requited information deemed necessary for their examinations and practice. A similar approach was used by mental health nursing group/08 to aid their learning and revision; they used separate headings for the information associated with the mnemonic, grouping headings together to make connections. Adult nursing group/13 drew the stages of the mnemonic, stating that this helped reinforce their understanding of the information that went with it. Later, when required to recall the information they saw the picture they had drawn.

The Senses

Adult nursing group/17

I think it's because I've seen it in practice so it's almost like a recall, a visual recall… I can remember the bay, the nurse, the light coming in the window; it is visual recall the way I've seen it.

Mental health nursing group/08

Like, the one I'm thinking about is basic life support and the way I remember it is doctor ABC, so you know visually seeing a doctor and it's broken down into doctor ABC and again it's just two chunks. I can smell the kind of the cleaning wipes, you know, the alcohol wipes that are used, and I think about the gloves and stuff so it's kinda trying to mould into one thing that helps me remember.

Adult nursing group/17 stated that what they found most effective and had the most impact on their recall of the mnemonic was that they had cared for a

patient with sepsis prior to their OSCE. So, when recalling the mnemonic, they saw a visual memory of the room and the patient. They recounted this in vivid detail including remembering the light coming through the window and the patient's hairstyle. They described how this actual memory combines with their recall of sepsis and the O_2 FLUID mnemonic.

The Word

Adult nursing group/16

I do quite a lot of name association and see if I can link it that way and then try to visualise an image of that, and that stays.

Adult nursing group/15

It's a real word and not just a jumble of letters… Simple and effective is probably the best way.

Mental health nursing group/08

Yeah, I think it actually visually I'm seeing it as a word and how it helped me is, I've had a diagnosis of dyslexia, so part of my dyslexia is accessing information that is memory-based, especially in the short-term memory.

All of these participants defined how they associated the word with their retrieval of memories and information associated with sepsis and the O_2 FLUID mnemonic. Adult nursing group/16 stated that they use name association as a learning approach, assigning a name to each component part of the mnemonic. They described how it was the word they saw in their mind,

which then acted as a recall mechanism when they needed to access the information. Adult nursing group/15 spoke of the fact that the mnemonics were real words and made sense; they said that if they had been random letters, they would not have been so easy to commit to memory. Mental health nursing group/08 described that visually seeing a word helps them remember; they spoke of how this approach helps support their learning style and also supports their approach to managing their dyslexia.

5.10.3.2 Seeing visual prompts in practice

Sepsis posters

Mental health nursing group/04

I probably have to be quite honest; I don't know if they were specifically O_2 FLUID posters, I think they were just the sepsis six ones, not that I can recall unless it was subliminal but it's almost as if I see the posters now and I don't [know] if it says sepsis six; I kinda go: I don't really need that. I kind of know the sepsis six if that makes sense. It might be a bit presumptuous, but you do go: I'm happy with the mnemonic and that does assist me with the remembering what they are.

Adult nursing group/15

You can tell being in practice, there's been a massive push towards understanding sepsis a lot more and the early recognition of deterioration, it's new rating so yeah, O_2 FLUID is quite a nice thing to come along with that. Probably the taught component to be fair, 'cos I think it should be more

noticeable in hospitals about the sepsis six. It's from the taught component because you understand it from being taught and hearing about it from the lectures.

Adult nursing group/17

I think there were a few, just on certain wards, like where the highest chances of it appearing… but I still think that visual aids are the best; it's just whether you pay attention to them when you're so busy on the ward, that's the thing. Yes, I've seen a big poster in generally the nurses' station, though I think it is more for the students; I think nurses now have got it ingrained in their mind, I think it's more for the students and also certain mentors. I know people say the simplest thing is better than the most elaborate, brightly coloured things but I think that sometimes you've got to remember that it's best to have it bold.

Mental health nursing group/08

No, I haven't had any experience of that; I haven't seen any sepsis posters in the Trust, however I have seen quite a lot of it on the internet.

All the above participants, with the exception of mental health nursing group/08, had seen posters in relation to sepsis and had had exposure to these within the clinical setting (their placement). Mental health nursing group/04 spoke of their lack of clarity surrounding whether the poster was for the sepsis six or O_2 FLUID, saying that they felt they did not pay much attention to these posters, as they had the knowledge now surrounding the sepsis mnemonic. Adult nursing group/15 felt that although they had seen sepsis posters while on placement, their main exposure to the information was at

university. For them, it was the taught element of their programme, which had delivered more exposure to the concept and importance of sepsis, rather than seeing visual prompts on placement. Adult nursing group/17 had seen some posters on placement but felt that these were mostly in clinical areas were sepsis would be more prevalent. They explained that nurses and students might not pay attention to these posters, depending on how busy they were. However, they did acknowledge that visual representation is one way they learn and that using bold letters rather than colours helps them remember. Mental health nursing group/08 described how they had not seen any posters in the Trust or on placement. However, they were aware of many from searching the internet for online information as part of their exam revision.

5.10.3.3 Structuring the mnemonic(s)

Visual structuring

Adult nursing group/13

I think the O_2 FLUID is good because that was like the clear and kinda bold bit at the top and like I said, it means you don't miss anything out. You've got a structure like SBAR as well; that's really handy, if you panic, it calms you down 'cos it gives you the structure to think and it means you don't miss anything.

Adult nursing group/04

It's how I remember things and especially things like that are quite detailed and I need to almost visualize it in my mind so I think the O_2 FLUID we were

given, it was like a PowerPoint slide; it's got O_2 FLUID written on it, so that each box is marked exactly.

Adult nursing group/13 spoke of the bold writing associated with the first letters of the mnemonics O_2 FLUID and SBAR; they spoke of how this provided them with a visual prompt within the structure of the mnemonic. This enabled the participant sequentially to work through each part of the mnemonics during recall, associating the details with each one. Adult nursing group/04 described how letters were placed in boxes, helping memorise the shape of the box as well as the information within it.

Structure in-action Memories

Adult nursing group/16

It just helps with where I'm at in my brain; make it logical like one, two, three, four, five, six. You tick it off; it's like, tick it off on your fingers or whatever. It's quite helpful, so that would be helpful for me.

Mental health nursing group/08

O_2 FLUID and then I know O is oxygen, which takes me to my subheading and then my subheading memory then takes me to that memory of information. It just helps me access into the deeper parts of my memory.

Both participants spoke of the action of recalling or retrieving memories associated with the mnemonic. What aided their learning of the mnemonic was associating the number of letters, for example in O_2 FLUID, there are six

letters. They spoke of physically counting these in their brain or on their fingers as they recalled each letter and component part of the mnemonic. Mental health nursing group/08 spoke of retrieving 'subheadings', which were the words and details associated with the clinical details of the O_2 FLUID mnemonic. For example, Fluid would be a subheading, then the amount and details of fluid to be given in another subheading in their deeper memories.

5.10.4 Summary of findings - Theme 3

Participants discussed "seeing in pictures", visualising the letters and words associated with mnemonics, particularly the O_2 FLUID mnemonic, which is mentioned in the quotes repeatedly. Many participants spoke of being visual learners; they had defined this as their learning style and many had strong associations with this style of learning. Participants spoke of the process of compartmentalising key sepsis information associated with the O_2 FLUID mnemonic by placing the letter associated with each word of the mnemonic into a "memory box", which was later used to retrieve key information. The role of the senses resonates for some participants, as these were used to visualise retrieval; the smell of alcohol wipes or the light within the ward environment acting as a memory hook. Participants associated the mnemonic with those "sense" memories. Visual word associations also facilitate learning and mnemonic use, with participants assigning words when committing information to memory. Sepsis poster exposure within placement had less of an impact for some participants; their attention to these posters and the subsequent impact on learning and recall appear to be minimal. Some participants were aware of these but described how they now rely on the O_2 FLUID mnemonic and their clinical experiences to reinforce their future learning. Visual structuring and the

importance of the words of the mnemonics being in bold type appears to be significant, as participants spoke of how they highlight these words in their mind when committing to memory and when retrieving the mnemonic. In-action memories triggered a physical process of participants using their fingers, for example when retrieving the O_2 FLUID mnemonic, counting out each word to ensure that none were missed.

5.11 Summary of qualitative findings

The analysis and quotes presented suggest that overall, the findings represent a sample of students who value mnemonics for their usefulness to their own learning and their significance and application in the clinical practice setting. However, this value and application does not extend to the ROME mnemonic; participants mention this less frequently and less favourably. Participant learning styles and their impact on current and future professional development suggest that the use of mnemonics has played a significant part in their learning, as this was limited prior to the commencement of their nursing programme. The quotes presented highlight experiences of both using and reflecting on the use of mnemonics during nurse training. There is minimal evidence from the interviews of prior use of mnemonics. However, the two participants that did mention using mnemonics prior to their nurse training were both from a military background and had exposure to using these favourably in that setting.

5.12 Summary of quantitative and qualitative findings

The combined findings from the quantitative SPSS data and statistical tests, and from the qualitative semi-structured interviews reveals a picture of how students appear to be using the O_2 FLUID mnemonic to facilitate their learning and retrieval during examination conditions. They do not score highly for the ROME mnemonic at all stages of data collection. During the interviews, students discussed how they value mnemonics as a learning tool, in particular the O_2 FLUID mnemonic. They also described different learning styles, from auditory, visual and olfactory memories.

5.13 Chapter Summary

This chapter has presented the quantitative and qualitative data. It can be gleaned from the quantitative data that students appear to be using the O_2 FLUID mnemonic to aid retrieval during examinations, whereas the ROME mnemonic scores considerably lower across the three phases of data collection. Hierarchical clustering analysis has indicated that there are connected factors that have clustered within the whole participant group. The qualitative themes that emerged from the semi structured interviews formed three distinct themes: prior mnemonic use, significance of mnemonics and visual learning. With numerous categories within each theme. The next chapter will discuss the significance of the findings in the context of addressing this study`s research questions.

CHAPTER 6 DISCUSSION

6.1 Introduction

The preceding chapter presented the study's the quantitative and qualitative findings. Following the strict methodological design of a mixed methods study, the explanatory sequential design collected quantitative data then analysed this to inform the next stage the qualitative interviews. Cresswell and Plano Clark (2011) describe that the mixing occurs when the two strands of analysis are brought together using an interactive strategy of merging, through combined analysis facilitating comparisons and interpretations. The point of interface for this mixed methods study design will always be in the writing of the results narrative (Morse and Niehaus, 2009). This chapter will discuss the meaning of the findings in relation to previous literature in the field and will address the research questions, using the key themes that emerged as a chapter structure. The aim of this study was to explain the factors that support the retrieval of clinical information using mnemonics.

6.2 Learning to pass exams or learning for life

6. To what extent do students use a mnemonic to structure their answer when communicating the management of sepsis during the communication station of a clinical examination? (Quantitative Strand).
7. To what degree does the structured approach of using a mnemonic decay over time? (Quantitative Strand)

Both of these questions above indicate key objectives for this research. Chapter two discussed how students use educational techniques primarily to

pass examinations. Indeed, they use mnemonics as a tool to achieve this and to enhance their learning and memory. Criticism of mnemonics as a tool have echoed their associations with superficial and rote learning. Functionalist literature from educational psychology indicates that recall remains high long after the requirement to succeed at examination is over. The research questions above were concerned with the extent to which students use a mnemonic to structure their answer when communicating the management of sepsis during the OSCE examination. From a philosophical perspective, this concept of "what works" for students, that is, using the O_2 FLUID mnemonic to pass examinations is one aspect of how student nurses are using the mnemonic to benefit their own learning. The lens of pragmatism has offered a unique view of capturing what occurs with mnemonics from an educational perspective but also a practice perspective. Using a mixed methods approach to this study has afforded a deeper understanding of how leaners are using the mnemonic to pass an examination of both personal, professional perceived importance. With the semi-structured interview approach, providing answers as to how this extends beyond the classroom setting in a clinical setting. With the findings of this study highlighting the nature of reality as created by learners.

6.2.1 Recognising sepsis

The overall scores for knowledge, using the OSCE scoring tool, encompassed information regarding sepsis management, as conveyed in the O_2 FLUID and ROME mnemonics. The scores of the adult, mental health and child groups combined reveal that the scores are different depending on which phase or

time point data was captured. Overall, the knowledge surrounding the retention of clinical management of sepsis/ scores are at their highest at the OSCE exam, lower at pre-OSCE, and drop to half of the OSCE score 12 months post-OSCE examination. This is interesting in terms of retention of overall knowledge and appears to support the literature surrounding retrieval rates of information by learners reducing over time (Cowan and AuBuchon, 2008). However, regarding the recognition of sepsis, the scores are relatively consistent with only a slight drop post-OSCE for average scores equalling 50% of the possible maximum score. In clinical content this could be questioned in terms of the value of mnemonics. However, the scores for the words associated with the O_2 FLUID are consistency high across all three phases of data collection. It could be argued that in a clinical context the mnemonic acts as a "trigger" or memory hook to alert the clinician to seek out other forms of information to manage the clinical sepsis situation, for example sepsis care bundles clinical pathways.

One of the questions of the OSCE scoring tool required answers surrounding changes in the patient's physiological parameters. The data indicates that there are no issues with students recalling information surrounding how to recognise sepsis and suggests they not only used this to pass their OSCE examination but were also able to recall it outside of the examination setting. This supports the theory concerning the significance of events to memory and selective attention (Cherry, 1953; Broadbent, 1954), and the depth of long-term memory on an individual (Chase and Ericsson, 1982). The data related to frequency level across all three phases indicates the "primacy of memory

effect" in that the frequency for scoring 6/6 was highest pre-OSCE than at any other phase. This is consistent with immediacy of information being encoded and stored but utilised for immediate retrieval (Ebbinghaus, 1885 in Thorne and Henley (2005); Waugh and Norman, 1965). Although there is a drop in average scores over time when looking at the data using the average scores. Interestingly, the scores for higher levels of retrieval for pre-OSCE are 4/6. As achieving an average score of 4/6 drops by 10% on average for the entire cohort 12 months post-OSCE. Indicating an effective level of recognition of sepsis with scores matching the "primacy of memory effect" 12 months after students have been exposed to the initial information surrounding sepsis recognition.

6.2.2 Knowledge intervention – the sepsis six

The examination scenario is based on identifying a patient with sepsis, then organising an initial response to the management of the patient based on the O_2 FLUID mnemonic – one of several mnemonics based on the sepsis six care bundles. During the examination, the nursing students were required to respond to the question: what are the likely medical/nursing interventions in the next 30 minutes to 1 hour. This was a viva voce element of a multi-station integrated OSCE, which also included recognising a problem, recording vital observations, recording an early warning score, reporting using an SBAR handover and creating a clinical record.

