ENHANCING THE DEVELOPMENT OF CLINICAL REASONING IN HEALTH PROFESSIONAL STUDENTS – SCOPING REVIEW

by

Ilse Engel-Gilbert

Full thesis submitted in fulfilment of the requirements for the degree of Master of Sciences in Physiotherapy, Faculty of Community and Health Sciences, Department of Physiotherapy, University of the Western Cape

UNIVERSITY of the
WESTERN CAPE

Supervisor: Mrs Danelle Hess

Co-supervisor: Associate Professor Michael Rowe

University of the Western Cape

November 2021

http://etd.uwc.ac.za/

KEYWORDS

Clinical reasoning

Critical thinking

Health professional students

Theories

Development

Educators

Teaching strategies

http://etd.uwc.ac.za/

ABSTRACT

Clinical reasoning is the central aim of student health professionals' education. However, educators still find it challenging to teach, and students still struggle to demonstrate clinical reasoning abilities. Various teaching strategies are used by educators to facilitate the development of clinical reasoning abilities, but it is unclear whether educators utilise robust theories to underpin their teaching strategies. Theories can assist with the conceptualisation, simplification and improvement of information. The aim of this study was to explore the use of theory to inform the teaching strategies which develop clinical reasoning in undergraduate health professional students. The specific objectives of the review were to identify which theories are used by educators to inform their teaching strategies, and if they are using theories to enhance clinical reasoning, to determine how they are being used. A scoping review was conducted to determine which theories inform the teaching strategies used by educators to develop clinical reasoning abilities in health professional students. The scoping review was conducted according to the PRISMA Extension for Scoping Reviews. A comprehensive electronic search was conducted on the databases available at the University of the Western Cape using specifically developed search strategies. The databases included Academic Search Complete, Biomed Central, CINAHL Complete EBSCO, ERIC, Health source: Nursing Academic Edition (EbscoHost) and Medline (EbscoHost). The search strategy included English articles published between January 1994 and December 2019. Population criteria included all undergraduate health professional students and randomised controlled trials, cohort, case-control and cross-sectional studies. This search strategy resulted in 6909 hits. A total of 321 titles were screened, of which 297 were removed after abstracts were screened. This left 24 articles for full-text screening. Two reviewers independently read the full text and evaluated the methodological quality of the studies; a third reviewer was

UNIVERSITY of the
WESTERN CAPE

http://etd.uwc.ac.za/

consulted when consensus was not met. The instrument used for the critical appraisal was downloaded from the Joanna Briggs Institute. After the 24 full-text articles were scrutinised, only two studies were left for inclusion in the review. The results of this study demonstrated that the overarching theory used in both articles was constructivism theory. A combination of learning theories was also used to develop clinical reasoning namely, assimilation of learning and situated cognition. The teaching strategies that were informed by theory included simulation and a tool called the clinical reasoning mapping exercise (CResME) tool. The theory informed either the design of the teaching strategy, or the way in which the exercise or teaching strategy was used by the students.

http://etd.uwc.ac.za/

DEFINITION OF TERMS

Clinical reasoning – "Clinical reasoning (or practice decision-making) is a context-dependent way of thinking and decision-making in professional practice to guide practice actions. It involves the construction of narratives to make sense of the multiple factors and interests pertaining to the current reasoning task. It occurs within a set of problem spaces informed by the practitioner's unique frames of reference, workplace context and practice models, as well as by the patient's or client's contexts. It utilises core dimensions of practice knowledge, reasoning and metacognition and draws on these capacities in others. Decision-making within clinical reasoning occurs at micro, macro and meta levels and may be individually or collaboratively conducted. It involves meta skills of critical conversations, knowledge generation, practice model authenticity and reflexivity" (Higgs, Jones, Loftus, & Christensen, 2008, p. 4).

UNIVERSITY of the
WESTERN CAPE

Educator – An educator is a staff member employed by a university who assists students in the clinical setting to gain the necessary knowledge, skills and attitudes to meet the standards defined by the university (Levett-Joes, 2015).

Learning theory – "A learning theory is a coherent framework and set of integrated constructs and principles that describe, explain, or predict how people learn. Rather than offering a single theory of learning, educational psychology provides alternative theories and perspectives on how learning occurs and what motivates people to learn and change" (Fayram, 2003).

Teaching strategies – Certain teaching and learning opportunities are perceived to be key elements for facilitating learning during clinical education (D. V. Ernstzen, Bitzer, &

http://etd.uwc.ac.za/

Grimmer-Somers, 2009). For this study, teaching strategies are referred to as key elements for facilitating learning of the undergraduate student health professionals.

Clinical setting – "Workplaces represent unique and complex contexts where situated learning is undertaken. Workplaces are arenas of activity in which socio-culturally determined practice occurs (Billett, 1998) and are one of the domains through which the social is ordered (Edwards & Nicoll, 2006)" (Patton, Higgs, & Smith, 2013, p. 3). In this study, the workplace is also referred to as a clinical setting.

http://etd.uwc.ac.za/

DECLARATION

I declare that this work entitled *Enhancing the development of clinical reasoning in health professional students – scoping review* is my own work. It has not been submitted for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged by complete references.

Name: Ilse Engel-Gilbert Date: November 2021

Signed:

Witness:

Mrs. D Hess

UNIVERSITY of the WESTERN CAPE

http://etd.uwc.ac.za/

DEDICATION

To my husband, for always believing in me, guiding me and being my biggest cheerleader.

To my kids, I hope you see that nothing is impossible and that what you set your mind to, you can do.

To my mother, she has always wanted me to further my studies after completing my undergraduate degree. Thank you for all your sacrifices.

http://etd.uwc.ac.za/

ACKNOWLEDGEMENTS

First and foremost, I have to thank our heavenly Father for the strength, wisdom and carrying me through this process of completing my masters. This journey required strength (emotional and mental), patience and many sacrifices away from my family and friends.

To my supervisors, Professor Michael Rowe and Mrs Danelle Hess, thank you for your consistent feedback and countless resources and lessons learnt during these three years. Thank-you for your time spent and valuable input, encouragement, and voice of reason when I needed it most.

A special thank you to Danelle Hess, she has always been a call, text, zoom call or email away. We all faced challenging times during this three-year period. Not only did Covid-19 stop the world of many things it placed pressure on us to try and do things in a 24-hour day which wasn't always easy or possible. She encouraged me, motivated, and checked in on me for mental and emotional support. I couldn't thank her enough for all the assistance and daily motivation to just try to do a little every day, even if it meant one sentence was read or written. Her dedication and positive energy are infectious and so inspiring.

Thank you to The National Research Foundation, who provided funding in support of this project, grant no: 117740. The support and funding allowed me to concentrate my time and energy on the research and not having to stress about funding or any financial strain.

Then my husband, kids and mom. The struggle of being the juggler in the house as a mom is very real, my Master's was always something for me, something I get to do. As a mother I tend to place everyone above myself, my dreams, my aspirations, and this was something I could do that was just for me. However, I could not have done it without the loving support of my husband. My constant right hand, my motivator on the tired, uninspired days where

UNIVERSITY of the WESTERN CAPE

http://etd.uwc.ac.za/

throwing in the towel felt easier. Thank you, Shaun for not only holding my hand but for guiding my hand at times too. My boys Caleb and Zeke who have never seen mommy work from home, but slowly started to try and understand. Our lockdown period was the most difficult period to juggle and fit myself and my work into a schedule that required a teacher, mom, domestic, friend, entertainer and wife. Thank you, boys for giving me an hour or few minutes during the day to play quietly or just understand not to disturb during that time. Your hugs, kisses and offering me water at times meant the most.

Then another right hand I could call upon to help with the kids and just my constant reminder that this too shall pass, and I will complete the task, my dearest Mother. Thank you for the kind, motivating and inspiring words. Sometimes I just needed a quiet day and you understood that. The door was always open for the boys to come over or you call with something made for supper. Thank you so much.

Lastly, my family and friends, the constant, "you got this", "you can do this", I can't express how much these words carried me through the rough days. Thank you so much for the check-in, the quick coffee dates just for a breather and just rooting for me to push through.

UNIVERSITY of the
WESTERN CAPE

http://etd.uwc.ac.za/

Table of contents

UNIVERSITY of the WESTERN CAPE

http://etd.uwc.ac.za/

UNIVERSITY of the
WESTERN CAPE

http://etd.uwc.ac.za/

LIST OF TABLES

LIST OF FIGURES

UNIVERSITY of the
WESTERN CAPE

LIST OF ADDENDA

http://etd.uwc.ac.za/

CHAPTER 1

INTRODUCTION

1.1INTRODUCTION

This chapter provides a background to the thesis, and it aids an understanding of clinical reasoning and the importance of clinical reasoning among health professional students. It also explains how clinical reasoning applies to this study. In addition, the chapter will outline the aims, objectives, and the significance of the study.

1.2 BACKGROUND

The term "clinical reasoning" is used interchangeably with terms such as "clinical decision-making", "clinical judgement" and "critical thinking"(Case, Harrison, & Roskell, 2000). Clinical reasoning is a process of developing skill and capability which is essential for all health care professionals. Durning, Artino, Schuwirth, and Van Der Vleuten (2013) and Higgs et al. (2008) explain that clinical reasoning is a multifaceted phenomenon required by health care professionals and is at the heart of practice thinking. "The ability to reason clinically demonstrates how practitioners or learners have assimilated, integrated and included all the various sets of knowledge they have developed cognitively and experientially" (Higgs et al., 2008, p. 383). Clinical judgement is the ability to assess the situation and to make a decision while also considering each individual's need and is affected by clinical reasoning skills (Lamartina & Ward-smith, 2014). Critical thinking includes "the component skills of analysing arguments, making inferences using inductive or deductive reasoning, judging or evaluating, and making decisions or solving problems"(Lai, 2011, p. 2). Critical thinking uses both cognitive skills and dispositions (Lai, 2011). Therefore, for the

http://etd.uwc.ac.za/

purpose of this thesis, clinical reasoning is defined as a mental process of using knowledge and collected data of a patient, assessing it and formulating the most appropriate decision to improve the patient's situation (Aparecida & Cerullo, 2010). Establishing sound clinical reasoning is a central aim of the student health professional's education, although the task of developing clinical reasoning is a challenge (Cutrer, Sullivan, & Fleming, 2013).

Development of clinical reasoning takes place in both the classroom setting and in the clinical setting. The clinical setting allows students to observe, engage and experience the clinical environment (Burgess, Diggele, Roberts, & Mellis, 2020). The clinical setting also creates a place where students can acquire immediate feedback from their clinical supervisors who assist students in developing their clinical reasoning abilities. This development relies on the faculty of the different health professional students and the educators (both lecturers and clinical supervisors). Educators are responsible for understanding the development of clinical reasoning abilities and the facilitation of strong clinical reasoning skills in undergraduate health professional students (Furze et al., 2015). However, educators themselves have voiced their own challenges with developing clinical reasoning. In a study conducted by van Wyngaarden, Leech and Coetzee, (2019) the authors explored the challenges nursing educators face with developing clinical reasoning skills amongst the nursing students. One of the areas highlighted was resistance to change and these educators admitted that the teaching and learning strategies are teacher-student-centred rather than learner-centred (van Wyngaarden, Leech, & Coetzee, 2019). Although this observation by van Wyngaarden et al. (2019) is only made regarding nursing educators, it is possible that these challenges are present across the different health professional disciplines. The educators also need to recognise that their own clinical reasoning abilities will influence and impact their choices on how to develop the reasoning abilities of the student health professionals (Golding, 2019;

UNIVERSITY of the WESTERN CAPE

http://etd.uwc.ac.za/

Schmidt & Mamede, 2015). Educators play a vital role in the development of students' clinical reasoning abilities. It is therefore important that the different schools and faculties select the most efficient and effective teaching strategies to develop clinical reasoning skills of health professional students (Audétat, Laurin, Dory, Charlin, & Nendaz, 2017). This is to ensure that students can provide optimum and effective care of their patients in a clinical setting (Audétat, et al. 2017). Errors and difficulties with clinical reasoning abilities need to be identified by the educators immediately and remediated quickly (Audètat, et al. 2017). Clinical supervisors need to identify students' clinical reasoning difficulties sooner rather than later to avoid errors and any harm or compromised care of the patients. Higgs et al. (2008), however, question whether clinical reasoning skills can be taught. It may be more beneficial to enhance students' clinical reasoning abilities by understanding how they think about their thinking (metacognition) and utilise the different theories to underpin chosen teaching strategies.

UNIVERSITY of the
WESTERN CAPE

Theories are unified ideas, views, beliefs, or models that clarify, predict events or situations by stipulating relations among variables (Booth & Carroll, 2015). They assist with the conceptualisation, simplification and improvement of information. Theories of learning can be formed from educational, social, philosophical and psychological theories (Taylor & Hamdy, 2013). Stewart (2016) agrees, indicating that theories of learning also arise from pedagogic studies, sociology, and more recently, neuroscience. Understanding learning theories, their application and limitations can assist the educator when planning the task of teaching (Stewart, 2016). Literature highlights the importance of learning theories in structuring the learning experience (Fayram, 2003). Failure to do this may hinder learning and bring a lack of clarity and meaning to the student's learning experience and development (Fayram, 2003). Theories for developing clinical reasoning skills can be used as a guide for

http://etd.uwc.ac.za/

educators to teach and improve clinical reasoning skills among health professional students. In evaluating five decades of theories and models, Yazdani and Abardeh, (2019) categorise the different theories and how they apply to the different concepts of clinical reasoning. The authors agree with the idea that theories assist in guiding educators, suggesting that it may be beneficial to create a meta-model or meta-theory which unifies all the models and theories of clinical reasoning (Yazdani & Abardeh, 2019).