The results indicate that when looking at maximum scores for all three branches, a similar picture to that of the overall cohort score is consistent. The

scores were 7/18 pre-OSCE, 9/18 at OSCE examination and 5/18, twelve months post-OSCE. This is comparable when looking at cohort scores overall but the overview data by branch gives a picture of the group as a cohort of adult, mental health and child branch nursing students. The first letter usage scores for the O_2 FLUID mnemonic shows that the cohort average was highest at OSCE examination. When comparing data across the three branches, the data reveals more detail. Adult nursing students score the highest at OSCE, then mental health then the child branch. Maximum scores of 6/6 were achieved at OSCE for using the first letter of the mnemonic, but this dropped by over half 12 months post-OSCE examination. This is in direct contrast to what would be expected of results using an acronym mnemonic (SBAR, 2013, Gibney et al., 2017).

Given the use of acronym-based mnemonics, it could be anticipated that the scores for the first letter of the mnemonic would be comparable 12 months later, compared to the OSCE examination. The findings for the word recall scores for the O_2 FLUID mnemonic indicate that the adult nursing student group scored highest on average at post-OSCE; the mental health group scored highest pre-OSCE and the child group scored highest at OSCE examination. These results suggest that adult nursing students' scores are higher after their placement experience, when they may have encountered caring for patients with suspected or actual sepsis. Mental health student results appear to reflect a primacy effect of memory, explaining their higher scoring pre-OSCE, immediately after being taught the mnemonic. The child branch results appear to conform to the expectation surrounding retrieval and

memory for the purpose of examinations. While the results are marginally different at each stage, interestingly, they are almost similar at each phase of data collection, showing little retrieval and decay of the word associated with the O_2 FLUID mnemonic. This finding is of significance in relation to the overall aim of my study. Having used a philosophical framework as postulated by Dewey, pragmatism has enabled a further challenge to the critical discourse in the educational literature surrounding mnemonic use and the value of memory devices beyond superficial surface learning. Many participants spoke of their value of mnemonics beyond using these solely to pass and succeed at their OSCE examination. These devices were perceived as integral to learner`s development and of perceived importance in their socialisation into the nursing profession.

However, when we explore the recall of the details of medical and nursing interventions associated with this mnemonic, the findings indicate a consistent picture, with the highest average scores for all three branches being at the OSCE examination phase of data collection. This suggests that overall, assessment appears to be driving the use of the O_2 FLUID mnemonic. The stages of data collection at pre-OSCE could be considered a developmental opportunity, as students were given feedback after the data had been collected in terms of information verbalised and information omitted in relation to key sepsis (O_2 FLUID) and blood gas information (ROME). In addition, students were also provided with OSCE preparation sessions by the module teaching team, prior to their summative OSCE examination. It could be suggested that the formative assessment of the pre-OSCE walkthrough is beneficial in aiding

students' initial recall and engagement in the memory task. This demonstrates developmental formative assessment principles and thoughtful improvement, rather than getting it right first time (Clarke, 2001). The pre-OSCE may also act as a precursor for the memory task of summative assessment; Sambell, McDowell and Montgmery (2013) define assessment for learning as a process, which helps students understand what they need to do next in order to improve. Fundamental key principles support formative assessment, and authentic assessment principles, which the OSCE approach in the learning and teaching strategy for the module upholds.

Higher levels of retrieval across all branches are evident at OSCE examination, albeit with differences in the adult group post-OSCE for the first letter recall. All branches combined showed higher average scores for word recall of the mnemonic rather than first letter or detail recall. When considering the concept of assessment literacy, this reflects that students appear to understand the importance of the summative OSCE examination, using the O_2 FLUID to pass the exam. Price et al. (2012) observe that enabling students to understand the assessment criteria and supporting them to achieve this can enhance their formative development, ergo their assessment literacy. The qualitative interviews indicated that students place a great deal of importance on learning in preparation for their summative OSCE assessment. In addition, learning using the mnemonic appears to be driven by the notion that sepsis is an important clinical and life-threatening condition, and there is a need to act in accordance with patient safety concerns as well as aspirations to professional nursing practice by the student nurses.

6.2.3 Word length retrieved - details forgotten

The word length of the details associated with the mnemonic being tested may also be factor affecting retrieval of the information associated with the mnemonic in question. As Miller (1956) initially proposed, the magic number seven plus or minus two is the number of slots or chunks of information that can be held in working memory. This view was challenged by Baddley, Thompson and Buchanan (1975), who found that short words had much higher recall than longer words in a list, leading to them theorising the impact of a word-length effect. The associations between short-term memory and a time limit rather than an amount limit was proposed. They found that individuals could remember about as much as they could repeat in two seconds, and that this needed to be refreshed in covert verbal rehearsal. The notion of challenge to Miller's "magic number" theorem (1956) was countered by the conclusion that limitations in recall were not a magic number but rather a "magic spell" or time period (Schweickert and Boruff, 1986). Many studies have focused on the effects of time on immediate memory and decay (Broadbent, 1958; Brown, 1958; Peterson and Peterson 1959; Baddley 1986).

The pre-OSCE recall phase for the first letter is low across all groups, with an average of less than one point, the average associated with the O_2 FLUID is (4/6) and recall of the details associated with the mnemonic is 2/6 at Pre-OSCE, 4/6 at OSCE and 1/6 post-OSCE. It may be that the word length of the details associated with the O_2 FLUID mnemonic proved challenging for students to recall at each stage, as the word length and sequence is considerable when comparing recalling the word 'oxygen' with the words 'via

a non-rebreather face mask set at 15 litres a minute'. There may also be an element of decay in long-term memory of some of the information encompassed in the mnemonic. As the scores indicate, there are three distinct parts to the mnemonic; the first letter, the word and the details associated with the O_2 FLUID acronym. Average scores demonstrated high levels of retrieval of the words of the mnemonic (oxygen, fluid, urine analysis, infection screen and drugs) across all three stages of data collection, compared with the other parts of the mnemonic, that is, the first letter and details. Although there is debate among psychologists as to time and word length, and reconciling these factors when concerning short-term memory. Cowan (2005) postulates it is incontrovertible that word length is a significant and constant factor, when information is committed to short-term memory. However, the word would be enough to initiate treatment, as the O_2 FLUID mnemonic would act as a memory hook in clinical practice and should be sufficient for staff to access information about the practical management of the clinical condition. As the literature reviewed in chapter two indicates, decay of memory is an integral part of memory per se, in that some form of decay will occur over time. However, due to this study`s design in has been possible to view the quantitative data in more holistic, real world context. The metaphysical associations participants spoke of during the interviews, would not have been ascertained if quantitative methods were used to collect data. As the OSCE conditions were controlled to ensure parity of assessment. However, by using a more pragmatic approach to research methodology. Participants have revealed how they used the O_2 FLUID mnemonic to create a reality in which the mnemonic device has a physical presence in their world, their mind`s eye

and that this extends beyond the OSCE examination environment. This is in direct contrast to a superficial view of the value of mnemonics in education and nurse education being of rote value. Higbee (2001) view of mnemonics being used to aid recall and never higher order thinking. This could be contextualised to the group of learners in my study, in that student nurses by using mnemonics such as O_2 FLUID could free up memory and reduce their cognitive load as theorised by (Sweller, 1988) by chunking information (Miller, 1956). Thus, enabling them to be more receptive in the clinical environment to focus their attention to patient safety messaging and increase their situational awareness (Flin, O'Connor and Crichton (2008).

6.2.4 Nature of the mnemonic used in the OSCE examinations

In relation to the O_2 FLUID mnemonic, the qualitative data indicates that students are using this mnemonic in its acronym form, with each letter representing a word, for example, O = oxygen F = Fluid and so forth. However, in the semi-structured interviews, students spoke of knowing there were six items or processes associated with the O_2 FLUID mnemonic and that these related to the sepsis six care bundles. Some students described counting the number of items to be recalled using this mnemonic, by physically counting on their fingers during the OSCE examination. Some also spoke of seeing the number of items to be recalled as six separate items "in their heads", when needing to recall the information on clinical placement. It could be argued that some students appear to be using multi-modal approaches (Fleming and Mills, 1992) to mnemonic techniques in the classroom setting and while on placement. It could be proposed that, as students created mental associations

between two objects in a one-to-one fashion that will later be applied to to-be-remembered information, they are using a PEG mnemonic technique.

Students interviewed spoke of assigning a physical item to each item to be recalled, for example, they assigned an oxygen mask set at 15 litres per minute for the O_2 component of the sepsis mnemonic. However, when looking at the quantitative data in isolation, the mean scoring of the OSCE does not support such a conclusion, as the first letter scores are consistently low pre-OSCE, during the OSCE and post-OSCE. It was not until the analysis of the qualitative interviews that a possible rationale for this was highlighted. Here, students described using a counting method as the PEG. Rather than overtly verbalising this during the phases of quantitative data collection, so this may explain why it was not seen during the scoring of the OSCE at each of the three stages. Therefore not scored by using the scoring tool, Verbal counting occurred non-verbally ("within the mind") of the learner as the information of the mnemonic is retrieved from long-term memory storage.

6.2.5 Other mnemonics tested - ROME

The findings concerning the use of the ROME mnemonic are in direct contrast to the O_2 FLUID quantitative data scores. The ROME mnemonic scores across all three branches were higher pre-OSCE for both adult and child branch students, whereas the mental health students scored the lowest. OSCE scores for all three branches, when questioned about the ROME mnemonic, were higher at OSCE examination and the sequencing of using the mnemonic was poor, along with the first letter usage. As the ROME mnemonic was not required as part of the summative assessment of the module, it could be

argued that it did not necessitate the same selective attention as the O_2 FLUID mnemonic. Therefore, in relation to the ROME mnemonic, the quantitative data indicates that summative assessment is not driving retrieval when compared to the O_2 FLUID mnemonic.

The qualitative data from the interviews reveals that student nurses felt the ROME mnemonic did not resonate as much as O_2 FLUID mnemonic even though they had been taught it at university. Some students recalled not understanding it, seeing little clinical value of blood gases until qualified, and they had little or no clinical exposure to blood gases unless their clinical placement was in a medical or children's ward.

6.3 Semantic language or semantic memory

3. What factors do students perceive as being important influences in the use of mnemonics in their learning? (Qualitative Strand).

The semantic language and clinical significance to students of the word sepsis, the acronym O_2 FLUID and the sepsis six, appears to resonate long beyond completion of the summative OSCE examination. The findings in this study indicate that retrieval of the O_2 FLUID mnemonic, used in its entirety, drops by over half 12 months post-OSCE. Having said that, knowledge and recognition of sepsis is as high as at the OSCE stage of assessment, while students are on placement, and at one-year post-OSCE. The NMC (2018b) supports that the purpose of clinical placements is to consolidate learning in nurse training and that exposure to clinical conditions reduces the theory/practice gap.

Students with a medical, surgical or paediatric placement have higher OSCE scores than those who do not. However, this does not account for mental health nursing students who achieved high scores during the OSCE, but who may not have been exposed to as many clinical situations surrounding sepsis as the adult or child branch students. The significance of the word ‘sepsis’ may have an equal impact factor to the auditory reinforcement students discussed during interviews. Students spoke of how the sound of the word sepsis triggered memories of taught content on their nursing programme or the sound of a previous patient’s voice. It could be argued that these learners may be auditory learners, with a strong preference for learning by this method. Fleming and Mills (1992) state that auditory learners adopt listening and speaking strategies in learning environments. However, the qualitative data suggests that the auditory sound of the word may act as a memory trigger. Visual strategies employed by the learner may also be beneficial; viewing concepts as pictures or objects in the mind (Fleming and Mills, 1992). Rather than targeting instruction to the "right" learning style, students appear to benefit most from mixed-mode presentations, for instance using both auditory and visual techniques for all students, as there is no one fixed style (Coffield et al., 2004). Many students spoke of using both visual and auditory cues to retrieve sepsis information. Although learning styles do not describe what people are like, they describe what people do when they are trying to learn. Weller’s (2010) critique of learning styles presents that effective learners adopt the appropriate style for the task and that styles are not fixed but are instead fluid.

6.3.1 Significance of episodic memories and mnemonics

Tulving (1972) discusses that episodic memory is one of two components of declarative (or explicit) and semantic memory. In episodic memory, events related to time, place or associated emotions are recalled; details such as whom, where and when. This enables a virtual “time travelling” ability of the person recalling the memoires to retrace the experience from their unique perspective (Schacter, Gilbert and Wegner, 2009). In interviews, students spoke of seeing pictures “in their heads” during their revision and said that this helped them retrieved information for the summative examination. Beyond this, they also saw visual information in their “mind’s eye”, describing the O_2 FLUID mnemonic in terms of each letter or words connecting with a memorable colour associated with danger. It could be argued that these students were retrieving long-term memories stored in their episodic memory. As they spoke of their OSCE or placement experiences in the clinical hospital or community environment, students described how they were using these memories as a hook to recall information, with “seeing in pictures” aiding this process to retrieve key information on sepsis. The visual cues associated with the structure of the mnemonic allowed them to recall the clinical detail in the treatment and management associated with the sepsis six mnemonic.

6.3.2 Interconnectedness of semantics

Students in this study appeared to use the sound of the mnemonic as a memory hook to pass their OSCE examination. However, they also used mnemonic strategies to retrieve vital clinical information while on placement, with the sound of the word ‘sepsis’ or clinical patient parameters triggering sepsis recall in their mind. The qualitative interview analysis categories define

mnemonic use on placement and the quotes from students highlight how students are “tuned into sepsis” as an important word in their nurse training vocabulary. It could be argued that the value placed on the meaning of the word is derived by the desire to pass examinations and motivates learning and performance goals (Organisation for Economic Cooperation and Development (OCED), 2010). The word ‘sepsis’ might previously have been ‘just another condition’ but the word itself has been elevated in importance through public health campaigns and visuals (posters) etc. that have become embedded in practitioners’ consciousness - So the word has more potency when people recall it. This is the semantic processing of concepts not associated with experiences; it is the factual information gathered and stored in semantic memory. It could be argued that the ROME mnemonic is of less interest to the students in this study because of the perceived importance of being able to interpret blood gases and acid-based balance. As a result of the reduced importance placed on this knowledge from a practice point of view it is suggested that students did not undertake semantic processing of associated information thereby reducing recall.