There is an abundance of research outlining various teaching strategies, frameworks and models to facilitate the development of clinical reasoning (Cutrer et al., 2013; Guraya, 2016). Therefore, when developing clinical reasoning skills in students of different health professions, it is difficult to single out one theory which underpins clinical reasoning skills (Higgs et al., 2008). Studies describing teaching strategies are aimed at developing clinical reasoning skills; however, the learning theories that support the theories are not clear (Durning, Artino, Schuwirth, & Van Der Vleuten, 2013). It is still uncertain which, if any, theories underpin teaching strategies and whether they can assist the educator in developing clinical reasoning skills among health professional students still remains. Health professional students might experience different factors that could influence their clinical reasoning abilities (Rochmawati & Wiechula, 2010).These factors may include different levels of knowledge and a lack of structure and clinical experience to administer this knowledge in the areas needed (Rochmawati & Wiechula, 2010). Students' clinical reasoning development can progress slowly over time, and at different intervals they may require different teaching strategies and interventions. Research pertaining to the development of clinical reasoning among the various health care professions dates back several decades (Jones & Rivett, 2004). Much has been learnt from previous research; however, there still seems to be some difficulty with regards to teaching, assessing and defining the concept. Previous systematic reviews

UNIVERSITY of the WESTERN CAPE

http://etd.uwc.ac.za/

have highlighted education strategies to develop clinical literature, but they are not conclusive and neither do they indicate which is best used (Rochmawati & Wiechula, 2010). Teaching strategies and assessments used to develop clinical reasoning primarily also focused on diagnostic reasoning, which overlooks the student's ability for critical thinking (Guraya, 2016).

When selecting teaching strategies, educators are encouraged to utilise the best available knowledge to guide, facilitate, and teach the undergraduate health professional students. Educators and clinical supervisors do make use of theory; however, whether they are aware of this or not is still unclear (Durning et al., 2013). It would be beneficial to investigate which teaching strategies are underpinned by theories. In doing so, one can assess if the theories assist the educator in developing clinical reasoning skills among health professional students. Consequently, the purpose of this scoping review is to identify which theories of learning are used to assist educators in improving the development of clinical reasoning skills in undergraduate health professional students.

UNIVERSITY of the
WESTERN CAPE

1.3 PROBLEM STATEMENT

Optimal clinical reasoning assists clinicians in making sound clinical decisions for their patients, resulting in positive patient outcomes. Undergraduate students struggle with the ability to demonstrate clinical reasoning, to diagnose patients and to develop an appropriate treatment plan for their patients. Several teaching strategies aim to enhance clinical reasoning; however, the use of a learning theory is not always explicit. By understanding the theory that underpins the teaching strategy, educators may be able to enhance the development of reasoning in students, which will improve patient outcomes.

http://etd.uwc.ac.za/

1.4 RESEARCH QUESTION

The research question for this review was formulated by using the PICO framework.

TABLE 1: PICO framework

P	POPULATION	All studies with all undergraduate health professional students were included.
I	INTERVENTION	In the context of this study, the 'intervention' is the use of theory by educators or researchers, to underpin their teaching strategies as they aimed to develop clinical reasoning
C	COMPARISON	This study will not exclude articles that lack comparisons between groups.
O	OUTCOME	The outcome will show whether there was a change in clinical reasoning when theory underpinned the strategies used by the educators.

UNIVERSITY of the
WESTERN CAPE

Therefore, the research question was: Which learning theories do educators use to inform their strategies that aim to develop clinical reasoning in undergraduate health professional students?

1.5 AIM

The aim of the study was to explore the use of theory to inform teaching strategies which develop clinical reasoning in undergraduate health professional students.

http://etd.uwc.ac.za/

1.6 OBJECTIVES

The first objective is to identify which theories inform teaching strategies used by educators to enhance the development of clinical reasoning in undergraduate health professional students.

If educators are using theories to enhance clinical reasoning, the second objective is to determine how they are using it.

1.7 SIGNIFICANCE OF THE STUDY

The clinical reasoning process should culminate in adequate clinical judgement which can result in ideal patient outcomes. Health professional students should be made aware of the clinical reasoning process in order to make good judgements for their patients. This study aims to contribute to consensus on the foundation for teaching strategies utilised to teach clinical reasoning to undergraduate health professional students.

UNIVERSITY of the
WESTERN CAPE

1.8 CONCLUSION

This chapter highlighted the broad concepts involved in the development of clinical reasoning, from its definition and interchangeable term usage to its importance in the learning process among student health professionals. Enabling sound clinical reasoning is the central aim of health professional students' education, in order to provide optimal care to patients. The development of clinical reasoning is still seen as a difficult task by educators and the ability to teach and assess clinical reasoning skills remains unclear. This introductory chapter also described the importance of the educator's role, within which environment clinical

http://etd.uwc.ac.za/

reasoning skill would be appropriate to develop and highlighted how theory and clinical reasoning are linked. It was noted how theory can contribute to the way that students think about their own thinking, and how educators can help with this process. The problem statement of this study was outlined and by identifying the theories available to develop clinical reasoning skills, this could help educators. The formulation of the review question, the aim and objectives of the review and the significance of the study were also included.

1.9 SUMMARY OF CHAPTERS

Chapter 1 – Introduction

This chapter provides a background to clinical reasoning and introduces the concepts used in this study. An introduction to learning theories is presented, and their importance for developing clinical reasoning skill in undergraduate health professional students is explained. The study's aims, objectives and the significance of the study are also introduced.

UNIVERSITY of the
WESTERN CAPE

Chapter 2 – Literature review

This chapter unpacks and explores what other authors and studies have found regarding clinical reasoning, specifically relating to teaching strategies and theories. Difficulties with clinical reasoning and possible solutions offered in the literature are explored.

Chapter 3 – Methodology

This chapter describes the way in which the scoping review was conducted and the format that was used. It also examines the advantages and disadvantages of this study design. The methodology is discussed in terms of the step-by-step procedure followed by the researcher, including the process of critical appraisal.

Chapter 4 – Results and discussion

http://etd.uwc.ac.za/

This chapter describes the findings of the step-by-step process undertaken in the scoping review. The findings of the study are explained in detail through a narrative synthesis and are discussed in relation to the data that was extracted.

Chapter 5 – Conclusion, limitations and recommendations

This is the final chapter. It provides a conclusion to the scoping review findings. With these findings, the research question, the aim and objectives of the study are answered. The chapter also discusses the limitations of the study and recommendations are made regarding further studies involving clinical reasoning development.

The next chapter will unpack the complexities of the concept of clinical reasoning and look at the literature regarding teaching strategies and theories available to support this phenomenon. The challenges faced by educators to teach, assess, and develop will also be explored.

UNIVERSITY of the
WESTERN CAPE

http://etd.uwc.ac.za/

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

In this chapter, literature pertaining to the development of clinical reasoning will be presented. This includes the teaching strategies explored by educators to develop clinical reasoning and the importance of learning theories that support the development of clinical reasoning. The learning theories available are highlighted, as well as theories explaining how reasoning occurs. Difficulties faced by educators and student health care professionals regarding the clinical reasoning process, as well as possible solutions made available in the literature, will also be discussed.

UNIVERSITY of the
WESTERN CAPE

2.2 TEACHING STRATEGIES SUGGESTED TO IMPROVE CLINICAL REASONING ABILITIES

Teaching strategies are aimed at improving knowledge, improving organisation of knowledge, improving metacognition, and improving data processing. Many teaching strategies assist with the development of clinical reasoning skills have been researched and the results of some of those studies will be discussed below. Cutrer et al. (2013) presents teaching strategies to guide clinical educators with improving clinical reasoning skills. Their study highlighted dual process theory as helping the development of clinical reasoning abilities, but they do not mention how this theory can be used in their suggested teaching strategies. Dual process theory is a cognitive psychology theory that can be defined as a means to provide an explanation of how thought can occur in two different ways or in two different processes (Lizardo et al., 2016; Vaisey, 2009). This concept will be unpacked further in this study. "Illness scripts" has been identified as a teaching strategy for improving

http://etd.uwc.ac.za/

knowledge, which are designed to help organise, store, and retrieve information. Illness scripts are "specialised knowledge structures that link clinically relevant information about general disease categories, specific examples of diseases, and conditions that enable diseases to flourish in living beings" (Lubarsky, Dory, Audétat, Custers, & Charlin, 2015). "Scaffolding" is used to assist with the organisation of knowledge; this can be used by the educator to help the student with solving a problem (Cutrer et al., 2013). Scaffolding is an active process involving the health professional student and the educator. The educators assist the health professional student to solve a problem, grasp a concept and accomplish their goals, independently. This requires the health professional student to learn through prompts, questions and reflection on their own knowledge and understanding.

Reflection, diagnostic "time out", and identification of cognitive bias are also noted as strategies to improve metacognition (Cutrer et al., 2013). Reflection and diagnostic "time out" empowers students to take a step back and analyse their own thinking and process. The authors aimed to provide a framework of teaching strategies to assist the development of clinical reasoning skill however had no outcome measure to assess whether clinical reasoning improved with any of these teaching strategies (Cutrer et al., 2013). It is also not clear whether dual process or any other theory underpins these teaching strategies.

Rochmawati and Wiechula (2010) conducted a systematic review, also highlighting educational strategies to improve clinical reasoning in health professional students. The review highlights two strategies, namely problem-based learning, and integrative curriculum. Problem-based learning refers to a student-centred teaching approach where students can learn from a problem scenario that encourages their learning process, while integrative

UNIVERSITY of the WESTERN CAPE

http://etd.uwc.ac.za/

curriculum combines various methods such as reflection, feedback and role play in which students take part in small group settings (Rochmawati & Wiechula, 2010). However, again these are educational strategies cited for assisting with clinical reasoning abilities, without mentioning which theory underpins them.

Simulation has also been researched as a teaching strategy to improve clinical reasoning abilities (Bae, Lee, Jang, & Lee, 2019). Bae et al. (2019) conducted a study to develop a simulation education debriefing protocol to improve clinical reasoning among nursing students. There debriefing protocol was formulated by first using comprehensive literature review, verifying the content validity using an expert group and also in-depth interviews (Bae et al. 2019). Core questions were then formulated and a guideline for the instructor to use. The debriefing protocol was then applied to the undergraduate nursing students. Students self-reported that their reasoning competency improved and that their understanding of the overall flow of reasoning improved by using the debriefing protocol (Bae et al. 2019). The authors found that debriefing is influenced by constructivist theory, claiming that the "constructivist learning emphasizes contextual meaning of situation. It was the result of the learner's understanding of errors that occur in the process of problem solving" (Bae et al., 2019, p. 5). This study can be a useful source for educators when selecting simulation and debriefing as a teaching strategy as it is underpinned by a learning theory. It also assists with the understanding of how the learning theory and teaching strategy influences the development of the learning experience of students.

UNIVERSITY of the WESTERN CAPE

http://etd.uwc.ac.za/

2.3 THEORIES SUPPORTING THE DEVELOPMENT OF CLINICAL REASONING SKILLS

2.3.1 IMPORTANCE OF THEORIES

Theories of learning are derived from philosophy of education, psychology, pedagogic studies, sociology and recently neuroscience (Stewart, 2016; Taylor & Hamdy, 2013). "Theories can provide complex and comprehensive conceptual understandings of things that cannot be pinned down: how societies work, how organisations operate and why people interact in the ways that they do" (Reeves, Albert, Kuper, & Hodges, 2008, p. 631). In health care, a consideration of theories can provide an understanding of situations faced daily and can be an important guide in delivering patient care (Reeves et al., 2008). The development and analysis of learning theories has influenced the understanding of how individuals obtain knowledge and how they adapt their ways of thinking, feeling and behaving (Fayram, 2003). Stewart (2016) discusses different learning theories such as behaviourism, constructivism, situated and social theories. These different theories are also highlighted by Fayram (2003) who points out that selecting and structuring the learning experience creates an opportunity for students to add more meaning and clarity to their development of clinical reasoning. Many theories overlap in the influence they have in implementing and developing clinical reasoning in health professional students. For this reason when categorising these learning theories, they can form part of or relate to several categories (Taylor & Hamdy, 2013; Young, 2018).