Normal processing responses would expect rehearsal to be phonological (Baddeley, 1986), or in serial based on the order in which the items in the list (O_2 FLUID) are presented. Reid et al. (1961) studied semantic categories and names; when presenting a category, participants recalled the preceding words from the cued category. For example, when hearing the word “city”, the correct response was to repeat the cities Berlin and Moscow. Reid conceptualised that when the mean or average storage load was the number of items

presented but not yet recalled – for example when city was presented the storage load was five – after recall, the storage load was reduced to three because Berlin and Moscow had been recalled. Similarly, students may be using semantic cues to retrieve vital clinical information in relation to the O_2 FLUID mnemonic; the quantitative average scores are high for the words 'oxygen' and 'fluid' as these encompass the mnemonic, although the scores for the first letter retrieval are low. Scores for the words associated with the O_2 FLUID mnemonic are high during the OSCE examination but are even higher 12 months post-OSCE for the adult branch compared with the other two branches. It could be argued that since adult branch nurses are more likely to be exposed to sepsis in the clinical environment compared with mental health or child branch nurses, their semantic cue may be more sensitive. As students were provided with, the O_2 FLUID and ROME mnemonics by academic staff prior to any summative testing, those students knew that the meaning of the words associated with the mnemonics were to be tested. This supports the premise that semantic cues, that reinforce the importance of key sepsis treatment and management stages, would focus attention (Cowan, 2005), rather than the traditional assumption that attention is focused by the phonological sound of the word, which may instead just aid recall; a rote response rather than understanding using a semantic cue system. The quantitative data presents that the low scores for the first word of the O_2 FLUID mnemonic may indicate that students are not verbalising this during the OSCE examination. However, auditory reinforcement may be occurring covertly rather than overtly.

It could be argued that a structured method of aiding memory, that also aids understanding of the information to be recalled, is a valued learning technique in nurse education. Initially, learners may be expected to use this technique to pass examinations but a more valued practical application could be argued for where students use a spoken mnemonic phrase, for example, O_2 then FLUID, then recall the treatment items associated with this. Perhaps the overt recall of the words O_2 and Fluid acted as a memory hook but also allowed learners to reduce cognitive load, as two of the six words to be retrieved had already been achieved.

6.3.3 Sepsis mind palace

The concept of a “sepsis mind palace” will be explored here. The concept is reinforced by qualitative data derived from the semi-structured interviews. The idea of creating a hospital environment with the imaginary patient in bed, who is flushed, unwell (septic), surrounded by the nurse and equipment required to treat and manage sepsis (based on the sepsis six care bundle), could support such a method of loci. The method of loci, or journey method, discussed in Chapter 2, is one way in which the memory of learners may be enhanced, although this is generally an uncommon form of mnemonic used by learners (Soler and Ruiz, 1996). In my study, many of the students spoke of creating this memory place, to aid the recall of particularly the O_2 FLUID mnemonic. This approach uses visualisations with the use of spatial memory (Metsämuuronen and Räsänen, 2018). Using familiar environmental information about one's environment to quickly and efficiently recall different information, learners create a “memory place”. The Latin for ‘place’ is ‘loci’,

giving rise to the notion of a method of loci for memory retrieval. However, this relies on visualisation of such environments to enable the spatial memory in which to create the place. If the place could be created for the learner by the use of visual media, it should be possible to create a pre-populated place-based memory for students to the use as their method of loci for sepsis, or a sepsis ‘mind palace’.

Several students spoke of their previous encounters nursing patients who had sepsis, including how they presented clinically and using the sepsis six care bundles and O_2 FLUID mnemonic to treat them. They recalled what the patient looked like, the light levels in the room and the smell of the hand gel as a trigger to recall the O_2 FLUID mnemonic when caring for subsequent patients. However, students who had this experience in clinical practice spoke of relying on the memories of being in class or how they had learnt the mnemonic. From the literature surrounding the method of loci mnemonic technique, it could be argued that many students appear to be using a “journey method” of recall for the O_2 FLUID mnemonic.

It may be clinically beneficial to use this mnemonic technique in contrast to the acronym technique students use to pass their summative OSCE examination. The use of a structured first letter word mnemonic can be inferred from the quantitative OSCE data and from those students who discussed how they were using the acronym (O_2 FLUID) to pass their examinations. However, one of the core qualitative themes is visual learning. Many students spoke of the

significance this had on their learning and how highly they valued seeing the mnemonic or pictures in their memories and when recalling memories.

It could be equally argued that nursing staff are often closer to the patient in terms of direct care and so have more visual memories to draw on. As the background literature has discussed, vital observations are often performed by the least qualified members of staff, who are often student nurses. Therefore, student nurses are pivotal in promptly recognising the signs and symptoms associated with sepsis and patients who may be at risk. The qualitative interviews support where students have challenged doctors by stating, “do you think we need to initiate the sepsis six?” Had they not had exposure to the O_2 FLUID mnemonic and their own sepsis mind palace, the patient outcome in those situations might have been very different.

6.3.4 Reducing cognitive loading

As the O_2 FLUID and ROME mnemonics present information in under seven objects, or “chunks”, this reflects the educational cognitive principles (seven items plus or minus two) of both Miller’s Law (1956) and Baddeley’s theory on working memory (1975a, 1986). Although it has been discussed that Miller’s magic number theory has been reflected in more contemporary thinking such as a “magic spell” (section 5.2.3), reducing both extraneous and internal cognitive loading could be seen as beneficial to improving attention and focus, as discussed in section 2.2.3. The quantitative results indicate that students are required in summative examinations to retain large amounts of information

in relation to the management and treatment of sepsis from a nursing perspective. The qualitative findings indicate key categories supporting the valuing of mnemonics being a key factor in students' retrieval of information. Students noted that the short length of the mnemonic (O_2 FLUID) made a difference to them being able to recall it with ease. In addition, they spoke of recalling the letters of the mnemonic, which enabled the information to come flooding back when they were "on the spot". This notion of being "on the spot" has parallels with the fast-paced clinical environment experienced by nursing students on placement, which many of them spoke of during interviews. Students described when the pace increased and patients were at risk of deteriorating, they needed a way of focusing their attention and offloading other tasks to be able to get on with initiating the sepsis six. From this data, it could be argued that nursing students in my study may be using the mnemonic as a focusing mechanism to aid them in processing extraneous loading such as noise and other environmental distractors, including the 'background noise' of demands placed on their attention by colleagues and patients. Increased cognitive loading may be associated with the need to fulfil caring responsibilities for patients, achieve success on placements, demonstrate team working behaviours and achieving competence in core nursing skills. The two data strands show that although students acknowledge that mnemonics are beneficial to helping them cope with these cognitive demands. While nobody actually articulated the issue in terms of "cognitive load" there is enough data to support the argument that mnemonics helped focus students' attention. The interviews clearly demonstrate their ability to reflect on these

situations but do not provide verbatim evidence of their metacognitive dialogue.

6.3.5 Mnemonic cocktail party effect as a conditioned response

Selective attention and the "cocktail party effect" is discussed in chapter two (Cherry, 1953; Moray 1959; Newman 2005). Newman's work found that infants as young as five months were able to selectively attend to their own name and this appeared to be fully developed by thirteen months. This might be an inherent evolutionary protection mechanism to alert us to danger by focusing on important auditory cues. It may be suggested that symbiosis between visual and auditory stimuli, if processed together, enables more efficient mnemonic encoding. Sub vocal rehearsal of the visual words on the sepsis six poster, coupled with an overlaid voice speaking aloud the O_2 FLUID mnemonic, would ensure dual encoding and storage into the phonological short-term store. Long-term memory storage would be enhanced by "chunking" vital clinical information. As the O_2 FLUID mnemonic is only six "chunks" of information, then acronym mnemonics which are no longer than six chunks would be more effective at encoding, thus enhancing retrieval. As discussed in the literature review, chunks of information in Miller's original work can be considered as more than one word.

The quantitative data captured during the OSCE phase indicate high scores for retrieval of vital sepsis information related to the O_2 FLUID mnemonic data. When triangulating this data with the qualitative interviews, students appear to be selectively "primed", by themselves and their teachers, to associate the

significance of the OSCE with the importance of a summative examination, and the importance of sepsis with high morbidity rates and death. This priming appears to be visual and auditory, as students described how they felt 'tuned' towards sepsis, visually saw posters in the clinical setting, and understood their professional responsibility towards early treatment. However, the behaviourist perspective might suggest that students are being conditioned by the educational exposure to mnemonics and the clinical response is seen in their behaviours. For example, interviewees spoke of the importance of responding quickly when using the sepsis six care bundles and that they associated the O_2 FLUID mnemonic and these care bundles with the need for an urgent response. It may be argued that a conditioned healthcare response is associated with the use of key sepsis information and mnemonic use. Pavlov (1927) defined operant conditioning as a type of associative learning process through which the strength of a behaviour is modified by reinforcement or punishment. A Pavlovian (classically) conditioned response would equate the stimuli of the sepsis mnemonic and OSCE using an operant conditioning approach to the teaching of mnemonics. In this study, nursing students were exposed to mnemonics in the classroom setting, in lectures and seminars on sepsis, using the sepsis six mnemonic and blood gases and the ROME mnemonic. It may be suggested that although not a deliberate approach to teaching, students were conditioned to use the O_2 FLUID and ROME mnemonics as this was reinforced during the teaching sessions and possibly the summative assessment viewed by learners as a reward or punishment concept. However, the fundamental explanation for the difference in higher retrieval rates for the O_2 FLUID mnemonic and lower retrieval rates for the

ROME mnemonic may be due to students viewing failure at the OSCE examination as ‘punishment’ and the risks of this to their progression on the Masters of Nursing programme. The contextual factors of memory and the O_2 FLUID and ROME mnemonics, and the significant differences between their recall have interesting and significant connotations for nurse education. Firstly, many participants stated that having undertaken the learning and theory behind the management of sepsis, then being exposed to this in clinical practice, enhanced their understanding of the mnemonic and understanding of sepsis. Secondly, some participants described the room, lighting and seeing the patient when recalling this event, while others described the sound of the word during practice (rehearsal) for the OSCE examination. This appears to be a significant theme emerging from the data.

Narine and Coverdale (2019) question why visual imagery and meaning promote such elaborative encoding. From a functionalist memory perspective, this may be due to memory systems, like other body systems, being designed to solve adaptive problems; our capacity to remember exists to achieve adaptive ends. Narine and Coverdale (2019) theorise that survival-related or selectively retained information is evolutionarily beneficial. Although there is no evolutionary benefit to student nurses to retain vital sepsis information using mnemonics, when considering the ethical, legal, moral and professional expectations and the associated duty of care, this may explain why the O_2 FLUID mnemonic was selectively retained over the ROME mnemonic. Furthermore, that use may have affected recall, as the adult nurses were exposed to sepsis as a clinical condition more in the clinical area. It could be

argued that this has a great perceived importance and that students in such clinical areas may be “primed” to be more aware and their attentional shift is towards the relevance of the O_2 FLUID mnemonic.

6.3.6 Military use – retrieval under pressure

It is possible to draw parallels from the data in how students perform under pressure. SBAR was conceptualised and used by the United States Navy to aid information handover when time is of the essence and individuals are required to work under pressure. Similarly, students are required to perform under pressure during examinations. Two students spoke of the examination being anxiety-inducing, but OSCEs are known for high-pressure and anxiety responses in learners due to the authentic nature of the assessment method (Traynor and Galanouli, 2015). Three interviewees spoke of their experiences in the military prior to their Masters of Nursing programme. They described how they had found mnemonics useful when working under pressure and equated this to their OSCE examination experience. They stated that it was useful to have something to rely on under examination conditions that they could use to recall the information on sepsis and noted the ease of the mnemonic. A valuable feature to those students was the structure of the mnemonic; both the ROME and O_2 FLUID mnemonics can be considered short in terms of their length. This may be a critical factor in the formulation and application of mnemonics in both military and clinical settings. Indeed, there is an expected behaviour associated with both these professions, when behaving under stressful and time critical situations. For example, when nursing students are on placement, they are expected to behave, demonstrate

knowledge and skill to the level of their nurse training (NMC, 2018a, domain three).

Although the ROME mnemonic is short, retrieval of the related clinical information was low across all participants. The quantitative data shows that recall of the constituent parts of the mnemonic was very low, as students struggled to demonstrate accurate recall of what each letter represented. The qualitative interviews revealed that students could remember 'Respiratory Opposite Metabolic Equal' but admitted they did not know what this meant or how to apply the mnemonic. Only two students mentioned seeing blood gas analysis performed in their clinical area; one student said that "blood gases will make more sense later on in my career". Although both sepsis and blood gas analysis carry a high level of clinical urgency. This does not appear to register with the majority of students interviewed; their importance does, but in terms of working under pressure, more attention is focused towards sepsis as a clinical condition, in which using a mnemonic can be advantageous to both the student and their patient.

6.4 Creative concepts

4 Do students utilise their own or other mnemonics to enhance their own learning outside of an assessment process? (Qualitative Strand)

The hierarchical cluster analysis reveals a clustering of performance scores around having a science-based undergraduate degree compared with having a social sciences undergraduate degree. As stated in the findings chapter,

although the sample had some homogenous characteristics (the Masters of Nursing programme requires applicants to have a science or social science-based degree). The science-based clustering may be due to students having more exposure to mnemonics in their undergraduate degrees, therefore using mnemonics more than other students in the group do. Bafile (2005) describes how mnemonics have been associated with professional groups with a strong science focus, for example the medical profession. Many Masters of Nursing students have an undergraduate degree in a science-based subject, such as biosciences. This may present a dichotomous relationship; do educationalists who teach science-based subjects use mnemonics because their use is associated with science-based subjects, so there is an expectation to use them? (Yousaf, and Chaudhry, 2006). Conversely, is this association due to factors surrounding the requirement to recall factual information rather than creatively constructing new information, for example, in art? Some interviewees did discuss using their own mnemonics, which they had designed. These centred on their experiences in the military and their familiarity with the SBAR structure.