UNIVERSITY of the WESTERN CAPE

2.3.2 LEARNING THEORIES HIGHLIGTED BY DIFFERENT AUTHORS

Patton, Higgs, and Smith (2013) revealed theories that are beneficial for educators to consider when developing the health professional learning skills. The theories mentioned in this study

http://etd.uwc.ac.za/

were social theories of learning and situated learning theories. The authors only assessed how the learning theories influenced the practice of physiotherapy (Patton et al., 2013). They presented the theories and mentioned that through social dimensions of clinical learning environments, specifically, access to people, influences the students clinical learning. The theories also allow learning to be meaningful for the students. The students learn through guided participation and by means of scaffolding Patton et al., 2013). The authors further encourage educators to make use of the learning theories described in their study when selecting teaching strategies.

Similarly, Young (2018) describes four categories of theories: knowledge, knowledge organisation, cognitive processes, and metacognitive processes. There is an array of theories, some of which are learning theories and this overview by Young (2018) gives insight into how theory can influence teaching, and which measuring tools educators can use to enhance clinical reasoning abilities. Young (2018) mentions that good clinical reasoning requires a broad and large knowledge base, these can be influenced through using approaches such as lectures, readings and self-explanation to influence teaching and learning. To assess these, multiple-choice questions and short answers can be used as approaches (Young, 2018). Knowledge organization can be influenced by Prototype theory, illness script theory and also exemplar theory. Prototype theory allows for a strong representation of typical symptoms or disease presentations which can be taught be using lectures on clinical presentations and small-group readings and activities. Progress can be assessed through using multiple choice questions and objective structured clinical exams (OSCE). Illness script theory (previously explained) can be taught by using case-based learning, concept mapping and clinical case discussion. The script concordance test and concept mapping can then be used as assessment. Exemplar theory requires a large and varied body of examples of clinical presentations of

UNIVERSITY of the WESTERN CAPE

http://etd.uwc.ac.za/

illness, these can be taught through work- based learning, virtual patients and simulated patients. Usage of written clinical case vignettes and extended matching items can be used to measure progress (Young, 2018). Cognitive processes highlight hypothetico-deductive model, dual process theory and situativity theory. These theories can be influence teaching through using case-based learning, virtual patients, clinical discussions practicing analytic and non-analytic approaches as well as workplace-based learning and interprofessional learning practices. Approaches to use for assessing these can be clinical reasoning problems, mini clinical evaluation exercise, oral case presentations, OSCE and key feature questions (Young, 2018). The last category described by Young (2018) is metacognitive process. These are influenced by Heuristics and Bias (the ability to monitor for possible bias and errors in reasoning and to correct them) and also reflective practice (the ability to reflect on one's own reasoning). These can influence learning by using small group coaching, prompted reflection, lectures introducing bias and debiasing strategies and also morbidity and mortality rounds. To assess these the educators can use written case reports, chart audit, direct observation, self-regulated learning microanyalytic assessment (SLR MAT) and clinical justification (Young, 2018). In addition, Young (2018) also mentions which of these learning theories fit into these selected categories and these theories mentioned were categorised into areas of clinical reasoning processes. This source by Young (2018) could be useful in assisting the educator with enhancing clinical reasoning abilities in students. Although this summary is provided by Young (2018), it is still unclear whether educators are using these approaches when developing clinical reasoning abilities.

A study by Durning et al. (2013) described four learning theories used by medical educators to understand learning. This study aimed to clarify the assumptions held by the different roles of learning theories and theories of reasoning regarding the assessment and understanding of

UNIVERSITY of the WESTERN CAPE
http://etd.uwc.ac.za/

clinical reasoning (Durning et al., 2013). The authors looked at behaviourism, situativity theory, cognitive load theory and information process theories (dual process and script theory), concluding that certain theories will apply to certain situations and provide a different way of showing reality and informing how the different aspects occur (Durning et al., 2013).

2.3.3 SCRIPT THEORY AND CLINICAL REASONING

Script theory aims to describe how information is stored in, and retrieved from the human mind to guide the individual's understanding of the world (Lubarsky et al., 2015). Script theory requires the individual to retain acquired knowledge in the form of schemas or scripts. These are described in health care as "illness scripts". According to the authors, script theory informs the relationship between clinical reasoning and knowledge organisation (Lubarsky et al., 2015). They furthermore list teaching strategies that are based on script theory. These teaching strategies include problem-solving, concept mapping and "think out loud" strategies, to mention a few. This example of how theory is underpinning the teaching strategy is ideal for educators to utilise when they are planning to develop clinical reasoning in health professional students.

UNIVERSITY of the
WESTERN CAPE

From all the information available in literature, there is an indication that using learning theories may support the development of clinical reasoning abilities. Although some authors have encouraged the use of theory in the development of clinical reasoning, there is little evidence that educators implementing teaching strategies with this aim, have made use of those theories to inform their pedagogical choices. In addition, there isn't a clear indication of whether clinical reasoning is improved using these teaching strategies. Clinical reasoning has

http://etd.uwc.ac.za/

been seen as a challenge for educators to teach and with the changing world, one should look at what ways are we changing our approaches to improve students' reasoning abilities (Higgs et al., 2008). Literature suggests that student health professionals still experience difficulties with developing clinical reasoning skills. Studies have revealed that errors can occur at any step of the student's reasoning process. These errors can occur in the form of inadequate knowledge, incorrect data gathering, incorrect metacognition and incorrect processing of the clinical information (Cutrer et al., 2013).

2.4 DIFFICULTIES WITH CLINICAL REASONING

Acquiring knowledge and practical skills can be seen as the primary way of teaching and preparing the student; therefore, acquiring clinical reasoning skills may become secondary to this. Clinical reasoning has been seen as a skill that comes with experience and time (Pelaccia, Tardif, Triby, & Charlin, 2011a) and even though the educator's teaching skills are based on expert knowledge, it is still not clear how experts acquire their reasoning skills (Kassirer, 2010).

UNIVERSITY of the
WESTERN CAPE

Another common difficulty that has surfaced is that students' errors with clinical reasoning are sometimes noticed too late. The best approach to remediate this is to do so early if clinical reasoning difficulties are observed by the educators (Audétat, Laurin, & Dory, 2013; Pestiaux et al., 2012). It is the role of the educator to identify these errors and help students to minimise further errors in their clinical reasoning abilities. Theories of learning can assist the student with their own understanding and thinking, which minimises these potential difficulties with the reasoning process. Making use of both the teaching strategies and the underlying theories that support them can assist the students in their reasoning processes and

http://etd.uwc.ac.za/

minimise errors which could compromise the health care of the patient (Gibbs, Durning, & Van Der Vleuten, 2011). This can be addressed by ensuring the educator's approach and intervention are aimed at continuing the development of clinical reasoning for the health professional students.

In their study, van Wyngaarden et al. (2019) described some of the difficulties and challenges mentioned by educators. The educators' own challenges and limitations were discussed when developing clinical reasoning skills and of these challenges were seen in the theoretical and clinical areas. Theoretical challenges placed an emphasis on educators admitting to using teacher-centred and not learner-centred strategies. Teacher-centred strategies pertain to rote learning, memorizing and information gained by repetition. The educators further highlighted that the clinical learning environment was not supportive or adequate for student learning (van Wyngaarden et al., 2019). Exposure to limited practice time in simulation laboratory for students and lack of opportunities to practice their clinical skills in safe and non-threatening environment were of the concerns. They also revealed that the nursing educators believed there is a lack of integration of theory and clinical and this outcome hinders clinical reasoning skills. Inadequate supervision and limited time within the clinical setting may also contribute to the students learning and in this way affect clinical reasoning abilities (van Wyngaarden et al., 2019). Although this was mentioned, one also needs to take into consideration that this study only looked at one health profession discipline, namely nursing. The study also only took place in South Africa and only at one university. Nonetheless, it still emphasises the issues and challenges faced by educators with developing clinical reasoning.

UNIVERSITY of the
WESTERN CAPE

http://etd.uwc.ac.za/

The study by Voges and Frantz (2019) also took place in South Africa looked at clarifying the role of clinical supervisors and also described the challenges faced by clinical supervisors. The authors also reported challenges that the clinical supervisors mentioned. Of these challenges, lack of theoretical knowledge was identified and the clinical supervisors found that time constraints during their clinical supervision sessions limited them to time spent on teaching theory instead of integrating theory into practice (Voges & Frantz, 2019). Furthermore, the authors mentioned that the main challenge for the clinical supervisors was that they questioned their own skill as educators. Acknowledging the difficulties and errors that educators and students might encounter, may allow one to analyse whether applying theories will assist in minimising these situations.

UNIVERSITY of the
WESTERN CAPE

Educators can attend to these challenges and difficulties and empower themselves to create an opportunity to change the way clinical reasoning is developed. The ability to adapt to a more learner-centred approach may require the assistance of learning theory, as the educators can improve the development of the health professional students' reasoning abilities. Learner-centred approaches are self-directed learning, problem solving methods making the student more involved in their own learning (Spencer & Jordan, 1999).

2.5 SOLUTIONS OFFERED TO ASSIST EDUCATORS WITH CLINICAL REASONING DIFFICULTIES

A study that explored teaching clinical reasoning claimed that clinical reasoning skills should be taught in the early stage of development and not once knowledge is acquired (Kassirer, 2010). This notion is supported by other researchers regarding the early development of clinical reasoning (Alshehri, 2017; Coelho et al., 2017). Another suggestion is to ensure that

http://etd.uwc.ac.za/

educators are aware of their own clinical reasoning abilities (Schmidt & Mamede, 2015). Schmidt and Mamede (2015) point out that the educators' own beliefs, experience, and interpretation of evidence have an influence on the teaching strategies they choose to develop the clinical reasoning abilities of health professionals. This observation is shared by other authors, such as Delany and Golding (2014). Their study trialled a method of teaching clinical reasoning where educators had to develop a heuristic of their own clinical reasoning and in doing so made their own thinking visible to students (Delany & Golding, 2014). This method allowed the educators to think about their own thinking (metacognition). They then also had the ability to assess whether it assisted the students' reasoning skills and if its aim was to develop those skills (Delany & Golding, 2014).

Students' experiences of the development of clinical reasoning are also available in the literature. Feedback and observation have been highlighted as a manner to develop clinical reasoning. According to Ernstzen, Bitzer, and Grimmer-Somers (2010), students gain more knowledge from observing the clinical supervisor and even more when the thought processes of the clinical supervisor are explained, thereby helping the development of clinical reasoning skills (Richmond, Cooper, Gay, Atiomo, & Patel, 2020). Learning by observation is supported by social cognitive theory and although mentioned by the authors, they do not indicate how theory is applied within their study or by the educators themselves (DV Ernstzen, Bitzer, & Grimmer-Somers, 2010). Students commented that they appreciated constructive and immediate feedback by their clinical supervisors, which encouraged their specific needs to help develop clinical reasoning skills (de Beer & Mårtensson, 2015).

UNIVERSITY of the WESTERN CAPE

http://etd.uwc.ac.za/

2.6 THEORECTICAL FRAMEWORK- DUAL PROCESS THEORY

Dual process theory is a model of reasoning that assimilates the major processes that have been identified since the 1970s in the field of clinical reasoning research (Pelaccia et al., 2011b). The work from Epstein and Hammon, dated to the 1990s, demonstrates that the theory consists of two cognitive systems: System 1 (analytical) and system 2 (non-analytical) (Pelaccia, Tardif, Triby, & Charlin, 2011b). System 1 is fast response, uses existing information, recognises similar patterns that were previously faced, and is indicative of the kinds of reasoning employed by experts (Cutrer et al., 2013; Pelaccia et al., 2011b, 2011a). System 2 refers to a slower, more analytical and conscious thinking approach. It is rational and analytical and is used when information is new. Using system 2 is slower and a more challenging cognitive process than system 1.

The dual process theory and as a model have been used by educators to explain how reasoning occurs. Therefore providing a wide-ranging framework to understand 'the paradox of experience' (Pelaccia et al., 2019). This recognition of how reasoning occurs in health professional students can assist clinical reasoning abilities (Cutrer et al., 2013; Pelaccia et al., 2011b). In the health profession disciplines, novices (students) are known to use an analytical approach while experts (clinicians, educators) are more likely to use pattern recognition (a more non-analytical reasoning approach) (Durning et al., 2013; Osman, 2004; Pelaccia et al., 2011b). System 1 and system 2 can also be used simultaneously throughout the cognitive process theories. With regard to clinical reasoning, dual process as a framework is seen as a non-analytical system (pattern recognition) and intuitive system (hypothetic deductive) (Pelaccia et al., 2011b). Durning et al. (2013) describe dual process theory as an information processing theory. The authors claim that dual process theory is an internal mental process and is used when physicians need to manage a clinical scenario (Durning et al., 2013).

http://etd.uwc.ac.za/

Applying this theory to the results of the current scoping review possibly highlights that choosing a teaching strategy based on theory may be a more analytical process compared to when the educator makes decisions regarding teaching practice intuitively.

2.7 CONCLUSION

This chapter described and highlighted the available literature on the development of clinical reasoning. A variety of findings assisting educators with teaching strategies to develop clinical reasoning were noted. However, very few of these teaching strategies were underpinned by theory. The importance of theory and how educators can incorporate it, is evident. There is available (but limited) literature concerning teaching strategies which are informed by learning theories. The chapter also identified the challenges that educators and students face with developing and understanding clinical reasoning. Theories, particularly learning theories, provide opportunities to understand how educators and students reason and also empower students to think about their own thinking. The next chapter describes the methodology used in performing the scoping review.