6.5 Mnemonics – the way forward for learners

5 To what extent do students use mnemonics to structure their future learning and professional development? (Qualitative Strand)

Historically, nursing has focused on task-orientated care (Ford and Walsh, 1995). This view has been criticised on the grounds that it objectifies patients into clinical conditions and tasks to be performed upon. Holistic care is now integrated into nurse education and training; viewing the patient as a whole

being, including mind, body and soul, and acknowledging that something is more than a sum of the parts (McMillan, Stanga and Van Sell, 2018). However, when nurses are in a stressful clinical situation, the busy nature of the job may mean nurses follow procedures mechanistically without thinking about what is being done and why (Ford and Walsh, 1995). Emphasising the importance of structure over task can be one way of ensuring holistic, evidence informed care is delivered in a timely manner, in situations that demand swift clinical decision making and prompt treatment. A key component of a mnemonic is structure. This is particularly important in nurse education, due to the time-dependent clinical context (Koksal et al., 2013). One of the qualitative interview categories is the structure of mnemonics; participants found the structure aided them to undertake a task. Many said that having the mnemonic structure not only made them feel more confident in clinical practice but also helped them ensure they were not missing anything when caring for their patients. The value of structure to students in this study appear to be linked not only with achieving success in the summative OSCE but also in aiding students' future professional learning and development. The O_2 FLUID mnemonic was valued more by the student nurses, as they felt this had a more logical structure and many students had experience of the associations between sepsis, the sepsis six care bundles and the O_2 FLUID mnemonic. The quantitative data demonstrates that the OSCE scores varied and although many students achieved a pass, they did not score highly.

Interviewees still valued the mnemonic and its structure. In the twelve months between the OSCE and the post-OSCE data collection, there was some lack

of retrieval of key sepsis information. Ricker et al. (2020) assert that there has been a longstanding debate around working memory, in that all memoires have the potential to be affected by the passage of time. The exact nature of this may be attributed to decay or interference, interference of a distracting task mirroring decay. However, Cowan, Saults and Nugent (1997) assert that the decay in this approach is not occurring at the level of specific memory items, is not caused by the passage of time, and does not occur gradually across a study. The observed performance decay is related to how long an individual stays engaged in the memory task as the retention interval increases. During this research, the retention period was immediately after information was given on mnemonics. Phase one demonstrated a primacy effect of memory; phase two was the OSCE after the students had been on placement.; and phase three was twelve months post- OSCE. However, large numbers of students could still remember information connected with the O_2 FLUID mnemonic more than the ROME mnemonic even at phase three. One possible explanation for this may be connected to the hierarchical clustering analysis, which indicated a cluster around students who had a medical, surgical or paediatric placement prior to their OSCE. Many students spoke of reflecting on their experiences of caring for patients with sepsis, using the O_2 FLUID mnemonic and seeing previous experiences playing out in their “mind`s eye”. Perhaps these factors are keeping the students engaged in the memory task (of treating sepsis more than blood gases). This could explain how the mental health students, who may not be as frequently exposed to sepsis within a clinical setting, still retain vital clinical information using the O_2 FLUID mnemonic. They are still engaged in their mind, so the memory task is still

active; since the sepsis mnemonic is familiar, it will be remembered more compared with students who are not engaged with the memory task, which accounts for the loss of memories for those students who only used it for their OSCE examination.

6.5.1 Other health mnemonics

From the late 1980's to the present, there has been a push in the use of mnemonics in public health messages. As discussed in chapter two, public health campaigns have increased their use of mnemonics, for example, the "Act FAST" television campaign, concerning the recognition and management of a suspected stroke. "Back to Sleep" or "Safer Sleep" campaigns alerted the public to the potential risks associated with cot death. Sepsis six, O_2 FLUID and BUFALO mnemonics all promote treatment and diagnostic interventions associated with sepsis. Proactive early recognition may have to come from other methods of using such mnemonics. Raising consciousness among the nursing workforce is one of the aims of such campaigns; surviving sepsis posters, displaying the sepsis six and think sepsis, are frequently displayed in clinical settings. This exposure has permeated clinical practice and cannot be ignored as a visual factor in this study, as students described seeing posters regarding sepsis while on placement.

6.5.2 Taxonomy of Learning – emotional domains of learning

Many students spoke of the anxiety they felt when undertaking their OSCE examinations. Summative examinations, in particular tests, can often elicit a negative effect on performance in terms of fear, stress or anxiety (MacDonald,

2001). However, for assessments to be meaningful they must be authentic, in that they mirror real word activities (Mueller, 2006). OSCEs are designed to mirror the clinical environment. Their intention is not to make students fearful, anxious or stressed, but to emulate authenticity within a nursing clinical situation and to reflect the emotional demands of clinical practice, which cannot be overlooked in summative examinations. It could be argued that in this context in particular, emotions are linked to learning. The emotional domain of learning – at the earlier stages of learning – could lead to higher rates of recall. Clewett et al. (2017) posit that emotional arousal during encoding enhances memory for high-priority items (goal relevant stimuli) and impairs memory for low-priority items, by modulating the strength of competing mental representations. In their study, this was reported more frequently in women than in male participants. However, the present study cannot make such assertions, since nursing is a predominantly female profession. When considering the goal-relevant stimulus of passing the OSCE examination, the encoding of heightened emotional arousal can be reflected in the quantitative data at different time phases. Comparing this with the interviews, the emotional arousal at encoding can be reflected in the recollections of the experiential learning students present when reflecting on their experiences of using the O_2 FLUID mnemonic in clinical practice. This is generally due to the “human element” of nursing practice, in that the practice setting reflects the potential risks to patients in terms of harm from failure to respond promptly when treating sepsis.

6.5.3 Learning design and mnemonics

In terms of the design of the sessions that prepared students for using the mnemonic, some areas may be enhanced with the use of mnemonics. Both the quantitative and qualitative data strands present information that supports the notion that participants are using mnemonics in different ways to that which was taught to them during their nursing programme. The semi-structured interviews indicate that students are using some guided imagery and a journey method of loci technique without consciously knowing that this is what they are doing. Some students had not had the prior experience of nursing a patient with sepsis to retrieve an emotional or visceral memory. When presented with a patient who may be at risk of sepsis, relied on separate memory hooks, memories of knowledge surrounding sepsis and, the O_2 FLUID mnemonic. Providing students with a mind palace, as discussed in section 5.3.3, would create a virtual environment in the student's mind that they could then use proactively in future clinical and learning situations.

The interactions between a learner and their experiences can be a critical learning catalyst. Piaget's theory of constructivism (1936) argues that people produce knowledge and form meaning based upon their experiences. A central tenet to the theory is that: assimilating causes an individual to incorporate new experiences into the old experiences, with learning occurring as the result of this interaction between learners and their experiences. When the learning has a planned outcome; it becomes a purposeful activity that requires the artistry and skill of a learning designer (Ferrel, Smith and Knight, 2019). It was not possible to find primary research on how mnemonics are taught and how experiential learning may be incorporated into pre-placement

teaching. However, there are studies, discussed in the literature review (Ballard et al. 2011, Blom et al. 2015, Joffe et al. 2013, Gibney et al. 2017, Gleadall et al. 2018, Vogelsang and Besse 2018). That support the use of mnemonics and their application to a specific learning goal – but the pedagogy behind how these are to be used by educators, particularly in higher education and nurse education are lacking. Using a learning design approach can support a creative process that occurs within a wider eco-system of people, processes, systems and places, in which one element is dependent on the others (Ferrel, Smith, and Knight, 2019). This approach has historically been used for online educational resources.

As the technologies available to educators increase, engaging with an iterative process of creating and redesigning programmes, modules and learning activities becomes easier. The way teachers design blended and online courses significantly influences students' engagement, satisfaction and success. Four relatively distinct clusters of learning design exist: constructivist, assessment-driven, balanced-variety, and social constructivist (Institute of Educational Technology (IET), 2019). Making use of learning resources and technology, the concept of a learning design approach rests on the main premise that learning is instructional; learning design is focused on 'what students do' as part of their learning, rather than on 'what teachers do' or on what will be taught (IET, online, 2019). Applying the principles of learning design to mnemonic use, it may be beneficial to look at how learners are taught about sepsis using a mnemonic approach. This concept of instructional design may also provide educators with a template for the teaching of mnemonics

using an interactive and technology-based approaches, underpinned by key pedagogical learning theory, for example, metacognition. Creating learning activities that break information down into manageable “chunks” reflects the concept of chunking (Miller, 1956) this in turn may reduce the cognitive loading (Sweller, 1988) and further extraneous background “cognitive noise” which may improve the encoding and retrieval process. Using instructional learning and teaching materials that incorporate visual, auditory and other cognitive stimuli could augment the natural cognitive processes with short-term memory retention (Baddeley, 1975a).

6.6 Becoming a reflexive researcher

Researchers must remain reflexive, bracketing their own biases in relation to the topic under investigation (Cryer, 2000). The rationale for this is to minimise their own potential undue influence on the research process, for example, on the recruitment and selection of participants, the collection and interpretation of data or the theorising and conclusions drawn from the study. However, achieving this can be challenging and should start with personal reflections on the topic, which should continue during all stages of the research, attempting, as far as is practicable, to ensure the research process is transparent and robust. On reflecting on my own research study however, I have only used mnemonics unidimensionally, not incorporating other dimensions and factors into their teaching, as the extant literature on mnemonics extols the virtue of their application to a generic population of learners, not specifically to student nurses. It was necessary therefore to “bracket” my own views on the topic, by

acknowledge my own bias and to ensure robust research methods were used, that reduced/negated any bias in the study design.

As an educator, my role teaching the group of participants (students) was decoupled from any potential bias from this perspective as I was not part of the module teaching team. There was no duality of role, for example teaching the students and being perceived as their educator and researcher. However, I could have been perceived as an “educator” part of the educational establishment or organisation. Although this issue was never disclosed to me during the interviews or study. Accounting for this was built into the study design during the participant briefing and interviews stating that participant details would be anonymised. Hart (2000) acknowledges the purpose of reflexivity should not solely rest on resolving the multiple paradigms of educational research but rather to focus on what we do, how and why we conduct research in the first instance. To this end reflecting on my own experiences in education, use of mnemonics as an educational tool and clinical management and recognition of sepsis all had the potential to shaped, bias and influence this study. As discussed in Chapter one by acknowledging my own experiences of using mnemonics and the significance they have had within my own development as a clinician and an educator. I have been transparent with the reader of this thesis. In chapter two, I have defined the process of how literature was included or excluded from the study and an audit trail of the decision-making processes (Mesel, 2012). This is so that when following the processes, I undertook and the supporting rationale this is transparent and repeatable providing a more robust process, than just description. Chapters two stating the research questions from the gaps in the

current literature. Interview questions were developed from the analysis of the quantitative strand of the study. The details of this is described in the methodology chapter four.

6.7 The challenge of nurse education and orthodoxy

A critique of the use of mnemonics may draw on the unidimensional perspective that mnemonic devices, as a learning or teaching tool, have a surface learning quality only (Dunlosky, et al, 2013). This was discussed in chapter one. However, it could equally be argued that they can be used multi dimensionally. Historically due to the component parts of the devices, they are only taught in a unidimensional manner, for example, in rote learning and auditory reinforcement of a peg mnemonic. Using other methods to reinforce the mnemonic, such as visuals to accompany a static picture of an acronym, and to enhance visual encoding, has been associated with higher levels of retrieval (Baddeley, 1975a). Furthermore in my study the first letter or acronym mnemonic`s details appear to have high levels of retrieval and during the interviews several participants appear to be using a method of loci to “see” the O2 FLUID mnemonic in their “mind`s eye”. This appears to be in conflict with students not using more complex forms of mnemonics to facilitate their learning (Soler and Ruiz, 1996). Within nurse education, a strong pedagogy has been the role of reflection in both education and clinical practice. This has permeated nursing curricula in the United Kingdom (NMC, 2018b). However, reflection in insolation may yield little in the way of reducing the theory-practice gap. As Dewey (1933) argues: to fully link theory to practice successfully, the process of utilising experience by reflection should be examined, defining

experience. Benner (1984) believes reflection is the refining of preconceived notions and theory through encounters with actual practical situations; these add nuances or shades of difference to theory. Further, the passage of time and experience are not mutually exclusive factors (Benner, 1984). In my study, students reflected on the value of mnemonics in helping them navigate the theory and practice transition while on placement. Adding structure to this transition and consolidation of learning; and enabling them to become more reflective practitioners, both in this research and for their future learning.

Reflection, to be able to draw on experiences for future learning, is without question an important skill (Schon, 1999). 'In the moment' reflections constitute a higher order thinking skill, beneficial to the nursing role. During this thesis journey, there were numerous challenges to the notion of learning using mnemonics and reflection. One example has been the variance of attitudes, knowledge and awareness from academic staff in my workplace towards mnemonics. This has been polarised from a belief that there is nothing original or new to be learnt from mnemonics, to some colleagues being unaware of mnemonics as a teaching device or a learning aid for memory to a superficial "nod" towards their use. The knowledge surrounding mnemonics had been generally poor; colleagues were aware only of acronyms in their visual form being used only for rote learning. One of the main goals of this thesis was to illuminate this area of research further and to add to the body of existing knowledge, for which there is a dearth of contemporary literature surrounding the factors effecting students nurses using mnemonics in relation to vital clinical information. Much of the literature cited in this thesis and indeed

in this chapter is somewhat dated or draws on classical studies in psychology related to memory. This is symptomatic of the view that there is nothing new in the field of mnemonics. Despite this, the NHS across the four nations of the United Kingdom has used mnemonics in campaigns to improve patient safety, safety messaging and to support nurses and other health professionals in care delivery.

This thesis aims to raise awareness of mnemonics among colleagues in nurse education; either through discovery for some colleagues new to mnemonics or rediscovering them based on shared evidence-based practice, rather than customs and practice.

An essential professional expectation of nurses is to demonstrate continuous professional development (NMC, 2018a). This study found that many students valued mnemonics as active learning tools and strategies to develop their future learning and practice. The recent NMC standards for pre-registration nurse education require student nurses to independently diagnose the nursing care required, using current theoretical and clinical knowledge and to plan, organise and implement care when treating patients, based on that knowledge and skills acquired (NMC, 2018b). Furthermore, the need for skills associated with the recognition and rescue of the deteriorating patient is predicted to intensify due to the increasing complexity and age of the acute care adult patient population (Johnstone, Rattray and Myers, 2007). Perkins and Kisiei (2013) assert that it is important that pre-registration education supports student nurses in gaining effective recognition and response skills. The role of

mnemonics to support this in nurse education may need to be reconsidered in terms of their impact as a teaching and learning strategy, and their implementation into nursing curricula. The value of mnemonics educationally and from a practice perspective, suggest that their structure and patient safety message and value beyond their conventional unidimensional use in nursing curricula, highlight an evolving sense of worth which has extended into the wider public consciousness, use and society generally. This has, in part challenged the historical ideology that has conflicted mnemonic “waning” in education, as a rote, surface tool. As the results of my study indicate their value, although this is to a very specific set of learners (student nurses). In this regards any findings could be considered “original” in terms of contribution to nurse education and education surrounding mnemonics.

6.8 Originality of thesis

The generation of new knowledge through the production of a focused thesis should justify the choice of topic and contribute to the body of knowledge in the field. This may be through originality of study design, sample or research questions (Phillips and Pugh, 1998). The thesis focused on mnemonics and the factors associated with the retrieval of clinical information. Originality of thought is considered a key concept for generating new knowledge (Cryer, 2000). The literature surrounding the use of mnemonics in nurse education is limited and has evolved mainly from the use of mnemonics in medical education. The methodological approach of this thesis is original in that a mixed methods approach has been used to ascertain not only the impact on learning from examination scores but also how the students used the

mnemonics to recall information in practice and beyond the assessment. This was explored by observing clinical examinations and considering the significance of mnemonic use in nursing practice, explored through qualitative results. This mixed methods approach is an original design in an under-researched area. The exploration of the key concepts within the thesis has generated new knowledge, providing an original perspective worthy of study at doctoral level (Cryer, 2000). The challenge to the orthodoxy of nurse education also defines the originality of this thesis, in that contemporary educational literature associated with the role of mnemonics in education and nurse education has been associated with an accepted status of surface learning. As there is a plethora of literature surrounding the use of mnemonics in education as a whole, but very little in relation to nurse education in comparison. This thesis asserts that, as a memory “hook” for the retrieval of vital clinical information, this is only one possible dimension of the value of mnemonic use in nurse education. Moreover, the lack of focused studies in nurse education reflects the lack of pedagogy and research interest in mnemonics. The exploration of this within the thesis has ascertained the significance of this to a sample of student nurses. A pragmatic philosophy compliments this stance and has underpinned this thesis, exploring what is known within the taught environment of the classroom (clinical examination) and what is known in the outside world (clinical placement). The synergy of these two “worlds” represents the students’ reality and has contributed to answering the study’s aims and questions. This new knowledge can now be used to formulate recommendations in wider nurse education.

Table 6.1 presents these factors, providing an overview of what has been discovered during the study, synthesising the findings and subsequent discussion.

Table 6.1 Summary of factors that support the retrieval of clinical information

Factor	Details
Prior mnemonics	• Learners who had a military background prior to their nursing programme value and use learning techniques related to this. • Learners who have studied science-based degrees appear to have higher OSCE scores and had more exposure to mnemonics in undergraduate courses.
Significance of mnemonics	• The mnemonic selected by learners and academics has higher retrieval at the examination stage if learners use it for summative assessments. • The mnemonic has great significance with learners if it has “connectedness” through clinical exposure. • The first letter of the mnemonic was not verbalised during the summative examination. Retrieval of the word of the mnemonic has greater recall.
Structure of mnemonics	• Shorter words in acronym mnemonics appear to be favoured, • Learners were only exposed to the mnemonics in two-dimensional form, for example in PowerPoint presentations or in written format on posters or paper.
Visual learning	• Students appear to be retrieving the first letter and the mnemonic through visual recall, which may account for the lack of verbalisation during the examination (OSCE). • Many students appear to be using a method of loci when retrieving vital clinical information on sepsis. • Many students spoke of “seeing in pictures” key information surrounding sepsis treatment and management.
Placements	• Clustering of placements suggests that medical, surgical, and paediatric student nurse placements are linked to higher OSCE scores.

6.9 Limitations of the study

The significance of the underpinning literature discussed in chapter two, surrounding knowledge retrieval and reduction in recall, appears to mirror the quantitative results. Although “performance anxiety” during examination conditions could be considered an extraneous variable, this could not be excluded during data collection due to the nature of the method of summative assessment (OSCE). Testing for this during clinical practice, could be problematic as there may be many factors associated with performance and student assessments in clinical practice, for example competency based assessments, mood (Cheung and Kit-FongAu, 2011) and the hawthorn effect of direct participant observation. However, this was acknowledged during the design of the study, in that data was collected under the same test conditions across all three phases, to ensure consistency. The sample of 47 student nurses was relatively small for the quantitative strand. The results therefore do not yield sufficient power (Bryman, 2004) and cannot be generalised to a wider student nursing population. It was not possible to gather a larger sample, unless multiple sites were used across the United Kingdom, as Master of Nursing programmes normally recruit approximately 50 students per cohort per year. This was not practicable due to the timescale and part-time nature of the research. Furthermore, controlling additional variables at OSCE stage across multiple sites would have been impractical and could have staggered the delivery of any validated nursing programme. Using a purely quantitative approach, such as a randomised controlled trial, would have been problematic, as extraneous variables in clinical practice would have been almost impossible to control, for example, students’ exposure to sepsis posters, or their varying experience outside of the nursing programme, such

as healthcare assistant work. The mixed methods design indicates, rather than scientifically proves, a cause and effect relationship between variables. As with all qualitative research, the results of this study may be transferable to other similar contexts and the study raises suggestions for further research. A further limitation could be that the study participants were postgraduates. This was a deliberate factor in the design of the study, as it was felt that Masters of Nursing students should be more advanced in terms of their critical thinking due to having already studied at degree level.

6.10 Demonstrating trustworthiness - verification

Yardley (2000) discusses the notion of strategies to demonstrate trustworthiness of research rather than a strict set of criteria, due to the dilemmas associated with evaluating exploratory studies and research methods. Table 6.2 details the ways in which trustworthiness has been demonstrated in this research study and highlights any further limitation, to ensure greater transparency (see also section 4.7 – Trustworthiness in qualitative research).

Table 6.2 Mapping trustworthiness within this research study

Strategy	**My research study**		**Met/ Not met**
Credibility (internal validity)	Member checking Tuckett (2005)	Transcriptions sent to participants for sense-check and accuracy.	Met. Chapter 3
	Triangulation	Mixed methods design	Met. Chapter 3,5
Transferability	Use of "thick" description Lincoln and Guba (1985)	Direct quotes from qualitative interviews, verbatim presented in the findings section of this thesis.	Met. Chapter 4
	Purposive Sampling	Information about participants, demographic data, sampling data.	Met Chapter 3
	Context transferability Lincoln and Guba (1989)	The potential for the transferable nature of the new knowledge and findings of the study. Decided by the reader. Context descriptions of background literature, clinical setting, sample	Discerned by the reader. Chapters1-7 Chapters 1-3
Dependability	Audit trail	Step by step description of the methods and methodology used to undertake the study.	Met. Chapter 3
	Limitations of study	Acknowledge and discuss any limitations in study findings.	Met. Chapter 5
Confirmability	Reflexivity	Acknowledge my own views on mnemonics and the bearing this had on undertaking this research study.	Met. Chapters 1 & 5
	Triangulation of themes	Reduce bias of interpreting results by another member of the research team independently coding sample transcripts.	Met. Chapters 3-4

6.11 Further research

Given the small sample size of this study, future research could involve testing the instructional design model using the sepsis six mnemonic as an example of the clinical information to be taught and recalled by undergraduate and postgraduate student nurses. Such a design would need to measure the impact of such an approach, possibly using a quasi-experimental approach. In instructional design, learning tasks would be designed to keep the extraneous cognitive load as low as possible, with the aim being to “offload” information processing to different channels, i.e. the audio or visual channel. For example, narration (audio) of a PowerPoint (visual) presentation. Further studies might explore how practice educators in nursing teach information regarding sepsis post-registration, involving post-qualified nurses.

The teaching of mnemonics and the factors involving clinical information to be recalled may not be exclusive to nursing. Students from many subjects might utilise the multi-dimensional possibilities of mnemonics in their specialist area of study, so the model may be applied or researched in various educational areas, for example engineering, medicine, pharmacology and other areas of the arts and scientific community.

6.12 Chapter Summary

From the Deweyan perspective of “knowledge is currency”, knowledge of theory in isolation may not be enough. This must be applied to reality; what is the truth in relation to the factors surrounding the retrieval of clinical information? This thesis has presented that assessment appears to be driving the use of the O_2 FLUID mnemonic, as scores were consistently higher across all groups during the OSCE examination compared to the ROME mnemonic, which was not summatively assessed. The

quantitative strand could be compared to the classroom, or what Dewey would define as the artificial or laboratory setting. Knowing what factors influence the use of mnemonics in this setting is useful, but only if coupled with how students use this in the “real world” setting. Hence, the ways in which students perceive and use the mnemonic has been revealed through the study`s supporting methodology, particularly augmented by the qualitative strand of the mixed methods approach. The interviews with students on their use of mnemonics in clinical practice has revealed core themes in relation to their significance, value and application to their professional practice and lifelong learning.

CHAPTER 7 CONCLUSION AND RECOMMENDATIONS

7.1 Introduction

The preceding chapters have discussed the literature surrounding mnemonics, the analysis of both the quantitative and qualitative research data, and the discussion arising from this. The purpose of a thesis is to produce new knowledge through originality in thought, application of methodology and collection of data to answer the research questions. The mixed methods approach was novel in this topic area, in answering this study's research questions. As the literature review revealed a dearth of mixed methods studies. This chapter will discuss the conclusion and recommendations arising from the analysis of the discussion.

7.2 Overview of recommendations

There are six main recommendations to enhance the design and application of mnemonics in nurse education and higher education generally. Central to the recommendations arising from this thesis is that by using mnemonics that engage multiple stimuli to recall clinical information, then a "virtual mnemonic" can be created in the learner's mind, thus facilitating a 'memory palace' to aid in the retrieval of vital clinical information, to ultimately recognise, treat and manage sepsis. This chapter will explore the scope of this research in extending beyond conventional applications in nurse education and nursing, and more broadly within healthcare and higher education.

7.3 Main findings

The main findings of this study are summarised here, in terms of the research questions answered. The primary aim was to explain the factors associated with the

retrieval of vital clinical information, chiefly focusing on two mnemonics, O_2 FLUID and ROME, although a couple of participants did generate their own mnemonics to aid their own learning. The overall conclusions of the thesis are:

- The factors associated with the retrieval of vital clinical information in this study appear to be more multi-dimensional than the existing literature on mnemonics suggests.
- The findings indicate that mnemonic use and value prior to the study shaped some of the participants' perceptions of mnemonics as a learning tool, in that those learners have had positive prior experiences of using them.
- Students appear to be using the O_2 FLUID mnemonic to pass their OSCE examination – the quantitative data indicates higher levels of retrieval at this stage than pre-OSCE and 12 months post-OSCE.
- The scores for retrieval of the ROME mnemonic show a different picture to that of the O_2 FLUID usage. One possible explanation is that as the ROME mnemonic was not summatively assessed for the module in which the quantitative data was collected, therefore its use was not driven by assessment. Additionally, the qualitative data reveals that students had little exposure to blood gases unless working in an intensive care unit, accident and emergency or paediatrics setting. Even then, only two students spoke of having seen blood gases performed in clinical practice.
- The significance of the mnemonic in question appears to be an important factor for all participants. The connections students placed on the mnemonic and the clinical information to be retrieved was deemed "vital" for two key reasons: for successfully passing their examinations (summative assessment); and to aid recall in the treatment and management of sepsis.

- The qualitative interviews describe how and why participants used the O_2 FLUID mnemonic to recall information. This appears to have had a secondary effect, as students discussed being able to recall information, which enabled them to recognise patients at risk of sepsis and intervene by escalating their concerns to other healthcare professionals.
- How students are encoding and storing the O_2 FLUID mnemonic and sepsis information has been most illuminating. Many students said they learn visually, but also spoke of their previous clinical experiences of nursing patients who have had sepsis, and using this, along with the O_2 FLUID mnemonic, to recall information. The resulting “memory hook” provides a powerful connection to these memories to the emotional domain of learning and sepsis.
- Students who had no previous clinical exposure to caring for patients with a sepsis diagnosis relied on having been taught the mnemonic at university. This used traditional methods of mnemonic teaching; a visual representation of the O_2 FLUID mnemonic, pathophysiology of sepsis and mortality statistics. Although they had still achieved a pass at their OSCE examination, it could be argued that their “memory hooks” were not as advanced as those of students who were using episodic memories.
- The creation of a sepsis mind palace uses the method of loci technique. Thus in this educational transaction, nurse educators who use such mnemonics equip students with the conceptual framework to build their own mind palaces. Using a multi-dimensional mnemonic tool founded on key principles of techniques to enhance encoding, storage and retrieval of memories could see the application of an instructional design for using mnemonics in nurse education. Therefore the concept of “gifting” this is in our gift as facilitators of

learning, gifting this to our students by presenting mnemonics in a more holistic multidimensional manner in our lesson design, teaching strategies and presentation of chunked information to our students.

- This study explored the experiences of student nurses, but future application of the findings could extend beyond nurse education. A multi-dimensional approach to using mnemonics in higher education could yield the positive impact of facilitating or gifting memory palaces to divergent student groups other than nurses.

7.4 Recommendations

Six recommendations will be explored in relation to how they may enhance the retrieval of vital clinical information to improve student nurse learning. These are:

1. Designing mnemonics for use in nurse education
2. Simulation of mnemonics – sepsis mind palace
3. Reducing cognitive load
4. Metacognition and Refocusing attention
5. Instructional design for simulated mnemonics
6. Recognition of sepsis as a global public health concern within the community setting.

7.4.1 Designing mnemonics for use in nurse education

As discussed in chapter five, to fully maximise the teaching and learning potential of mnemonics, a paradigm shift may be required; moving thinking beyond the view of mnemonics as being simple recall tools, used to pass examinations or regurgitate facts

by rote. The findings from this study and prior literature indicate that mnemonics can enhance performance during examinations. However, a unidimensional view, for example, presenting a mnemonic in the visual domain only, restricts the potential to unlock more memories through holistic encoding, storage and retrieval methods. The placing of a mnemonic on a PowerPoint slide provides a unidimensional stimulus in the visual domain of encoding only, with retrieval relying largely on visual recall. Using a multi-dimensional technique would require the incorporation of different stimuli. The formulation of a multi-dimensional tool to enable nurse educators to use mnemonics effectively with their students could enhance the retrieval of clinical information by addressing different learning styles. This tool providing a guide of how to design mnemonics within nursing education and factors that should be considered.

7.4.2 Simulation of mnemonics – the example of a sepsis mind palace

As discussed in the previous chapter, simulation has been used in healthcare and nurse education with positive results for knowledge, skills development and patient safety. It provides a “safe” learning environment for students to make mistakes, using low to high levels of fidelity. The quotes from the qualitative interviews in this study illuminate how participants are using previous memoires of patient encounters in clinical practice to create a “memory hook” for future encounters with patients who have, or are suspected of having, sepsis. Students who have not had this experience are unable to rely on such memoires, which may have an emotional dimension. Instead, they primarily rely on theoretical information about the impact of sepsis, based on statistics presented in class at university. One of this study’s recommendations is that “facilitating” a sepsis mind palace, via visual and auditory teaching methods shown to students prior to placement. Could provide a similar “simulated memory

hook” to that described by students who have been exposed to patients with sepsis in the clinical setting. The rationale for this is to provide a mental video of a patient who is suspected of having sepsis with the O_2 FLUID mnemonic overlaid visually and with auditory reinforcement.