UNIVERSITY of the
WESTERN CAPE

http://etd.uwc.ac.za/

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This chapter explains the research methodology, the collection of data and the data analysis techniques used in this study. Scoping reviews do not necessitate a review protocol (Thomas et al., 2017) therefore a protocol for this review has not been registered. The PRISMA Extension for Scoping Reviews (PRISMA-ScR) guidelines were followed in conducting the review and reporting the findings. The first step was to develop the search strategy that led to the identification of articles, which led to screening of the articles that were identified. The third step was to assess their eligibility before reviewing the full text of articles that were eligible for inclusion. A data extraction form was designed and used to extract the relevant data from selected articles. Finally, a narrative synthesis was conducted on the results.

UNIVERSITY of the
WESTERN CAPE

3.2 RESEARCH DESIGN

The research design for this study was a scoping review that was conducted according to the PRISMA-ScR guidelines (see addendum 5). These guidelines aim to improve the reporting of scoping reviews and increase their relevance for decision-making (Tricco et al., 2018). Scoping reviews are used to present a broad overview of the evidence pertaining to a topic (Peters et al., 2015). They aim to map out an overview of key concepts that underpin a research area, are useful when examining areas that are emerging, and can identify gaps in the literature (Peters et al., 2015). Scoping reviews can also assist by recognising the need for future systematic reviews (Arksey & O'Malley, 2005; Tricco et al., 2016). According to Arksey and O'Malley (2005, p. 22), the "scoping review method is guided by a requirement to identify all relevant literature regardless of the study design". Arskey and O'Malley (2005)

http://etd.uwc.ac.za/

also provide a possible framework for conducting the review. Scoping reviews have also been found to be beneficially in health professional literature where evidence base is growing and the emphasis on evidence-informed methods is increasing (Thomas, Lubarsky, Durning, & Young, 2017; Thomas, Lubarsky, Varpio, Durning, & Young, 2020). Selecting a scoping review design is for the researcher who is more interested in the identification of certain concepts in papers or studies, and this can assist in the mapping, reporting or discussion of these concepts.

3.2.1 ADVANTAGES AND DISADVANTAGES OF SCOPING REVIEWS

The advantages highlighted by Arksey and O'Malley (2005) are that a scoping review assists the researcher with providing rigorous and transparent research in a short period, compared to a lengthy period required for a systematic review. The disadvantages of scoping reviews are that they do not have to appraise the quality of evidence, the quantity of data can be considerable, and scoping reviews may not address the issue of synthesis (Arksey & O'Malley, 2005). Bearing all these factors in mind the scoping review proved to be a viable option for the length of the present thesis being submitted for a master's degree. Even though it is not customary to appraise articles as part of a scoping review, the present review has done so in order to comment on the rigour of the included articles.

UNIVERSITY of the
WESTERN CAPE

3.3 SEARCH STRATEGY

The strategy commenced with searching for literature published during the period of January 1994 and December 2019. Clinical reasoning research has also been undertaken for many years, which influenced the decision to search as far back as 25 years. Furthermore, only articles published in English were considered. The population criteria included all studies

http://etd.uwc.ac.za/

conducted among undergraduate health professional students from the disciplines of medicine, physiotherapy, occupational therapy, dentistry, speech therapy, nursing, dietetics, pharmacy and emergency medicine.

The study designs included randomised controlled trials, cohort, case-control and cross-sectional studies. Grey literature did not yield significant contributions in this study. Studies that described interventions used to develop clinical reasoning in undergraduate health professional students were included in the identification process. Studies that addressed clinical reasoning in postgraduate students, studies that included educators, faculty members and/or experts in their data collection were excluded. Any duplications were also removed.

UNIVERSITY of the
WESTERN CAPE

The following databases were accessed: Academic Search Complete, Biomed Central, CINHAL, ERIC, Health source: Nursing Academic Edition (EbscoHost) and Medline (EbscoHost). These databases were chosen because they are multidisciplinary full text databases. They also provide citations for nursing, allied health, medical and other education related journals. Short inscriptions of the databases selected can be found on the University of the Western Cape online databases. Each database has its own indexing terms and functions, and therefore different search processes were developed for each database by the researcher and the supervisor. The search terms and synonyms in Table 2 below were used in different combinations as part of the search strategy.

TABLE 2: Search terms and synonyms

Search term	**Synonym**
Clinical reasoning	Critical thinking, clinical decision-making, clinical judgement
Educators	Lecturers, clinical supervisors/educators

http://etd.uwc.ac.za/

Health professional student	Novice, learner
Development	Enhancement, improvement, learning process

The reference lists of all identified articles were manually searched to identify additional evidence that may have been relevant. The search strings are presented in Addendum 1.

3.3.1 SCREENING OF ARTICLES

Retrieving the studies took place after reviewing the titles and abstracts. For studies that satisfied the inclusion criteria following this preliminary evaluation, abstracts were read and then the full texts of articles were reviewed for eligibility. The articles were reviewed independently and any discrepancies regarding eligibility were discussed between the researcher (IE) and supervisor (DH) until consensus was reached.

UNIVERSITY of the
WESTERN CAPE

3.3.2 CRITICAL APPRAISAL OF METHODOLOGICAL QUALITY

Critical appraisal is not necessarily a requirement for a scoping review; however, it was conducted to gain a sense of the quality and rigour of the articles that were included in the review. It should be noted that articles were not excluded if they did not satisfy the criteria for critical appraisal. The methodological quality appraisal of the article's rigour was conducted using standardised critical appraisal instruments from the Joanna Briggs Institute Qualitative Assessment (JBI) tools. These appraisal tools offer various checklists for the different study designs that were specified in the inclusion criteria. There are 13 tools, each of which addresses a specific study design or other form of evidence. Each tool contains an introduction to JBI, and a checklist followed by an in-depth explanation of each question. Each checklist contains a series of critical appraisal questions and ends with an overall

http://etd.uwc.ac.za/

appraisal decision. The questions and explanations are clearly written and could be utilised by novice consumers for evidence (Buccheri & Sharifi, 2017). The full text articles were separately appraised by the researcher and supervisor. Each reviewer appraised each article with the JBI tool separately, and then compared their results. Any differences were discussed, and a decision was made regarding the academic rigour of the article. A third reviewer, the co-supervisor (MR), was consulted when consensus on academic appraisal was not reached. The critical appraisal was used to make statements about the rigour of papers that claim to develop clinical reasoning (see Addendum 2).

3.3.3 DATA EXTRACTION

A self-developed data extraction form was used to extract the data. This data extraction form was modified from a form originally adapted by (Hoque et al., 2017). The form was consequently adapted by the researcher to make sure the research question and objectives could be met, allowing the researcher to extract data pertaining to the theory that informs the teaching strategy. The data extracted was then categorised according to the following criteria: theory that was used, location of the study, number students and educators who participated, the disciplines involved, the outcomes reported, and improvement of clinical reasoning (if any). The data extraction process was completed by the researcher. Prior to the data extraction process, a pilot of the data extraction was completed by the supervisor and the researcher. Articles that had been removed from the screening process because they did not meet the inclusion criteria, were used for this pilot. The piloting went through two iterations. During the first iteration, only three of the non-included articles were reviewed. Reviewers IE and DH considered this number to be inadequate and then further piloted six different articles which had been excluded, as part of the second iteration. The co-supervisor (MR) was asked

UNIVERSITY of the WESTERN CAPE

http://etd.uwc.ac.za/

to review the extraction form and provide consensus on some items that were ambiguous. After piloting, the final self-developed extraction form was used separately by the researcher and the supervisor for the included retrieved articles. The data extraction form is attached as Addendum 3.

3.3.4 DATA ANALYSIS

A narrative synthesis was undertaken by the researcher. Narrative synthesis was selected for the study design and was considered suitable for the retrieved studies for the scoping review. Narrative syntheses are also used when statistical meta-analysis or another specialist form of synthesis (such as meta-ethnography for qualitative studies) is not possible (Popay1 et al., 2006). These authors also refer to narrative synthesis as an approach to the review and synthesis of findings from multiple studies that rely primarily on the use of words and text to summarise and explain the findings of the synthesis (Popay1 et al., 2006). It allows for a textual approach and allows the researcher to "tell the story", bringing together the evidence and explaining why it needed to be done or be stopped (Popay1 et al., 2006).

This study's narrative synthesis was conducted in such a way that best describes the findings so that the theory underpinning teaching strategies is adequately highlighted. The results from the included studies were grouped according to the theories that underpin teaching strategies, and the teaching strategies that were utilised. Text summaries and tables were used to synthesise and explain the data. The methodology and results of the studies chosen were compared to see if there was any association between methodological features and results (changes in clinical reasoning). The critical appraisal of the included articles was also

http://etd.uwc.ac.za/

explained, providing insight into the robustness of the final articles. The different health profession disciplines and the countries where the research took place were commented on, as well as outcome measurements and the improvement of clinical reasoning. Accordingly, the results of this study may also serve as a guide which could be utilised by educators when developing the clinical reasoning abilities of health professional students.

3.4 ETHICAL CONSIDERATIONS

Ethics clearance was obtained from the University of the Western Cape's Biomedical Research Ethics Committee (BMREC), with ethics reference number BM19/8/1. To ensure transparency, the studies included in this review were published articles which are available to the public. The primary researcher in this study was registered as a full-time student at the University of the Western Cape, therefore enabling full access to the university library databases. To maintain the trustworthiness and reliability of the findings and data analysis, the study maintained awareness of ethical dilemmas such as plagiarism, duplication of publication and having transparency (Vergnes, Marchal-Sixou, Nabet, Maret, & Hamel, 2010; Wager & Wiffen, 2011). To avoid bias, two people independently reviewed the current study (the primary researcher and their supervisor). All discrepancies between decisions were referred to the co-supervisor, who provided clarity and assisted with reaching consensus.

UNIVERSITY of the
WESTERN CAPE

3.5 CONCLUSION

Chapter 3 explained the step-by-step process that was followed in conducting this scoping review. The chapter detailed the review procedure and which was carried out in accordance with the stipulations of the PRISMA-ScR. As part of the methodology of the scoping review, the researcher opted to include a critical appraisal of the reviewed articles in order to discuss

http://etd.uwc.ac.za/

and comment on the rigour of the articles. The data analysis was discussed through a narrative synthesis. Approval of the study was obtained from the university's Ethics Committee. The next chapter details the results after following these methodological steps. The results are discussed in such a way that the research question of the study is effectively answered.

http://etd.uwc.ac.za/

CHAPTER 4

RESULTS AND DISCUSSION

4.1 INTRODUCTION

This chapter sets out the results, explores the research findings and demonstrates whether the research question could be answered and if the aims and objectives of this review were also met. Furthermore, the researcher describes the findings through the literature as part of the discussion. The aim of this review was to explore the use of theory to inform the teaching strategies which develop clinical reasoning in undergraduate health professional students.

UNIVERSITY of the
WESTERN CAPE

4.2 SEARCH STRATEGY

The search terms and search strings used across the chosen databases resulted in a total of 6909 hits. (See Table 3 below).

TABLE 3: Summary of search by database

Database	Hits	Identified	Duplicates	Final retrieved
Academic search	1103	128	48	80
BioMed Central	1922	13	13	0
CINHAL	768	6	3	3
Health Resource	1398	169	62	107
ERIC	835	108	40	68
Medline	883	120	57	63

http://etd.uwc.ac.za/

The figure below (flow chart) summarises the electronic search strategy of one database, ERIC. No limits were used and all possible search strings were included.