7.4.3 Creating a sepsis mind palace

The practical application of this mind palace would be a video, filmed in a “mock ward” or immersive simulation suite. In creating a sepsis mind palace, several key factors are associated with maximising encoding to long-term memory and facilitating retrieval. These are:

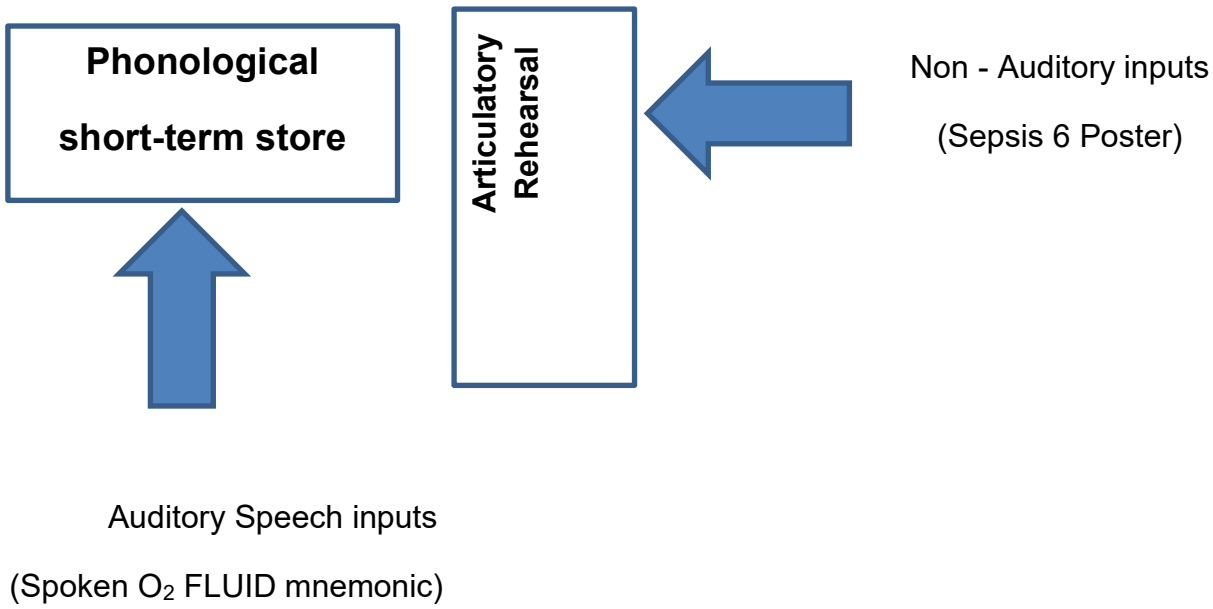
1. Video “fly through” of the clinical environment
2. Visual representation of O_2 FLUID mnemonic
3. Auditory representation of O_2 FLUID mnemonic
4. Emotional dimension to the fictitious patient presented in the video

The mock ward environment would be presented with a patient in a bed. The patient’s hair would be an artificial bright red; they would be sweating and confused. The colour of the hair would signify danger and thus further act as a “memory hook”, to be recalled when triggered by future patients. The camera would fly over equipment key to the treatment and management of sepsis, such as an oxygen mask, with the oxygen flow meter being moved up to 15 litres per minute. An audio voice is describing each element of the sepsis six mnemonic and a visual representation of the mnemonic is overlaid on screen. During this flythrough of the ward/bed environment, an audio voice is describing who the patient is; they are a mother with two children. This adds the

effective domain to learning with the patient being viewed as a person, not simply an artificial creation or mannequin, which is often used in simulated healthcare scenarios.

The audio and visuals provide encoding to the phonological and visuo-spatial sketchpad and the description of the treatment and management stages of sepsis (Diagram 6.0 below). Equipment associated with the sepsis six care bundles and O_2 FLUID mnemonic reinforcing declarative long-term memory storage. This would enhance semantic memory, a type of long-term memory involving the capacity to recall words, concepts or numbers by their meaning. The video could also enhance episodic memory. This is a type of long-term memory that involves conscious recollection of previous experiences together with their context in terms of time, place and associated emotions. Providing an emotional dimension to students by "gifting" them this memory prior to their clinical placement would enable them to view the patient in the video as a human being, thus engaging the emotional domain of learning. The memory in the video would be virtually "time stamped" with the emotion of concern, empathy for the preservation of human life, professionalism and the requirement to act promptly. The final visual element would state "Think Sepsis! – Think O_2 FLUID!" thus necessitating a twofold initiative: the visual 'think sepsis' raises awareness of recognition of sepsis; while 'think O_2 FLUID' could raise awareness of the importance of prompt treatment and management of sepsis within the first hour of diagnosis. Public health messages using the Think message date back to 2000, but the original campaigns concerned road safety using this approach (Central Office of Information, online, 2020). All of these factors independently are known to aid recall. The originality contribution to knowledge of this thesis is the recommendation to combine these stimuli with the use of mnemonics.

Diagram 7.0 Phonological Loop and Visual encoding model applied to O_2 FLUID mnemonic



7.4.4 Facilitating a sepsis mind palace

The restructuring of taught sessions on sepsis to include the sepsis mind palace could augment existing taught components in current or future student nursing curricula. The video would be shown prior to placement, when students are first introduced to the pathophysiology of sepsis. If current methods of teaching sepsis continue to be used in student nurse education, there are a number of risks. Using a unidimensional version of a mnemonic presents risks when the mnemonic is associated with the recall of vital clinical information, such as sepsis, as students may only be relying on one method (e.g. visual) of learning. A tool that can aid recall in a time-critical situation should not be used in an arbitrary or piecemeal fashion. Holistic application could yield richer and longer lasting retention of information.

7.5 Reducing cognitive load

Due to the “chunking” effect associated during encoding, mnemonics can be attributed to reducing cognitive loading, particularly extraneous cognitive loading. This may be beneficial, as increased cognitive loading has been associated with de-focusing of attention and the background “noise” of additional cognitive distractions is linked to patient safety, clinical errors and the potential to not detect sepsis quickly enough. By using cognitive cues with learners, it may be possible to reduce the cognitive loading and thus aid retrieval of clinical information more efficiently. To achieve this, it could be recommended that, when teaching using mnemonics, learners are encouraged to use a questioning, self-critical manner to question the experience “in the moment” as it occurs. This way, any extraneous cognitive loads competing with attention can be reduced. Questions such as ‘why have I arrived at this decision?’ and ‘how do I know this?’ may stimulate the learner to increase their metacognition and “offload” extraneous attentions, ensuring a priority of processes of focused attention are encoded.

7.6 Metacognition and refocusing attention

As discussed previously, metacognition is concerned with awareness of one’s own cognitive processes. The act of thinking about cognitive processes and one’s ability to manipulate these is linked with self-awareness. This concept is particularly useful if applied to the retention of vital clinical information. Failure to recognise and respond in a critical situation could have serious consequences. Nurses are constantly thinking about care, their patient, and tasks to be undertaken; balancing these thoughts with the professional requirement for high quality care in a busy clinical environment can be challenging. Focusing these thoughts to consider the process of metacognition in

a meaningful and pragmatic way may be an important factor in refocusing a nurse's attention away from distracting thoughts and towards the true task of greater cognitive awareness.

A critical lens exists within the literature surrounding task-oriented nursing, with patients being historically viewed as an object; passive in their own care. This is not the drive of contemporary care delivery – although when time-dependent care is required, there is a danger that task-oriented nursing might be adopted. Selective attention theory, using the metaphor of a "cocktail party" effect, can apply in various settings, both clinical and non-clinical. By associating the words 'sepsis', 'sepsis six' and 'sepsis care bundles' with the need for prompt action, the selective attention of learners may be increased in a higher education environment, but more importantly, within a clinical practice setting. Having sepsis so prominently featured and on the cognitive radar of student nurses on placement can focus their attention in being more vigilant to the signs and symptoms of sepsis. Enabling recall of vital clinical information when hearing the word 'sepsis' would be an "after the fact event". Using behaviourist principles of conditioning, hearing the word 'temperature', 'temperature check', 'observations', or 'patient obs' could trigger a reinforced memory response: "could this patient have sepsis?" This recommendation is not implying that student nurses should act beyond the scope of their practice in the diagnosing and prescribing; by simply asking the question, they may be more aware of connections between the patient's history and reason for admission, and cases where no active treatment for sepsis has been initiated. Their attention and "sepsis radar" has been shifted from routine nursing of physiological observations to a heightened state of cognitive arousal. This "arousal"

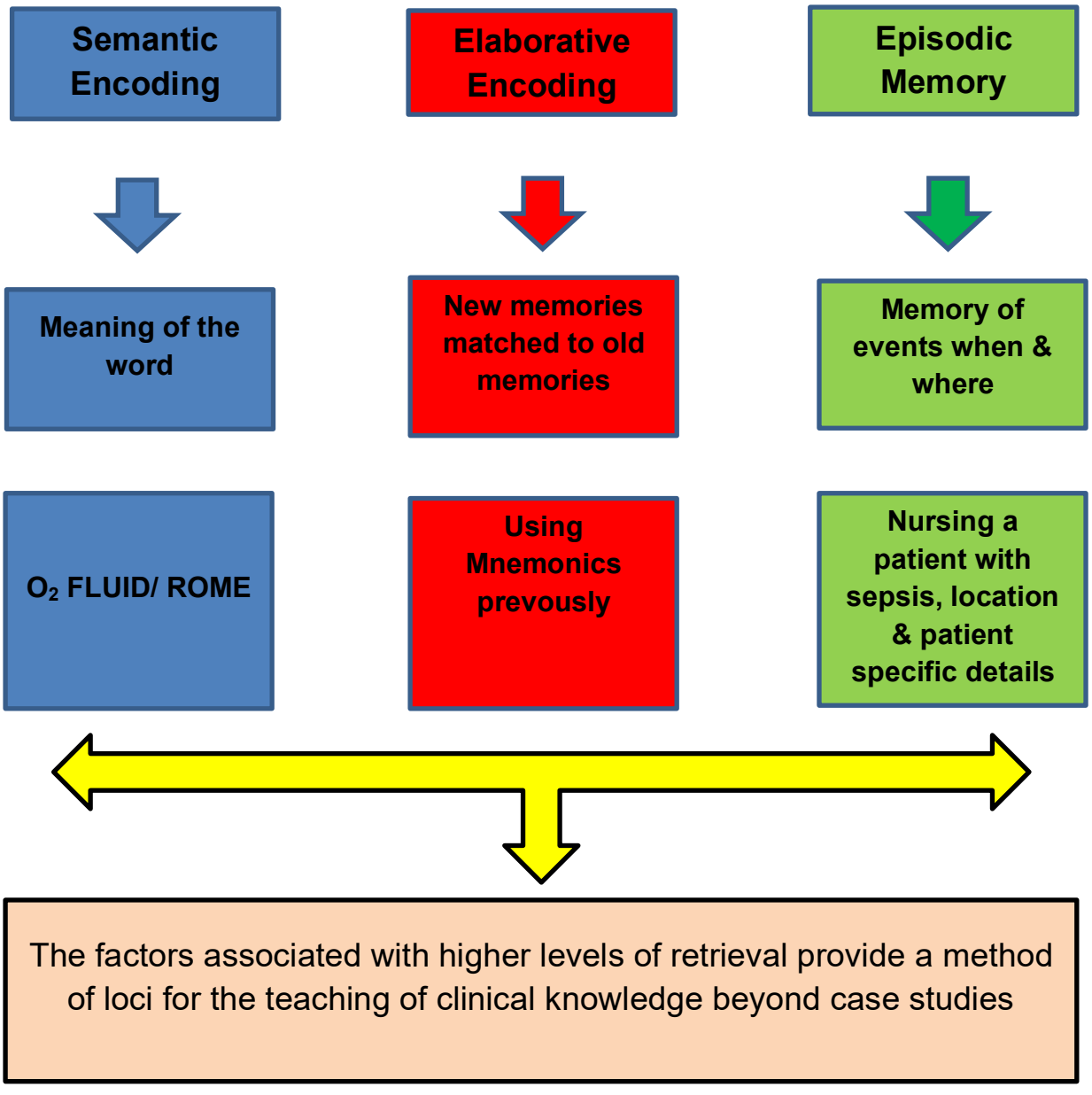
state could lead to swift action, recognition of deterioration and using the vital information to treat patients using sepsis care bundles such as the sepsis six.

As discussed previously, when nursing staff are busy, care can become hurried and task oriented. The task ultimately is to save lives by early treatment interventions associated with improved patient outcomes. Care in this sense can still be holistic, as considering the patient as a whole involves not only the physical but also the psychological impact of surviving sepsis and quality of life post-recovery.

Diagram 7.1 is a summary of key memory factors surrounding the data processing of memories if the O_2 FLUID mnemonic is applied. This is a visual representation of memory processes associated with the encoding stage, storage of short-term and long-term memories, and the retrieval stage of learning. As discussed previously, semantic encoding is concerned with the encoding of the *meaning* of the word, not just the (acoustic) sound of the word. This enables lecturers to explore with students the meaning behind key sepsis information, mortality rates and patient stories of surviving sepsis. Elaborative encoding is concerned with using a mnemonic that relates to “be remembered information”, pre-existing memories or knowledge. In this respect, the learner may be required to recall the information for an examination or test, using key sepsis knowledge or knowledge of the O_2 FLUID mnemonic. Learners can enhance this by making connections between the sound of the word, visually how the word looks, the meaning of the word or the spatial context (e.g. the setting in which the learning takes place). Episodic memory is the “lived experience” of past memories, in terms of the place, setting, time, person or emotional context of the learning. Students

who had nursed patients with sepsis were able to recall those memories. Using case studies is a powerful learning tool in healthcare and has been proven to enhance the application of theoretical knowledge to a fictitious clinical scenario. However, the application of mnemonics beyond superficial techniques of applying the information to be recalled to pass an examination, does not unlock some of the potential of the recommendations proposed in this thesis. Using a method of loci, creating a sepsis journey in which the learner plays an active part, by encoding, could create a gifted episodic memory.