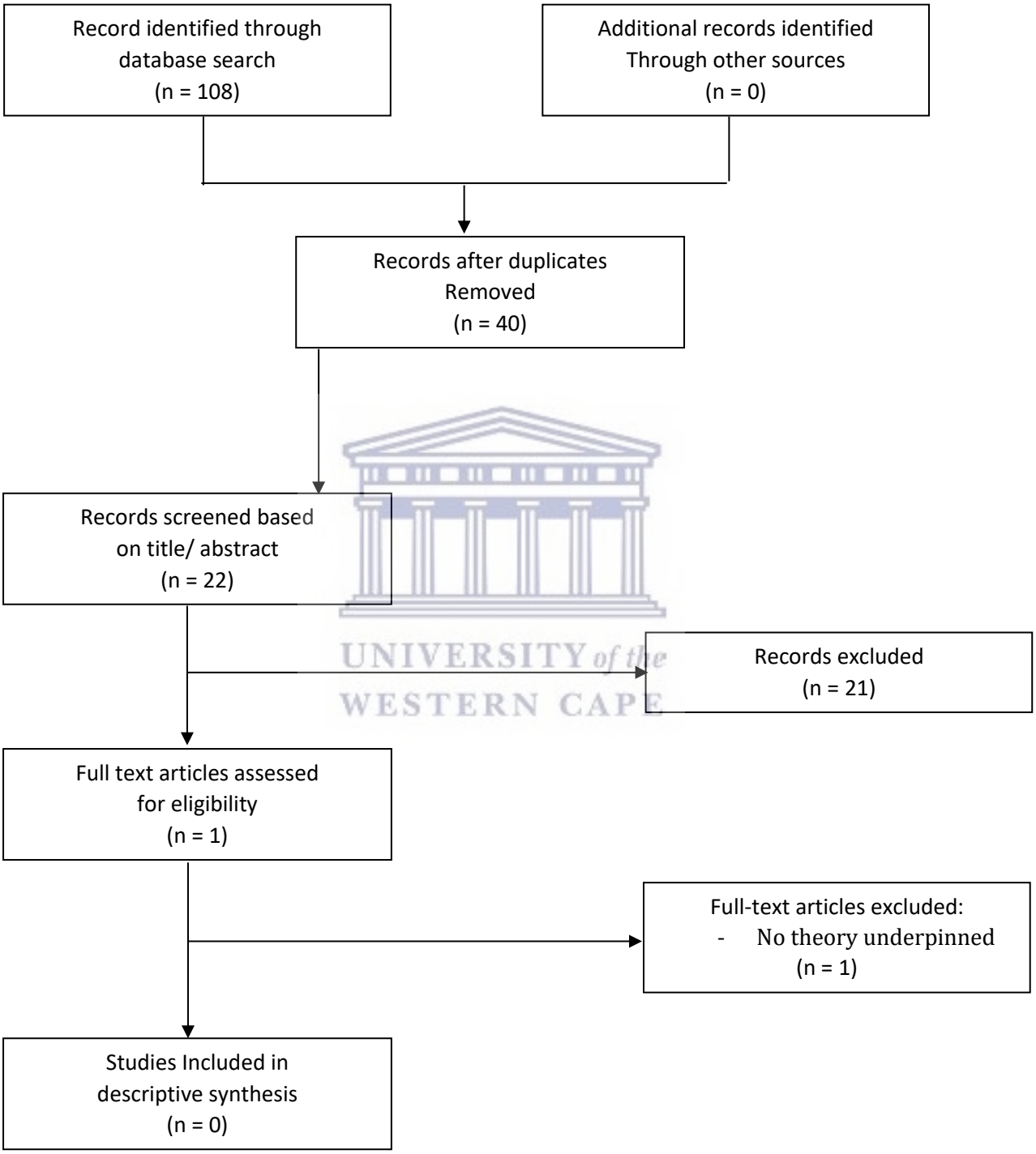


FIGURE 1. Search strategy flow chart

UNIVERSITY of the WESTERN CAPE

http://etd.uwc.ac.za/

The figure below summarises the stages of the review according to the PRISMA-ScR flow chart.

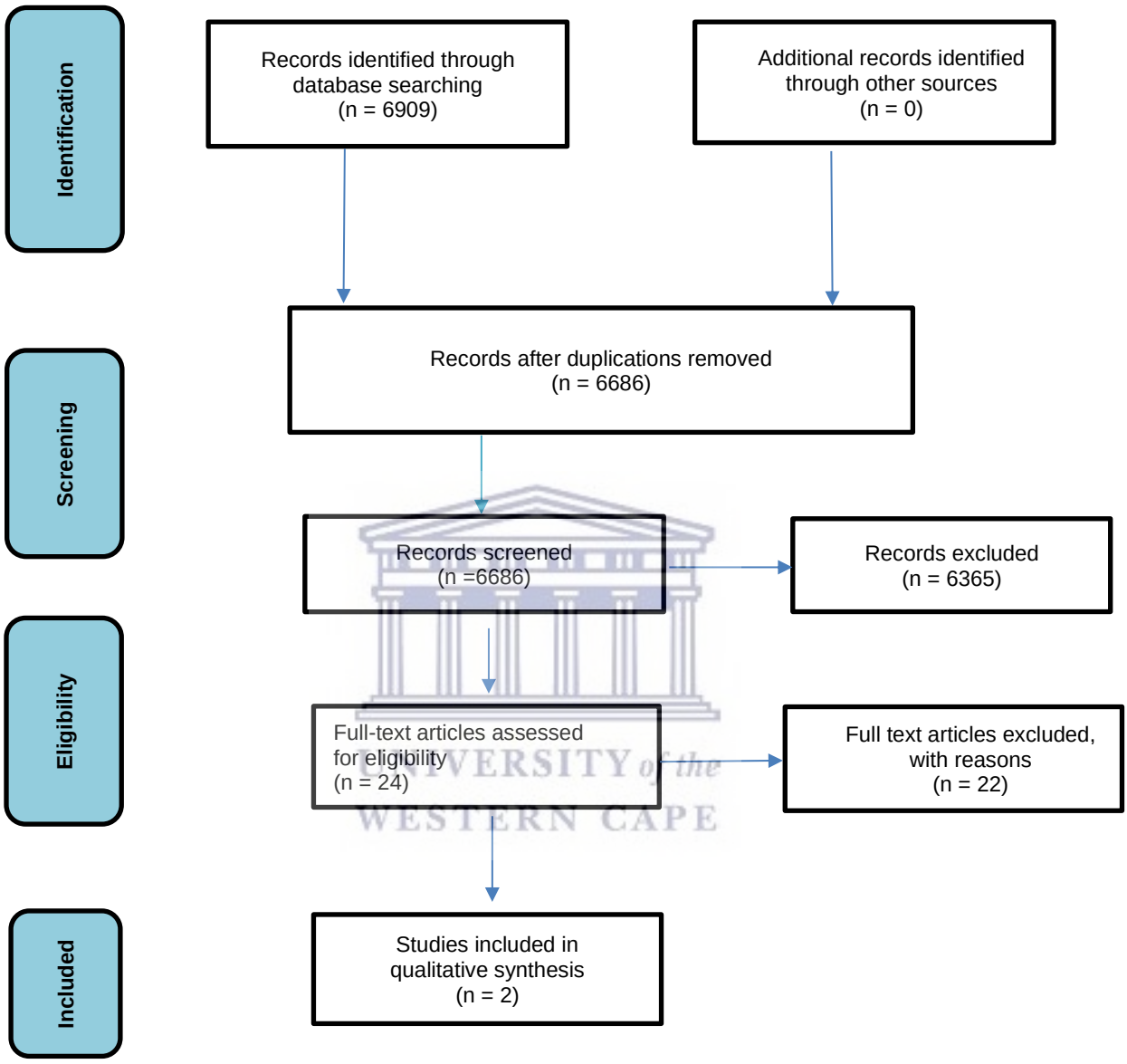


FIGURE 2: PRISMA-ScR flowchart

UNIVERSITY of the WESTERN CAPE

http://etd.uwc.ac.za/

4.3 SCREENING

A total of 6686 titles seemed applicable from the initial hits after the 223 duplicates were removed. After removing titles that did not meet the inclusion criteria a total of 321 abstracts were read by the researcher. Once the abstracts were screened, another 297 studies that were not applicable were removed. A total of 24 potential studies remained for full text screening. These remaining studies were screened independently by the researcher and by the supervisor. When consensus could not be reached regarding including or excluding studies based on their full text, a third reviewer, the co-supervisor was consulted for a decision. Of the remaining 24 studies, 22 were consequently removed, and the final two studies were included in the review. Reasons for the exclusion of studies are illustrated in figure 3 below

UNIVERSITY of the
WESTERN CAPE

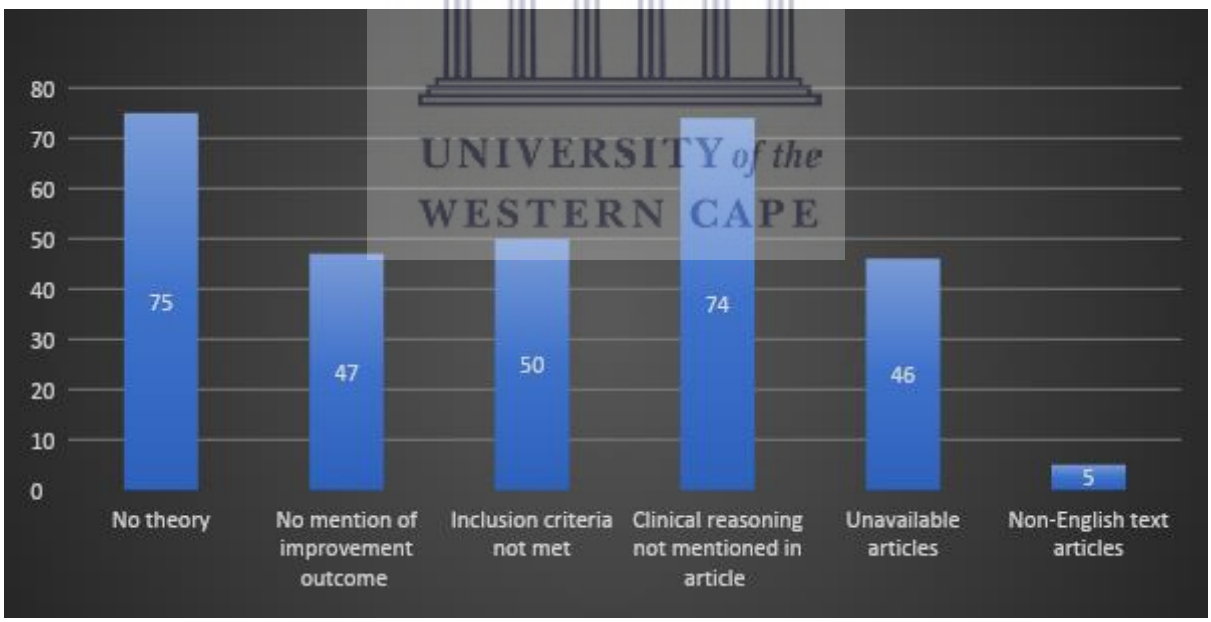


FIGURE 3: Reasons for exclusion of articles

http://etd.uwc.ac.za/

4.4 CRITICAL APPRAISAL

This step is not required as part of a scoping review (Tricco et al., 2018), but was performed to explore the rigour of the included studies. This is commented on further in this chapter as the critical appraisal of methodological quality as part of the discussion.

4.5 SELF-EXTRACTION FORM

Summary of results

The self-extraction form was adapted from a form originally adapted by Hoque et al. (2017). The form aided in extracting specific data pertaining to the research question, aim and objectives of the review. The co-supervisor was contacted for comment on the form prior to the pilot, and once again regarding the final version of the self-developed form. A summary of the data extracted from the two reviewed articles is shown in Table 4 below.

UNIVERSITY of the
WESTERN CAPE

http://etd.uwc.ac.za/

TABLE 4: Summary of data extracted from the two studies reviewed

Citation	Rush, S., Acton, L., Tolley, K., Marks-Maran, D., & Burke, L. (2010). Using simulation in a vocational programme: does the method support the theory? *Journal of vocational education and training*, *62*(4), 467-479	Torre, D. M., Hernandez, C. A., Castiglioni, A., Durning, S. J., Daley, B. J., Hemmer, P. A., & LaRochelle, J. (2019). The Clinical Reasoning Mapping Exercise (CresME): a new tool for exploring clinical reasoning. *Perspectives on medical education*
Aim	1. To evaluate simulation as a learning and teaching strategy 2. To identify its relationship to practice learning	1. To develop, implement and evaluate a novel clinical reasoning mapping exercise aimed at promoting clinical reasoning
Study design	(Case-control study) Qualitative design	(Case-control study) Qualitative design
Population	First- and third-year students	First- and second-year students
Country	United Kingdom	United States of America
Health profession	Nursing	Medicine
Teaching strategy	Simulation–students were required to work together in order to make clinical decisions	CresME (clinical reasoning mapping exercise) instructional tool
Theory underpinning the teaching strategy	Constructivist Situated learning theory	Constructivist, assimilated theory of learning, work theory and situated cognition
How theory was used	Constructing new meaning works well when learning is embedded in the social context. Simulation mimics the workplace. Accordingly, demonstrated concepts from situated learning were used.	CresME in small groups is consistent with social cognitive theories such as situated cognition, according to the authors.
Outcome measures and measurement of clinical reasoning	Outcome measures were based on the opinions and perceptions of the students. The authors used questionnaire, focus groups, observations to collect data	Outcome measures were based on the opinions and perceptions of the students. The authors used 5-item evaluation form with open-ended questions after each session to collect their data
Reported findings	Simulation model appears to promote situated learning in students. Evidence from the data–students stated that simulation affected their clinical placements practice. Students perceived learning was meaningful. Simulation mimics workplace as a learning environment. Students identified that having someone to guide their attempts helped them.	Promoted understanding of differential diagnosis. Tool helped compare and contrast differential diagnosis.

UNIVERSITY of the WESTERN CAPE

http://etd.uwc.ac.za/

4.6 NARRATIVE SYNTHESIS

The narrative synthesis describes the data as it was collected using the data extraction form; for this reason, it will be discussed under headings similar to those on the form. The study's research question asked which theories educators use to inform their teaching strategy when developing clinical reasoning. The objectives were therefore 1) to identify which theories are used by educators to inform teaching strategies that aim to enhance the development of clinical reasoning in health professional students, and if so 2) to determine how the theories are being used. Although every effort was made to ensure the search was meticulous and that the inclusion criteria were followed, the sample size remained small. The two studies included in this review used two different teaching strategies, but the overarching theory that influenced both was constructivism. The two teaching strategies in the respective studies were a type of concept map which was used in formulating the clinical reasoning mapping exercise (CresME) (Torre et al., 2019) and simulation (Rush, Acton, Tolley, Marks-Maran, & Burke, 2010) respectively. Although a "one-size-fits-all" approach when developing clinical reasoning is not possible, if learning theory is appropriately integrated, teaching strategies can assist with the development of clinical reasoning.

Rush et al. (2010) conducted their study among nursing students and Torre et al. (2019) conducted their study among medical students. The number of participants enrolled in the studies ranged from 92 to 185 students (Rush et al., 2010; Torre et al., 2019). All the nursing students who participated in the simulation process were included and a convenient sample of medical students was selected. There was no indication of age or gender of participants for both studies. Clinical reasoning studies and research regarding nursing and medical students dates back to the 1980s and has been available for decades. This is likely to be the reason

http://etd.uwc.ac.za/

why the researchers found similar studies based on nursing and medical students (Holder, 2018; Yazdani & Abardeh, 2019).

The two studies in this review took place at academic institutions located in the United States of America (Torre et al., 2019) and the United Kingdom (Rush et al., 2010). Kononowicz et al. (2020) conducted a longitudinal study of 76 countries regarding insight into clinical reasoning globally. Responses mainly came from Europe, and especially from the United Kingdom. The second country to provide the most feedback was the United States of America. These are first-world countries where resources and assistance with research may be more accessible than in third world countries. The feedback received from these countries can also relate to the regions researching clinical reasoning and its development. For this reason, in the current study's search, the articles found were located in these areas. Both study designs (Rush et al., 2010; Torre et al., 2019) were qualitative, using open-ended questionnaires as data collection tools; however, focus groups and observation of simulation were also included in the Rush et al. study. According to Higgs et al. (2008), the most preferred study design for clinical reasoning is a mixture of quantitative and qualitative methods. Higgs et al. (2008) point out that qualitative methods have a common theme of dealing with real-life situations. This supports the choice of methods by Rush et al. (2010) in their simulation programme. Furthermore, Higgs et al. (2008) observe that studying a unique situation is another common theme for selecting qualitative methods and allows the researcher to explain a single episode in detail. This relates to Torre et al. (2019) in that their tool was unique and only used in their study, making the choice of using a qualitative method more suitable for them.

UNIVERSITY of the
WESTERN CAPE

http://etd.uwc.ac.za/

4.6.1 INFLUENCE OF THEORY

Constructivism broadly underpinned the teaching strategies of the included studies, but the authors also used a subset of constructivism, namely situated learning theory. Other theories which also influenced their teaching strategies were assimilation theory of learning and situated cognition. Constructivism, a theory developed by Piaget in 1973, is "based on the premise that the act of learning is based on a process which connects new knowledge to pre-existing knowledge" (Dennick, 2016, p. 200). Piaget's theory also suggests that experience is frequently being adapted through pre-existing concepts and new knowledge is then constructed as existing knowledge(Clark, 2018; Dennick, 2016). This is then associated with existing knowledge (Clark, 2018; Dennick, 2016; Nurse et al., 2010).

Clark (2018) and Dennick (2016) describe constructivism as a learner-centred approach which requires the students to take responsibility within in their learning process. Students actively participate and the educators facilitate the process. The educators however also have the opportunity to develop, design and implement the curriculum. The research does highlight limitations to using constructivism theory, due to the rigorous academic standard and the educators requirement to capably meet the students' learning expectations (Clark, 2018; Dennick, 2016). One area that may be seen as challenging is when the educator relinquishes the control of learning to students, therefore transforming passive student learning into active learning. Constructivist theory assists health professional students because it improves critical thinking skills and allows for quick adaptation to change in evidence-based practice. Among medical and health professional learning, constructivism has been used for many years, and can be seen as the more popular choice of theory among educators. Furthermore, constructivist theory assists in the clinical setting as it teaches concepts rather than large amounts of content loaded material (Clark, 2018; Dennick, 2016; Nurse et al., 2010).

UNIVERSITY of the
WESTERN CAPE

http://etd.uwc.ac.za/

The use of simulation and the CresME tools as teaching strategies among the nursing and medical students is consistent with constructivism theory. The teaching strategies and the leaning theory are student-centred and allow the student health care professional to actively construct meaning of new information to existing knowledge(Clark, 2018; Mukhalalati & Taylor, 2019). In addition, it allows the educators to assist in development of learning by giving detailed feedback and asking guiding questions (Clark, 2018; Mukhalalati & Taylor, 2019). This learning theory allows the learner to take an active role in the learning process, which is also consistent in the respective studies.

Using constructivism theory in the learning setting provided guidance for the educator to ask questions to the students about a concept and then build on their existing knowledge. Along with constructivism theory, there has also been an increasing shift to more self-regulated learning among learners, allowing learning to be more active and constructive. This may indicate why the authors have found constructivism more suitable for their studies (Bramucci, 2013; Panadero, 2017). In the respective studies through the simulation process, the students could stop and rewind the simulation, ask questions and also reflect about their own thinking process and decision-making. The CresME tool allows the health professional students to add to their existing knowledge, which is consistent with constructivism. The need to have a more learner-centred approach when teaching clinical reasoning has been highlighted by Van Wyngaarden et al. (2019) and the use of constructivism theory by Rush et al. (2010) and Torre et al. (2019) in their studies mimicked this learner-centred approach. The advantage of this was in creating an opportunity for students engage in a metacognitive process through observation, reflection and feedback. Incorporating constructivism theory with the learning development of students has increased as part of applied learning and teaching among researchers, according to Schunk (2012). This shift of focus to the learners and how learners'

UNIVERSITY of the WESTERN CAPE

http://etd.uwc.ac.za/

knowledge is constructed, rather than on how it is acquired, could explain why both studies in the review found that constructivism was appropriate to inform their teaching strategies. This is indicative of the importance of theory, and of unifying theory with practice, as it may help to improve educational research and practice (Gibbs et al., 2011).

4.6.2 HOW THEORY WAS USED TO DEVELOP THE TEACHING STRATEGY

Rush et al. (2010) used the understanding that constructing new meaning works well when learning is embedded in the social context. Simulation was then chosen as it imitates the workplace. Therefore, the study demonstrated concepts from situated learning. Torre et al. (2019) stated that meaningful learning was used by utilising previous knowledge (designing of the illness scripts used) and then linking it to an existing cognitive framework (students using the framework). The use of the CresME tool in small groups is consistent with social cognitive theories such as situated cognition, according to the authors. The two reviewed studies appeared to use multiple theories under the umbrella of constructivism to develop their teaching strategies. Rush et al. (2010) used concepts of situated learning, work-based learning, and transfer of learning to implement their study.

UNIVERSITY of the
WESTERN CAPE

Situated learning theory is a subset of constructivism theory. This learning theory was developed by Lave and Wenger (1991). Rush et al. (2010, p. 470) suggest that situated learning theory is “training [that] cannot be separated from learning in practice and that knowledge is situated within the community of practice rather than existing somewhere else”. Situated learning theory was used when the students worked together to make clinical decisions about the care of the simulated patients. The educators and role players gave feedback to the students immediately. The educators created an opportunity to then explain

http://etd.uwc.ac.za/

their own thinking, and in this way, the students accounted for their decisions. This type of feedback is important for learning and developing clinical reasoning skills and has also been highlighted by other authors (Delany & Golding, 2014; DV Ernstzen et al., 2010). This allows educators the opportunity to immediately correct any errors that the student encounters while also enabling students to reflect upon these errors, encourages their thinking, and assists in the development of clinical reasoning. Work-based learning facilitates the construction of knowledge and transfer of learning through related experiences. This is a subset of situated learning which assists with additional theoretical understanding (Rush et al., 2010). The study also emphasised that, in order to maximise learning, the model of simulation used should reflect learning theory (Rush et al., 2010). This notion of underpinning learning theory with the simulation model is a good indication of educators recognising the need for theory in the context of developing clinical reasoning.

UNIVERSITY of the
WESTERN CAPE

Torre et al. (2019) designed the CresME tool and used three different theories of learning to develop and implement it. The development of the CresME tool was also underpinned by situated learning theory (Torre et al., 2019). This provided a platform for group discussion and promoted peer learning (Torre et al., 2019). Assimilated theory of learning was used to feature the difference between rote learning and meaningful learning. The students had to use the knowledge they had acquired to make a new decision. In the clinical setting, students will encounter many new experiences and situations that they have not dealt with previously. Understanding what they have previously learnt, and relying on that knowledge, becomes important in facing these new decisions. Illness scripts were used by the educators to structure knowledge organisation and to formulate the cases needed for the tool. Illness scripts have been supported by script theory in other literature, creating a link between clinical reasoning and knowledge organisation (Gee, Anakin, & Pinnock, 2017; Lubarsky et

http://etd.uwc.ac.za/

al., 2015). This indication of theory in both studies is very informative for educators to utilise when planning the teaching and development of clinical reasoning.

4.6.3. TEACHING STRATEGIES DESIGNED AND USED

The teaching strategies claiming to develop clinical reasoning differed in the included studies, simulation and the CresME tool were the teaching strategies used in the respective studies (Rush et al., 2010; Torre et al., 2019). Various teaching strategies can be used and are designed to develop clinical reasoning, but this may not be as important as educators informing their choice or design of teaching strategy with a learning theory.


UNIVERSITY of the
WESTERN CAPE

4.6.3.1 USING SIMULATION IN A VOCATIONAL PROGRAMME

The simulation activity was set up for students who volunteered to take part in the Rush et al. study; those who declined to be part of the study still participated in the simulation activity but were not included in their findings. Their simulation followed a Kingston University/St George's University of London model of simulation (KU/SGUL). This model has been in use for more than 10 years and includes the use of "real" rehearsed role players/actors as part of the simulation experience. The study involved 148 third-year and 37 first-year nursing students who answered the questionnaires, but it is unclear how many students participated in the focus groups and observation of simulation data. The authors presented the findings of the simulation under four themes: the value of simulation as a learning experience, the relationship between simulation and real practice, the value of instant and ongoing feedback, and simulation and the theory–practice gap. Results from the study were that 72% of all the

http://etd.uwc.ac.za/

students revealed that they felt safe and supported while using the simulations (Rush et al., 2010). The findings also indicated that 69% of the students found that simulation positively assisted with their nursing clinical practice when at a clinical placement. These results were obtained through the questionnaire. This type of simulation is referred to as high fidelity simulation, which allows students an opportunity to engage in a "real-life" situation without causing any harm to the patients (Plackett et al., 2021; Vyas, Ottis, & Caligiuri, 2011; Weller, Nestel, Marshall, Brooks, & Conn, 2012). Simulation helps to reduce the gap between theory and clinical practice (Plackett et al., 2021; Vyas et al., 2011; Weller et al., 2012). This was also emphasised by Rush et al. (2010).

4.6.3.2 THE CLINICAL REASONING MAPPING EXERCISE A NEW TOOL FOR EXPLORING CLINICAL REASONING

CresMe is an instructional tool which can be modified for context, structure and level of difficulty (Torre et al., 2019). The study participants included 93 first-year medical students and 92 second-year medical students at two universities. The students completed a five-item evaluation tool that could be accessed either electronically or via paper at their institutions. Descriptive statistics were used to determine the results of the study and a qualitative analysis of the open-ended questions was conducted. This resulted in two themes emerging: 1) the use of the CresME as a tool to promote student thinking, and 2) the role of CresME in facilitating group learning and discussion. Accordingly, the students made suggestions and recommendations for future use of the CresMe tool. The CresME tool itself is unique and was only developed and used by the authors in their study (Torre et al., 2019). The usability of CresME relies on the ability to be flexible for a range of learners and assist at different training levels in different formats (Torre et al., 2019). CresME was seen as helpful to use

UNIVERSITY of the WESTERN CAPE

http://etd.uwc.ac.za/

when teaching clinical reasoning, voiced by the educators and students. It was also seen as a tool to be used across different schools and levels of training. The authors do note that one of their limitations was that results not indicating an improvement in clinical reasoning can be better explored using their CresME tool.

Other tools similar to the CresME tool have been developed, such as the MATCH (Measuring Analytical Thinking in Clinical Health- care) test and CIP (Clinical Integrative Puzzle). However, these tools promote and develop illness scripts and not clinical reasoning directly (Ber, 2003; Capaldi, Durning, Pangaro, & Ber, 2015). The CIP assessment tool provides students with the ability to compare and contrast key features that comprise a diagnosis, similar to the CresME tool (Capaldi et al., 2015). Another model which has been used to evaluate the development of clinical reasoning is the OPT (Outcome Present State Test) model (Kautz, Kuiper, Pesut, Knight-Brown, & Daneker, 2005). According to these authors, the OPT model provides learning tools that can assist a faculty in evaluating students' thinking and reasoning abilities (Kautz et al., 2005).