Diagram 7.1 Visual schema of memory processing and the use of sepsis six mnemonic



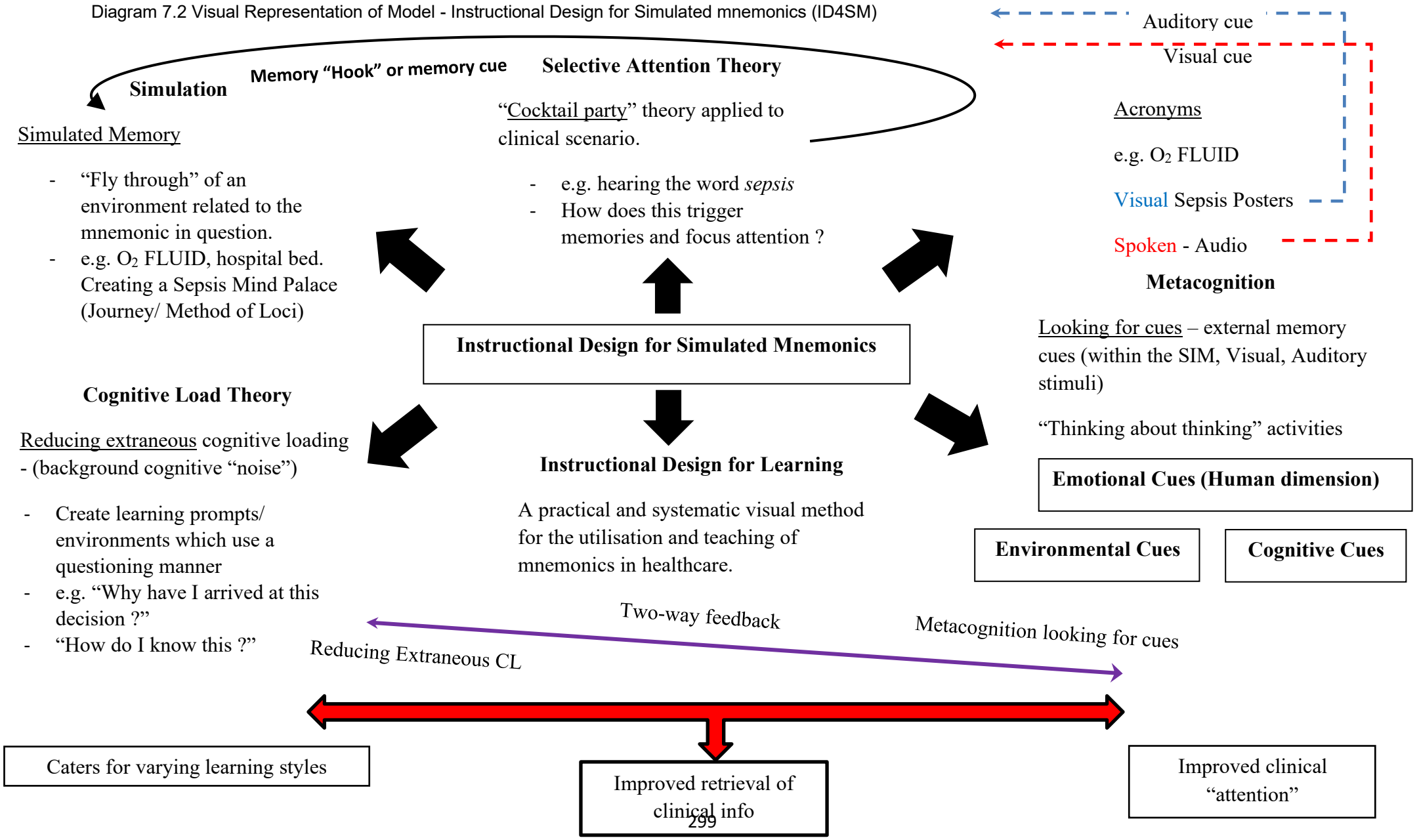
7.7 Model for instructional design for simulated mnemonics (ID4SM)

As discussed in the previous chapter, instructional design is used in education, mainly in the development of online educational content in Virtual Learning Environments (VLEs). However, if the principles of instructional design were combined with the pedagogy of simulation, then a framework for maximising the mnemonic potential may be achieved. Using the premise of instructional design, a tool or model of how to structure mnemonics using a simulated approach would encompass a framework to develop instructional materials. This could help academic staff, and nurse and clinical educators provide a structure and meaning to the learning material. It may allow them to visualise the training need and break down the process of designing training material into a more systematic series of processes, considering the key factors that support the retrieval of vital clinical information using mnemonics. The rationale for using such a tool is listed below (Diagram 7.2), Instructional Design for Simulated Mnemonics Model (ID4SM) gives a visual representation.

- A multi-dimensional tool for how to design and use mnemonics in nurse education
- A set of teaching principles based on the encompassing mnemonic literature and thesis findings
- Use of video, audio and simulation. Facilitating a memory palace (method of loci), for example, the sepsis six mnemonic/O_2 FLUID

The model incorporates the key factors revealed by this study, alongside the recommendations made in this chapter to support the retrieval of clinical information using mnemonics. The model therefore provides a framework for the design of teaching sessions using mnemonics in relation to clinical information.

Diagram 7.2 Visual Representation of Model - Instructional Design for Simulated mnemonics (ID4SM)



7.8 Sepsis as a global public health concern

As 70% of suspected sepsis cases develop in the community setting, there is an inverse focus on sepsis towards secondary care provision – although this is logical given that this is where the majority of patients are currently treated for sepsis. National Early Warning Scores have been updated and modernised to reflect the incorporation of sepsis as a trigger for patient deterioration and concern ($NEWS^2$). However, the lack of consistency of early warning scores within community nursing environments presents some concerns (Tucker and Lusher, 2018). The development of mnemonics to detect sepsis, or initiate some of the component parts of the sepsis care bundles within the community prior to hospital admission, could enable stronger links between community nursing services and the paramedic services if both use the O_2 FLUID mnemonic. However, it is recognised that in practical terms, these professional groups would only be able to initiate three of the six care bundles (oxygen, fluid and urine/catheterise) pre-hospital and this would require nursing staff to have advanced diagnostic skills or be working under a community patient group directive.

A proactive awareness campaign, similar to the 'Act FAST' stroke campaign, might help within the community nursing environment. Act FAST, aimed at the public, has been successful in promoting the prompt detection and treatment of strokes (CVAs). An approach aimed both at the public (carers) and at community nursing staff, working closely with potential patients/members of the public at risk of sepsis, could incorporate an acronym to detect sepsis

based on key physiological signs and symptoms (high or low body temperature, feeling chilly and shivering, fast heartbeat and fast breathing).

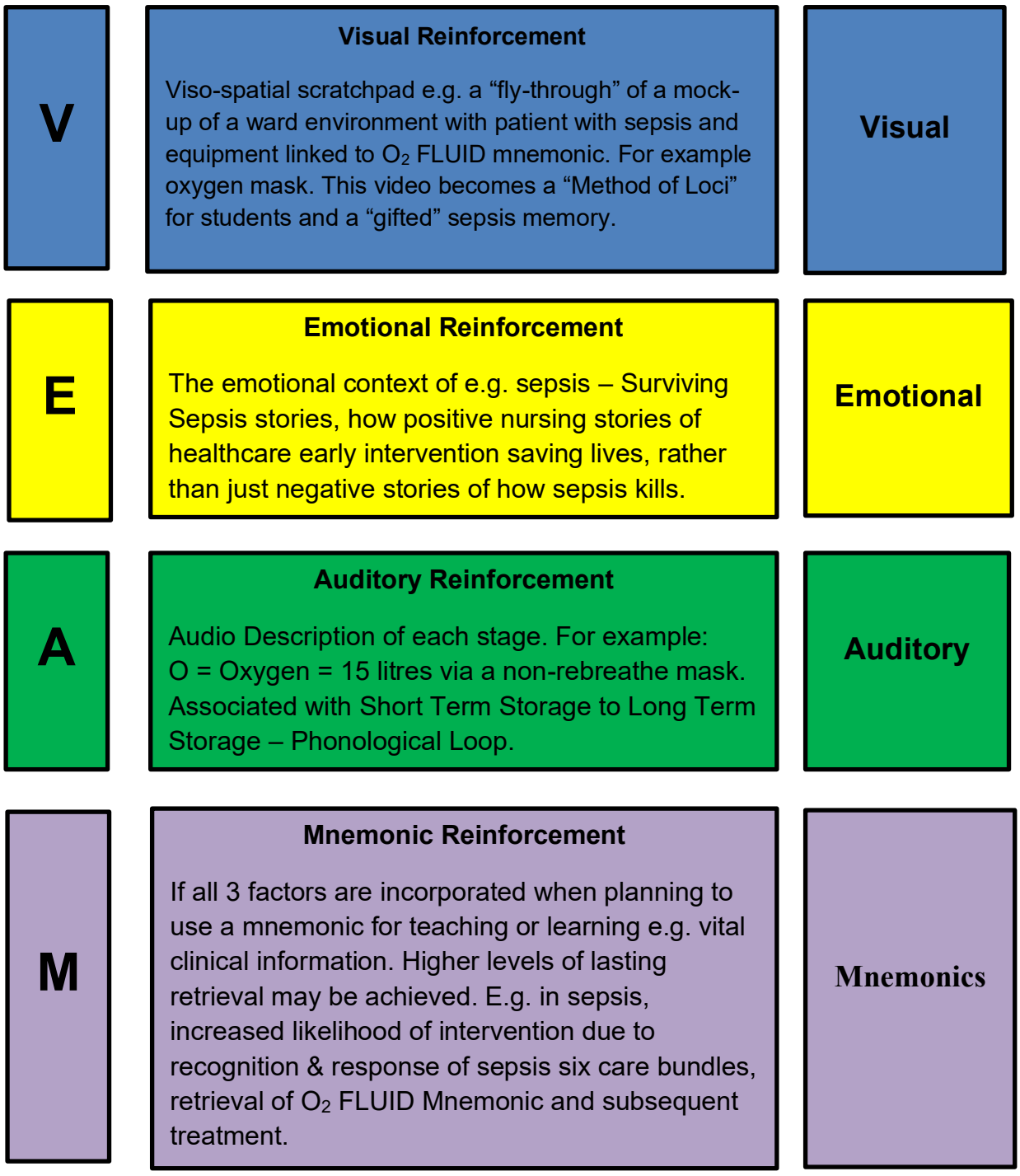
The participants in this research were student nurses. As discussed, the majority of vital observations and hands-on care is undertaken by the least qualified members of staff in the healthcare system (often student nurses). Therefore, using a framework to design mnemonics for use in healthcare, encompassing a multi-modal approach to instructional design as outlined in section 7.7 and Diagram 7.2 above, this might create safer care for patients being seen by less qualified practitioners or practitioners who are less likely to see a patient with sepsis. When they do encounter this clinical condition, having a mnemonic framework that has been reinforced by more holistic teachings on mnemonics, which the ID4SM model attempts to achieve, could be beneficial to patient safety.

7.9 VEAM (vm)

VM, pronounced 'VEAM', stands for Virtual Mnemonics (vm). The philosophy of pragmatism, which has driven this study, culminates in adding a further recommendation for the instructional design of mnemonics: a mnemonic of how to teach mnemonics, with each letter representing key considerations for academics. Diagram 7.3 details this structure and meaning. For example the visual element of mnemonics, for example a visual representation of the mnemonics. Emotional element of the mnemonic linked to the topic. Auditory factors should be considered in how the mnemonic sounds and creating reinforcement of this with the visual factor. The final consideration is the

mnemonic reinforcement; how this is to be embedded into the consciousness of the student's memory, as the encoding stage is critical for successful retrieval. The concept of "action aiding learning" should be embraced in nurse education; refection is a valued skill in nursing, critical for the advancement of both personal and professional knowledge among student nurses, and theory must be applied to practice in nursing for it to be perceived as meaningful and to have value to learners. A notion of 'the pragmatic' should be balanced against the importance given to the teaching of refection and reflective skills in nursing.

Diagram 7.3 Methodology for Virtual Mnemonics (vm) (Framework)



7.10 Reflections

The motivation for focusing on mnemonics for this thesis has been rationalised in the background section and by the gaps revealed by the literature review. However, my own feelings towards mnemonics and their educational use have been challenged during this PhD journey. Prior to commencing the thesis and the various stages of data collection, it was necessary to “bracket” my own thoughts and feelings on mnemonics, so as not to bias my own research. Acknowledging this bias was the first step in this process. This was a challenge, as I have been exposed to mnemonics throughout my nursing career, while advancing my clinical skills and knowledge as a specialist nurse, and in the classroom setting with my own students. I had previously valued mnemonics, as they had helped me retain vital information for passing my OSCE examinations and recalling how to undertake advanced physical assessment skills in clinical practice as a Community Matron. However, I had not appreciated how unidimensional my use of mnemonics had been in the classroom, other than knowing their structure and my enthusiasm for their use. A startling revelation in the quantitative results of this study was many students’ limited recall of the details in relation to the mnemonic after 12 months post-OSCE. Although recall remained high, regarding word associated with a meaningful (to the learner) mnemonic O_2 FLUID. I thought that this would have been much higher and it was not until undertaking the qualitative interviews and subsequent data analysis that key explanatory themes emerged.

Undertaking this thesis has enhanced my knowledge of research methods and methodology, but it has further enhanced my awareness of the potential of mnemonics. Their history is long, from the early stone and woodcarvings used to denote food sources and spiritual sites, to their use by the ancient Greeks, or as memory places (loci), to their resurgence in medical, nurse education and public health and safety messages. Further research may explore techniques that are more detailed and the fuller potential of mnemonics to support learning, retrieval of vital information and in the case of sepsis – save lives.

7.11 Chapter summary

This chapter revisited the aim of the study and has summarised the numerous factors that aid the retrieval of vital clinical information using mnemonics. An important factor for students is using mnemonics to pass summative examinations during a nursing programme. For many students who took part in this study, this is not the sole reason for using mnemonics or the students' motivation for using them. The application of a mixed methods approach has indicated how students are using mnemonics outside of the classroom and university environment. Indeed, the underpinning philosophy of Dewey's pragmatism has provided an exploration of the aim of this study to answer the research questions in a pragmatic manner, sympathetic to the complexity of contemporary nursing practice. The study also reflects the ethos, echoed by Dewey, that understanding what happens inside the classroom environment is equally important as knowing how knowledge is applied outside of it. Understanding to what extent students use a structured mnemonic approach

in their OSCE examinations has reflected the concept that summative assessment drives learning. If a mixed methods approach had not been used, it may not have illuminated how those students interviewed are using, valuing and conceptualising mnemonics in the clinical setting. The recommendations in this thesis have highlighted possible future directions for ensuring that students or academics in nurse education do not view mnemonics as unidimensional. The thesis has explored a pragmatic approach to mnemonic use, in view of the urgency of the treatment and management of sepsis or that mnemonics appear to be valued by students in terms more than rote learning. However, there are limitations in the generalisability of the findings and categorically defining the educational reach, based on the results per se. Nevertheless, the potential to explore these factors with student nurses, nurses, healthcare professionals and the wider higher education community could be an area for further research.

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Appendix A Data Collection Tool – OSCE Scoring Tool – To be matched to SMOTS™ video Footage (V4)

Master of Nursing / Registered Nurse Programme - Module ??????

*OSCE STATION 4 – At Station 4 each student will be asked **one question** from **each of the following** sections in Grey*

Section number	Model Answer		
Section 1 relating to Question 1 on the OSCE score sheet:	**Fully Answered = 6 points** **1 points/ bullet point**	**Participant`s score**	**Total score for question**
A. *What do you think is wrong with your Patient?*	• *Given the fall in the patient's Blood Pressure* • *Fall in SPO2,* • *Rise in pulse,* • *Rise in temperature* • *Increased respiratory rate* • *I think the patient has septicaemic shock. It appears that the patient has developed a blood borne infection possibly from the chest infection (e.g. chest for adult / MH and meningitis for child scenario)*		

Section number	Model Answer				
Section 2 relating to Question 2 on the OSCE score sheet:	**Fully Answered = 18 points max** **1 point for 1st letter**	**/ 1 point for word**	**/ 1 point for details**	**Participant`s score**	**Total score for question**
B. What are the likely medical / nursing interventions in the next 30 mins to 1 hour?	• **O_2** -	Oxygen	(15L non-rebreather mask)		
	• **F-**	Fluid Challenge	(20 /30 mls per KG of body weight bolus)		
	• **L-**	Lactate	(measure serum lactate)		
	• **U** -	Urine Measurement	(expect 0.5mls per kg of body weight per hour)		
	• **I** -	Infection Screen	(swabs, urine, sputum and blood cultures)		
	• **D -**	Drug Therapy	(Antibiotics – broad spectrum and not the drug the patient is on)		

Section number	Model Answer				
Section 3 relating to Question 3 on the OSCE score sheet:	**Fully Answered = 18 points max** **1 point for 1st letter / 1 point for word / 1 point for details**			**Participant`s score**	**Total score for question**
C. Did the participant use all of the O_2 Fluid Mnemonic (Sepsis 6) to demonstrate management of Sepsis? **USE OF MNEMONIC**	• **O_2** -	Oxygen	(15L non-rebreather mask)		
	• **F-**	Fluid Challenge	(20 /30 mls per KG of body weight bolus)		
	• **L-**	Lactate	(measure serum lactate)		
	• **U** -	Urine Measurement	(expect 0.5mls per kg of body weight per hour)		
	• **I** -	Infection Screen	(swabs, urine, sputum and blood cultures)		
	• **D -**	Drug Therapy	(Antibiotics – broad spectrum & not the drug the patient is on)		
Section 4 relating to Question 4 on the OSCE score sheet:	**Fully Answered = 3 points max** **1 point = Yes 1 point = Full answer 1 point = must follow each previous letter**			**Participant`s score**	**Total score for question**
D. Did the participant use the O_2 Fluid Mnemonic (Sepsis 6) in a sequential way ? **USE OF MNEMONIC**	• Yes	in full	Following each previous Mnemonic letter		

Section number	Model Answer				
ROME Mnemonic (not part of assessed OSCE exam)	**Fully Answered = 12 points max** **1 point for 1st letter / 1 point for word / 1 point for details**			**Participant`s score**	**Total score for question**
A: Could the participant recall the ROME Mnemonic **USE OF MNEMONIC**	• **R**	Respiratory	(Resp Acidosis pH Decreases PCo_2 Increases)		
	• **O**	Opposite	(Resp Alkalosis pH increases PCo_2 decreases)		
	• **M**	Metabolic	(Meta Acidosis pH Decreases HCO3 Decreases)		
	• **E**	Equal	(Meta Alkalosis pH increases PCO_3 Increases)		

Section number	Model Answer				
ROME Mnemonic (not part of assessed OSCE exam)	**Fully Answered = 3 points max** **1 point = Yes 1 point = Full answer 1 point = must follow each previous letter**			**Participant`s score**	**Total score for question**
B: Did the participant use the ROME Mnemonic in a sequential way ? **USE OF MNEMONIC**	• Yes	in full	Following each previous Mnemonic letter		

Appendix B Semi Structured Interview schedule

Interview Questions

1. During this module, you have been using mnemonics. Have you ever used mnemonic devices before in your learning?
2. During this module, you have been using mnemonics. How has this affected your learning?
3. What factors do you perceive as being important influences in the use of mnemonics and your learning?
4. Did you utilise your own mnemonic(s) as part of your own learning in relation to Sepsis?
5. What factors influenced you in helping to retain the mnemonic information?
6. How did you use O_2 FLUID (mnemonic) to structure their future learning and professional development?
7. How did you use ROME (mnemonic) to structure their future learning and professional development?
8. What relevance do you think mnemonics have in nurse education?
9. Having taken part in this research study, do you have any other comments to make?

Appendix C – Excerpt of Qualitative Transcription (Adult participant)

I So undertaking the qualitative interview with Participant, (Name), the unique identifier number is GT23/04, all data will be anonymised and any names replaced with the unique identifier GT23/04. Today's date will be the 14th September, Guy Tucker the interviewer and PhD reviewer on a series of semi structured interview. So (Name) thank you for coming in and chatting with me today, really appreciate that. As I explained I just want to ask you some questions in relation to, if we think back to the Module that was attached to your OSCE examination, NS0603, you've been using some mnemonics in that, you were introduced to the O2 fluid mnemonic and the ROME mnemonic. Could I ask you, prior to coming on this nursing programme, cos you're a MNurse student, an adult student, have you ever used any mnemonic devices before in your learning

R Oh it's probably been a while since I've used anything to be quite honest so I couldn't think of any specific examples off the top of my head, maybe at high school probably but after that not really, not during my last degree at all

I Okay, so it's quite a while ago then prior to being introduced to a couple of mnemonics on this module, so as part of this Module NS0603, the O2 fluid mnemonic and the ROME mnemonic, how do you feel as though overall that using those two mnemonics, has affected your learning

R I think that the O2 fluid mnemonic that's had I suppose I found that the most useful predominantly because the ROME I suppose it kinda doesn't really explain all of the physiology behind that cos you know respiratory, opposite metabolic equal and fair enough even me saying that now I'd have to go back and check my notes to see which one's equal and which one's opposite, whereas the O2 fluid I just found that one a bit more accessible really cos it's kind of, the action you just have to take for sepsis 6 really I just found that 1 really … it's almost like age ? for me really because I must admit I'd probably describe myself as like a visual learner, I can almost visualise the O2 fluid in my mind and then you can kinda work back from there to say "actually what was the O2, what does the F mean what does the L mean and I found that useful in practice as well where in terms of implementing it cos there was a patient that I was looking after just showing signs of sepsis, the doctor had actually recognised the patient is probably septic, it was a case of asking "what would you recommend we need to do with this patient" bearing in mind I'm thinking O2 fluids and there was a couple of things the doctor had missed out ? so I said "should we not actually be implementing the sepsis 6 " this is what it is and that kind of aided both of

our approach I suppose it kind of supplemented the mnemonic with the you give three things you take 3 things in some cases sometimes you forget.

I Okay was that something, what you mentioned about three things going in to the patient, three things coming out, was that something you were introduced to on the modules or is that something you designed

R No it was mentioned that's actually something that it's just recently I think in the past 6 months, it was one of the lecturers mentioned it in one of the scenarios , it was like what would you need to implement the O2 fluid and she said "well I remember it as give 2 things and take 2 things you actually have to supplement that with the O2 fluid but with the O2 fluid, I almost don't feel the need to use the give 2 things and take 2 things but I think I, it's just to remind me cos I think there's certain parts of O2 fluids I just think I mix up sometimes which 1 is it I think it's the I and the D so the drugs I've confused it now but no I found it quite useful actually

I So you've mentioned, it's quite interesting you've mentioned about, and I'm paraphrasing you now so correct me if I'm wrong, you were saying that you're a visual person, a visual learner, is that a factor that you've found was very helpful in relation to the O2 fluid mnemonic then

R Yeah

I The structure of it

R Definitely, well it's how I remember things and especially things like that are quite detailed and I need to almost visualize it in my mind so I think the O2 fluid we were given it was like a power point slide, it's got O2 fluid written on it, so that each box is marked exactly, it's almost like I can picture that kind of slide from the O2 fluid mnemonic which I know seems odd but it just seems to be how my brain remembers things

I Okay, so that's an important factor that you feel …

R Yeah

I You mentioned about kind of adapting things, have you made up any of your own mnemonics as part of your learning in relation to sepsis or whilst you've been on this programme?

R I haven't no

I That's absolutely fine. Okay any other factors that have helped influence your retaining this mnemonic information O2 fluid you mentioned about the visual having the letter and also kind of the word underneath, have you seen anything else in clinical practice, any posters, to do with O2 fluid

R I probably have to be quite honest, I don't know if they were specifically O2 fluid posters, I think they were just the sepsis 6 ones not that I can recall unless it subliminal but it's almost as if I see the posters now and I don't, if it says sepsis 6 I kinda go I don't really need that I kind of know the sepsis 6 if that makes sense it might be a bit presumptuous but you do go I'm happy with the mnemonic and that does assist me with the remembering what they are.

I You mentioned about, there was a scenario where you had to utilize O2 fluid, a practice scenario, and you talked about where you had to involve the doctors and between the two of you you managed to get through some of the information to recall. How do you see using O2 fluid with your future learning and your professional development then?

R Well again I suppose it would be a similar situation, but I suppose the way I would use it is I suppose when I become a mentor with students particularly, I mean hopefully it's going to be used in this university but with moving down to Manchester they mightn't even use O2 fluids and I think sometimes sharing these little golden nuggets this is how I remember, this is how I was taught I think like sharing that information with students by newly qualified staff, to say well look this is how I remember the sepsis 6 so I imagine that's how I would use that and, you know, again if I'm dealing with medical staff who aren't really familiar with it then this is a case of this is what sepsis 6 is if you don't know then maybe you need to go and find out about it

I So sharing that information with others then, anything else any other ways you could see it helping you

R Not really

I What about the ROME mnemonic then, I know we introduced that to you as part of your OSCE examination, any other ways, any ways you could use the ROME mnemonic for your future learning and your professional development, have you seen it used in practice

R I haven't seen the ROME used in practice but I can kind of see how it would be useful cos in terms of knowledge around blood chemistry when you start to look in to that you kind of recognize what you're looking for so if it asatatic you need to look at it, you know, so the value should be going in a certain direction I probably would supplement the ROME mnemonic with more like in depth learning but I think at this stage particularly in your nursing career you think God there is so much that I need to learn and maybe that can wait a bit but I do find it useful but again it's kind of like I almost need to do some further learning to supplement that so in my mind if someone says its respiratory opposite what exactly does that mean, what should the values

be of what I'm looking at cos I'm the kind of person that needs to know everything to the enth degree

I That level of depth

R Yeah so I think it has been useful on a basic level at the minute I think I would supplement that later on with some further learning once I get my head around everything we do

I Okay. Have you seen, we're not going to break any confidentiality or mention any wards or names, but have you seen any arterial blood gases being taken on patients, have you been involved in that in the placement areas you've been on

R I have, I've seen them being taken, I've seen the results come through, the electronic results and kind of have discussed some of the values with my mentors and with some of the nursing staff to say well look some of it looks like gobbledygook really so obviously it's about saying what does that mean you know so I've discussed with them what does the PH of the blood mean and them saying it needs to be 7.35 to 7.45 if it's acidic its need to be above if it's allylic it needs to be below that so that has been quite interesting but that's my limited knowledge of it at the minute but I think probably that will improve as time goes on

I Okay, and what relevance do you think mnemonics have in nurse education from your perspective

R From my experience of using them this time round I've actually found them really quite useful, I was quite skeptical at the beginning I think oh a mnemonic, in my previous experience of using them at high school it's like, almost childlike approach to education but I've found that if you keep it simple then I suppose, that simple approach I found quite useful I think in terms of sepsis you need to be quite hot in terms of recognizing it and treating it delivering all of those in the first hour I think then to memorise those in a stressful situation, as it is I found them really useful actually

I Okay, is there anything else in relation to either this research study or any other comments, any comments on maybe how we've used O2 fluid from a teaching perspective or how you feel it could be utilized better or differently

R I wouldn't necessarily say that it should be used any differently really, like I said I found the O2 fluid one easier to use than … as I had necessarily seen that around clinical skills I don't know like I said I had seen posters around clinical skills about sepsis 6 and I think well if we're going to be using O2 fluid in the modules it might be beneficial to in a university can we just say look this is the mnemonic that we use here then everybody can access

that and the more you see it the more you are exposed to it the more you're going to learn.

I Right, is that in the format of posters being on display in areas of is that about it being embedded in other modules

R Well probably both really but I think predominantly in clinical skills as that's where we have most of our clinical scenarios and you ask these questions whereas if it was just there on the wall you'd probably have forgotten it but you know this is O2 fluid this is what it is I think I would find that useful. I think I would continue to use the ROME cos I don't know how you would make in terms of all that building on additional information you know keep it at the level that you need to really so that's the only suggestion I would make its just making lectures aware that it's being used better talking about that and prompting students to say what is the sepsis 6 what is the O2 fluid what does it stand for I think if you've got more people encouraging its use by repeating it you're more likely to learn it

I Have you seen any mnemonics used in any other modules as part of your masters, your MNurse, sorry, programme I know we've mentioned about this module

R Yes I have actually it's a SPICES acronym don't ask me exactly what it stands for its about addressing holistic needs I patients sort of like spiritual, physical oh I've got no idea now I don't tend to use it I don't find that hugely accessible but it goes through all of the different holistic needs. Have there been any others used? I probably have I think when you're put on the spot your mind goes blank doesn't it and that's about it I would imagine in terms of mnemonics we would be shortening down cycles but that's the only one but like I said I did find that massively helpful but then I suppose I've just handed in two assignments that were about delivering holistic care so using that might have been a weakness I don't know I'll to wait til I get the results to see how well I've done to see holistic I've been.