UNIVERSITY of the
WESTERN CAPE

There is a vast difference between the two teaching strategies mentioned in the studies included in this review. Simulation allows students to be more active and incorporates a real-life situation without actually threatening the safety of any patients. It also allows the student to rewind the simulation, and in this way, educators can assist if errors have been made. This assistance should encourage the students' thinking process and allow them to reflect, hence the need for theory to underpin these teaching strategies. The CresME tool used concept maps, which allows the student to connect different concepts, comparing and contrasting differential diagnoses which facilitates learning. In the case of the CresME tool, differential

http://etd.uwc.ac.za/

diagnosis was that concept for the students. Teaching strategies need to incorporate both classroom and clinical settings. Consequently, one teaching strategy may not be singled out as more effective than another when developing clinical reasoning (Higgs et al., 2008).

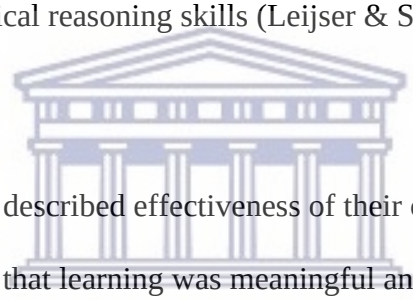
4.6.4 IMPROVEMENT OF CLINICAL REASONING, THE EFFECTIVENESS AND USABILITY OF SIMULATION AND CresME

Torre et al. (2019) evaluated the improvement of clinical reasoning with a five-item evaluation form which the students needed to complete after every session. In contrast, Rush et al. (2014) used a questionnaire, focus groups and observations as part of their evaluation.

Both articles failed to determine whether there was a direct improvement of the health professional students' clinical reasoning abilities with the use of a standardised outcome measurement tool. Although both studies reported an improvement of clinical reasoning, it is important to note that this improvement was self-reported by the students through their views and opinions (Rush et al., 2010; Torre et al., 2019). Literature does, however, provide tools to assess teaching strategies and clinical reasoning. Coelho et al. (2017) identified the following assessment tests to assess teaching strategies and clinical reasoning: the Watson-Glaser critical thinking appraisal (WGCTA), the critical thinking skills test (CTST), the California critical thinking disposition inventory (CCTDI) that assesses critical thinking, the Spanish test of creative intelligence (CREA e), and the thinking styles inventory (TSI) that investigates associations between thinking styles and creativity (Coelho et al., 2017). The script concordance test and the Lasater clinical judgement rubric (LCJR) test was also described as an assessment tool (Coelho et al., 2017). The script concordance test was used by Humbert et al. (2011), who commented that this assessment tool may be used early in the student's education programme and measure the student's clinical decision-making (Humbert

http://etd.uwc.ac.za/

et al., 2011). Measuring the outcome of clinical reasoning abilities can assist educators with identifying the possible difficulties the student could be struggling with (Audétat et al., 2017; Killam & Heerschap, 2013). In a recent study by Leijser and Spek (2021), the authors used the Lasater clinical judgement rubric (D-LCJR) as a measuring tool when using simulation as a teaching strategy to test the levels of clinical reasoning of students (Leijser & Spek, 2021). The results of the study displayed that 45% of the fourth-year students, measured with the D-LCJR achieved an accomplished level of clinical reasoning. The first- and second-year students scored lower using the D-LCJR in their clinical reasoning abilities. However, this assessment was based on theoretical knowledge, it still indicated that they required more assistance with developing clinical reasoning skills (Leijser & Spek, 2021).


UNIVERSITY of the
WESTERN CAPE

Neither of the reviewed studies described effectiveness of their choice of teaching strategy. However, the students reported that learning was meaningful and that they had benefited by expanding their existing knowledge using both simulation and the CresME tool as teaching strategies. Simulation was reported to play an important role in clinical reasoning and in better preparing these health professional students for the clinical practice (Rush et al., 2010). Using simulation also demonstrated the potential to develop both the clinical and cognitive skills of the students. Similarly, a systematic review conducted found inconclusive evidence for the effectiveness of simulation as a teaching strategy to improve clinical reasoning directly, but that the use of stimulation significantly improves learning outcomes related to clinical reasoning (Lapkin, Levett-Jones, Bellchambers, & Fernandez, 2010). This conclusion and similar findings of the inconclusive effect of simulation are noted, but simulation nonetheless improved learning outcomes (Lapkin et al., 2010; Mok, So, & Chung, 2016). The contribution to learning outcomes improved areas such as critical thinking, clinical skill performance, and knowledge acquisition, the author's result also indicated student

http://etd.uwc.ac.za/

satisfaction with simulation experiences, similarly, to Rush et al. (2010). A systematic review by Mok et al. (2016) also presented inconclusive evidence for simulation being more effective than other teaching strategies, but simulation again was found to have positive effects. Again, this outcome supports the researcher's contention that the teaching strategy in itself may not be as important as informing it with theory or learning theory. There is still some contradictory literature stating that there is a lack of evidence that simulation is more effective than other teaching methods (Mok et al., 2016). However, simulation, if integrated appropriately, can be used in academic settings as an active learning model to assist in developing clinical reasoning (Lapkin et al., 2010; Rush et al., 2010). Recommendations for the integration of their simulation strategy were made as part of frameworks or tools that educators could use (Rush et al., 2010). Torre et al. (2019) provide insight into how CresME differs from other developing clinical reasoning tools, confirming that the students and faculty have recommended it for future use.

UNIVERSITY of the
WESTERN CAPE

4.6.5 CRITICAL APPRAISAL OF METHODOLOGICAL QUALITY

As mentioned earlier, a scoping review does not require an appraisal. However, for the purpose of this review, an appraisal was conducted using JBI qualitative tools to evaluate the methodological quality of the articles that were retrieved for the review. The JBI tools consist of 10 questions, with the available responses including "yes", "no", "unclear", or "not applicable". The two included articles were answered with this form of questions and response were tallied at the end to formulate its score. Research articles of good methodological quality are necessary for educational and learning development. Good methodological quality allows for more distinct conclusions to be made regarding the study and strengthens the findings and evidence of the study (Buccheri & Sharifi, 2017). Of the two

http://etd.uwc.ac.za/

articles, only one had a good methodological score of 70% (Rush et al.,2010). This suggests that the study was reliable, unbiased, and that the participants were adequately represented. The study had a robust design with the interpretation of data and conclusions following through (Buccheri & Sharifi, 2017).

The other article (Torre et al., 2019) did not obtain a good methodological score. This suggest that the validity and reliability of the article was not sound, in that the participants' voices, research methodology and analysis of data was not clearly represented. Poor methodological quality can suggest a risk of bias and reduce the strength of evidence of the published article (Mok et al., 2016). It can also affect the ability to draw definitive conclusions from their study (Mok et al., 2016).

UNIVERSITY of the
WESTERN CAPE

4.6.6 STUDENTS' YEAR OF STUDY

The selection of the health professional students for the included studies differed slightly. Rush et al. (2010) included first- and third-year nursing students whereas Torre et al. (2019) included first- and second-year medical students. It was, therefore, expected that there would be a difference in the level of clinical reasoning the students may have demonstrated, according to the year of study (Leijser & Spek, 2021). Torre et al. (2019) researched the first two years of medical students instead of comparing the last year of medical students. The knowledge gain and the practice–theory gap can be narrow in such a short time, and students might not have developed more reasoning abilities between the first and second year. Notably, in a study examining the different levels of clinical reasoning according to the year of study, students in their fourth year had gained more clinical reasoning skills than first- or second-year students (Leijser & Spek, 2021). However, other authors suggest that clinical

http://etd.uwc.ac.za/

reasoning should be taught in the early stages of the student's learning rather than later, to assist with the development of clinical reasoning (Alshehri, 2017; Coelho et al., 2017; Kassirer, 2010a). This could be the reason why many studies, including that of Torre et al. (2019), look at the first and second years of study. The last year of study can place emphasis on clinical reasoning competence before the students commence as professional health practitioners. Students have voiced concerns of feeling pressured in their final year, in response to higher expectations of clinical competence (Killam & Heerschap, 2013).

4.7 KEY FINDINGS

Both studies included in this review claim to have demonstrated an improvement in the development of clinical reasoning of health professional students. It must be acknowledged that the methodological appraisal of the study by Torre et al. (2019) was poor and its claims may require further research. The CresME tool was well received by the health professional students, who reported a positive impact on their understanding of differential diagnosis and found it to be a valuable tool for comparing and contrasting the elements of differential diagnosis (Torre et al., 2019). The ability to effectively diagnose and understand different diagnoses is an important component of developing clinical reasoning among health professional students(Durning et al., 2013).

Simulation has an important role to play in clinical learning; high fidelity simulation has the potential to prepare students for clinical placements. Rush et al. (2010) indicated that simulation is a model which promoted situated learning in mimicking the workplace. Linking clinical practice and simulation creates meaningful learning for health professional students. This will benefit their learning experience and better prepare them for their profession.

UNIVERSITY of the WESTERN CAPE
http://etd.uwc.ac.za/

Underpinning teaching strategies with learning theories has also assisted in a more learner-centred approach that enables students to be more active in the process. The close guidance and observation from clinical educators led to students feeling more at ease and helped them to deal with more complex and risky situations (Rush et al., 2010).

From these studies, one can deduce that active student engagement enriches the student's learning and experience. This type of feedback offers insight into how the students think about their own learning experiences, and also assists with their thinking processes. Improvement of cognition and metacognition may be beneficial for the students, especially in the early years of study and while they are still gaining experience.


UNIVERSITY of the
WESTERN CAPE

4.8 CONCLUSION

This chapter presents the results of the scoping review that was conducted. Two studies were examined in this review as they described teaching strategies that were informed by theory and explained how the theory was used to develop the teaching strategy. The results were guided by the data extraction using a self-developed data extraction form and were displayed in terms of a narrative synthesis. The data extracted from the two reviewed studies was presented in a manner which best answered the research question, aim and objectives of this scoping review. The researcher also drew on literature to explain why the possibilities of the findings were limited and resulted in a small sample size. The critical appraisal highlights the importance of having robust methods to contribute to educational development and learning. The effectiveness, usability and outcomes of both included studies were presented in this chapter. Key findings pertaining to both studies were presented and further recommendations made by the authors were included. The following chapter draws this thesis to a close. The

http://etd.uwc.ac.za/

main conclusions of the study are discussed, limitations are addressed, and recommendations are offered in the final chapter.

http://etd.uwc.ac.za/

CHAPTER 5

CONCLUSION, LIMITATIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

The conclusion to the scoping review is presented in this chapter. The chapter aims to provide an overview of the study, highlight the outcomes, and presents the limitations. Recommendations are also made in this chapter in terms of the studies used in the scoping review. The importance of using good methodological approaches and following guidelines is emphasised, and future study recommendations are also suggested.

UNIVERSITY of the
WESTERN CAPE

5.2 OVERVIEW OF CHAPTERS

Chapter 1 introduced the broad concepts of and principles surrounding clinical reasoning and its development. The importance of developing clinical reasoning among student health professionals is paramount. This chapter also introduced learning theories and how they affect clinical reasoning development. The goal of the curriculum and learning activities is not only to impart knowledge, skills, and attitudes but also to integrate these into the clinical setting so students can apply them to patient care. Optimum patient care is of utmost importance. Difficulties with developing clinical reasoning, and the way in which these difficulties can account for errors in assessing, diagnosing and treatment of a patient, were also highlighted. The purpose of this scoping review was to explore theories that informing teaching that aim to enhance the development of clinical reasoning in undergraduate health professional students. The objectives were to identify the use of theories used by educators, and to establish how they were used.

http://etd.uwc.ac.za/

Chapter 2 was the literature review which unpacked findings relating to theories supporting the development of clinical reasoning skills, and other authors' findings regarding these theories. It also provided an overview of which theories and strategies are already available in the literature. It was noted that many of these strategies were not necessarily underpinned by any learning theory. The difficulties experienced by educators with teaching clinical reasoning were pointed out, as well some of the struggles that students may encounter.

Chapter 3 explained how this scoping review was conducted and why this choice of study design suited the research question. Critical appraisal was included, although it is not required for a scoping review. However, its inclusion allowed the researcher to assess the rigour of the studies included in this review. The PRISMA-ScR guidelines for scoping reviews were used for reporting.

UNIVERSITY of the
WESTERN CAPE

Chapter 4 presented the results and discussion of the study. These results and discussion were done through a narrative synthesis and also represented the data extracted from the studies included in this review.

5.2 MAIN FINDINGS

The findings from this research study may contribute to the work of previous researchers in this knowledge area. The two included studies broadly supported their studies with constructivism as an overarching theory. The included studies also mentioned how other learning theories such as situated learning and assimilation learning theory supported their teaching strategies and the design thereof to develop clinical reasoning in health professional

http://etd.uwc.ac.za/

students. The learning theories were learner-centred and contributed to making learning meaningful for the health professional students by allowing them to construct new knowledge. This enabled the students to engage with the educators but also empowered them to think about their own thinking. The teaching strategies, simulation, and the CresME tools differed, and assisted the health professional students differently in their learning experience. It is important to note that the teaching strategy may not be as important as the learning theory which underlies the strategy. Educators are then encouraged to explicitly underpin their teaching strategies with learning theory.

Constructivism theory allows the learner to construct new knowledge and allows the student to be active in this learning process. This moves towards a more learner-centred approach and also makes learning more meaningful for the student. These learning theories are available to educators, but it is not clear how to use them effectively and efficiently to develop clinical reasoning. This scoping review therefore highlights the need for clarity around whether theories are used to inform teaching strategies and if so, how they are used.

UNIVERSITY of the
WESTERN CAPE

It is also important to note that the use of standardised outcome measures that demonstrate the improvement of clinical reasoning were lacking in both of the included studies. Rush et al. (2010) made use of questionnaires, focus groups and observations to assess the use of simulation in improving clinical decision-making. Torre et al. (2019) made use of a five-item evaluation form which was completed after each session. The outcome measure tools mentioned previously and available allow for the authors to strengthen their evidence. This creates an opportunity to state whether clinical reasoning or clinical decision-making has improved when using teaching strategies, whether in the classroom or clinical context.

http://etd.uwc.ac.za/

5.3 LIMITATIONS

The researcher is aware that this sample size is very small and therefore may seem biased, since not many relevant articles were available for the analysis. Another limitation could be the decision to exclude all articles which include educators, faculty members or experts as part of the research data. This decision was made to place emphasis on the development of clinical reasoning among undergraduate health professional students. Including the experts, faculty and educators may have hindered the ability to assess the development of clinical reasoning at the basic level of undergraduate students. Clinical reasoning development in experts and educators is assumed to be adequate because they have experience and have gained knowledge and skill over time. This is not the case with undergraduate students. Furthermore, the experts themselves still find it difficult to clarify the development of clinical reasoning.

UNIVERSITY of the
WESTERN CAPE

There are a few possible reasons why only a limited number of studies met the inclusion criteria for this scoping review. It could be related to the lack of understanding of theory, its use, and how to effectively select theory for teaching strategies by the educators. In a study by Kononowicz et al. (2020), the authors found that, globally, there was poor awareness of the need for explicit clinical reasoning teaching; this was one. Moreover, creating guidelines for clinical reasoning curriculum development, and teaching clinical reasoning strategies as part of a trainer course, were identified as critical requirements (Kononowicz et al., 2020).

The limited number of studies found for this review highlights the challenges faced by researchers, which is also mentioned by Kononowicz et al. (2020). The need for theory-

http://etd.uwc.ac.za/

driven practice has been described in the literature (Gibbs et al., 2011) as it can assist in unifying ideas and practice. Gibbs et al. (2011) also highlights this notion of the importance of improving practice and unifying practice with more theory. They state that "theory is the cement between educational research evidence and educational practice" (Gibbs et al., 2011, p. 4). This statement clearly amplifies the need for unity in the development of clinical reasoning abilities for undergraduate health professional students and suggests how the use of learning theories can contribute to this development.

5.4 RECOMMENDATIONS

This recent information from Kononowicz et al. (2020) assessed a global perspective of the practice of teaching clinical reasoning. Kononowicz et al. (2020) highlight the absence of guidelines for clinical reasoning curriculum development, the absence of awareness of best practice and the need for training of theory on clinical reasoning. The authors findings support the researcher's task to review whether teaching strategies are underpinned by theory. The suggestion of a global need for assistance in clinical reasoning strategies exemplifies the need for change and the potential for different approaches to the development of clinical reasoning. This calls for educators to move beyond the simple choice of a teaching strategy to improve clinical reasoning, and to base their choices on a foundation of theory.

UNIVERSITY of the
WESTERN CAPE

The lack of research underpinning teaching strategies with learning theories has become apparent. The lack of unity in the development of clinical reasoning abilities and use of learning theories can contribute to this. Rush et al. (2010) stipulate that although their simulation project did not set out to test learning theory, the analysis of their findings indicated that students' perceptions of learning were relevant to learning theory. This

http://etd.uwc.ac.za/

indicates the lack of clarity regarding which learning theory can be used for the different teaching strategies, and aligns with a statement made earlier, that the teaching strategy itself may not be as important as informing or underpinning it with learning theory.

After conducting this scoping review, educators should consider informing their decision making around teaching strategies that aim to improve clinical reasoning, with the appropriate learning theory. Future research that aims to improve clinical reasoning abilities should consider the use of standardised outcome measuring tools to determine whether these teaching strategies, have in fact, contributed to a change in clinical reasoning, as this will strengthen the findings of the research. Furthermore, educational strategies need to explicitly target and create learning opportunities that incorporate the concepts of clinical reasoning in both the classroom and clinical settings (Barrett, Denegar, & Mazerolle, 2018). These strategies should provide students with real-life applications of principles, and faculties should consider assessing the strategies they use to develop clinical reasoning (Barrett et al., 2018). Finally, future research should be mindful of how studies are conducted and reported on, so that they are aligned with critical appraisal guidelines. This will contribute to sound methodological research and attempt to ensure that studies are robust and rigorous.

UNIVERSITY of the
WESTERN CAPE

5.5 CONCLUSION

This final chapter closes by describing the key findings of the review. It also mentioned the limitations with this scoping review and included recommendations. Constructivism was the overarching theory which supported both included studies. The authors of both included studies also provided other theories which they utilised in their respective studies. Highlighting these theories allows the learning process to move towards a learner- centred

http://etd.uwc.ac.za/

approach as the students found this more meaningful. After four decades of studying and developing ways to improve clinical reasoning skills, it is clear that there are still challenges around defining, assessing and teaching these skills. It has been demonstrated that there is no one-method-fits-all approach, but unity regarding the structure and the way clinical reasoning is enhanced among health professional students should be considered. Faculty development, the support of educators, and the need to improve or update the way students are being taught should be addressed. Educators face an immense task in the development of clinical reasoning and ensuring that student health professionals are ready to face the challenges awaiting them once they engage with patients. It is vital that students obtain a level where they are can effectively and efficiently think about their own reasoning abilities.

UNIVERSITY of the
WESTERN CAPE

http://etd.uwc.ac.za/

REFERENCES

Alshehri, M. (2017). Teaching clinical reasoning to physiotherapists in saudi arabia: a theoretical report *1. *International Journal of Physiotherapy*, *4*(2), 106–111.

Aparecida, J., & Cerullo, B. (2010). Clinical Reasoning and Critical Thinking, *18*(1), 124–129.

Arksey, H., & O'Malley, L. (2005). Scoping studies: Towards a methodological framework. *International Journal of Social Research Methodology: Theory and Practice*, *8*(1), 19–32. https://doi.org/10.1080/1364557032000119616

Audétat, M.-C., Laurin, S., & Dory, V. (2013). Remediation for struggling learners: putting an end to 'more of the same.' *Medical Education*, *47*(3), 230–231. https://doi.org/10.1111/medu.12131

Audétat, M.-C., Laurin, S., Dory, V., Charlin, B., & Nendaz, M. (2017). Diagnosis and management of clinical reasoning difficulties: Part I. Clinical reasoning supervision and educational diagnosis. *Medical Teacher*, *39*(8), 792–796. https://doi.org/10.1080/0142159X.2017.1331033

Bae, J., Lee, J., Jang, Y., & Lee, Y. (2019). Development of simulation education debriefing protocol with faculty guide for enhancement clinical reasoning. *BMC Medical Education*, *19*(1), 1–7. https://doi.org/10.1186/s12909-019-1633-8

Barrett, J. L., Denegar, C. R., & Mazerolle, S. M. (2018). Challenges Facing New Educators: Expanding Teaching Strategies for Clinical Reasoning and Evidence-Based Medicine. *Athletic Training Education Journal*, *13*(4), 359–366. https://doi.org/10.4085/1304359

Ber, R. (2003). The CIP (comprehensive integrative puzzle) assessment method. *Medical Teacher*, *25*(2), 171–176. https://doi.org/10.1080/0142159031000092571

Booth, A., & Carroll, C. (2015). Systematic searching for theory to inform systematic reviews : is it feasible ? Is it desirable ?, 220–235. https://doi.org/10.1111/hir.12108

Bramucci, A. (2013). Self-Regulated Learning. *I-Tutor Lifelong Learning*, 1–22. https://doi.org/10.1016/B978-0-08-097086-8.25091-5

UNIVERSITY of the WESTERN CAPE

http://etd.uwc.ac.za/

Buccheri, R. K., & Sharifi, C. (2017). Critical Appraisal Tools and Reporting Guidelines for Evidence-Based Practice. *Worldviews on Evidence-Based Nursing*, *14*(6), 463–472. https://doi.org/10.1111/wvn.12258

Burgess, A., Diggele, C. Van, Roberts, C., & Mellis, C. (2020). Key tips for teaching in the clinical setting. *BMC Medical Education*, *20*(Suppl 2), 1–7. https://doi.org/10.1186/s12909-020-02283-2

Capaldi, V. F., Durning, S. J., Pangaro, L. N., & Ber, R. (2015). The clinical integrative puzzle for teaching and assessing clinical reasoning: Preliminary feasibility, reliability, and validity evidence. *Military Medicine*, *180*(4), 54–60. https://doi.org/10.7205/MILMED-D-14-00564

Case, K., Harrison, K., & Roskell, C. (2000). Differences in the clinical reasoning process of expert and novice cardiorespiratory physiotherapists. *Physiotherapy*, *86*(1), 14–21. https://doi.org/10.1016/S0031-9406(05)61321-1

Clark, K. R. (2018). Learning theories: Constructivism. *Radiologic Technology*, *90*(2), 180–182.

Coelho, S., Vasconcelos, R., Iii, M., Paulo, U. D. S., Preto, R., & Paulo, S. (2017). Clinical reasoning in nursing : teaching strategies and assessment tools, *70*(3), 662–668.

Cutrer, W. B., Sullivan, W. M., & Fleming, A. E. (2013). Educational Strategies for Improving Clinical Reasoning. *Current Problems in Pediatric and Adolescent Health Care*, *43*(9), 248–257. https://doi.org/10.1016/j.cppeds.2013.07.005

de Beer, M., & Mårtensson, L. (2015). Feedback on students' clinical reasoning skills during fieldwork education. *Australian Occupational Therapy Journal*, *62*(4), 255–264. https://doi.org/10.1111/1440-1630.12208

Delany, C., & Golding, C. (2014). Teaching clinical reasoning by making thinking visible : an action research project with allied health clinical educators.

Dennick, R. (2016). Constructivism: reflections on twenty five years teaching the constructivist approach in medical education. *International Journal of Medical Education*, *7*, 200–205. https://doi.org/10.5116/ijme.5763.de11

Durning, S. J., Artino, A. R., Schuwirth, L., & Van Der Vleuten, C. (2013). Clarifying assumptions to enhance our understanding and assessment of clinical reasoning.

UNIVERSITY of the WESTERN CAPE

http://etd.uwc.ac.za/

Academic Medicine, *88*(4), 442–448. https://doi.org/10.1097/ACM.0b013e3182851b5b

Ernstzen, DV, Bitzer, E., & Grimmer-Somers, K. (2010). Physiotherapy students' and clinical teachers' perspectives on best clinical teaching and learning practices: A qualitative study. *SA Journal of Physiotherapy*, *66*(3), 25–31.

Ernstzen, D. V., Bitzer, E., & Grimmer-Somers, K. (2009). Physiotherapy students' and clinical teachers' perceptions of clinical learning opportunities: A case study. *Medical Teacher*, *31*(3). https://doi.org/10.1080/01421590802512870

Fayram, E. (2003). *Nurse as Educator: Principles of Teaching and Learning for Nursing Practice, 2nd ed. The Journal of Continuing Education in Nursing* (Vol. 34). https://doi.org/10.3928/0022-0124-20031101-12

Furze, J., Black, L., Hoffman, J., Barr, J. B., Cochran, T. M., & Jensen, G. M. (2015). Exploration of Students' Clinical Reasoning Development in Professional Physical Therapy Education. *Journal of Physical Therapy Education*, *29*(3), 22. https://doi.org/10.1016/j.imavis.2005.06.012

Gee, W., Anakin, M., & Pinnock, R. (2017). Using theory to interpret how senior clinicians define, learn, and teach clinical reasoning. *MedEdPublish*, *6*(4), 1–11. https://doi.org/10.15694/mep.2017.000182

Gibbs, T., Durning, S., & Van Der Vleuten, C. (2011). Theories in medical education: Towards creating a union between educational practice and research traditions. *Medical Teacher*, *33*(3), 183–187. https://doi.org/10.3109/0142159X.2011.551680

Golding, C. (2019). Discerning student thinking: a practical theoretical framework for recognising or informally assessing different ways of thinking. *Teaching in Higher Education*, *24*(4), 478–492. https://doi.org/10.1080/13562517.2018.1491024

Guraya, S. Y. (2016). The pedagogy of teaching and assessing clinical reasoning for enhancing the professional competence: A systematic review. *Biosciences Biotechnology Research Asia*, *13*(3), 1859–1866. https://doi.org/10.13005/bbra/2340

Higgs, J., Jones, M., Loftus, S., & Christensen, N. (2008). *Joy Higgs - Clinical reasoning in the health professions-Butterworth-Heinemann (2008*.

Holder, A. G. (2018). Clinical Reasoning: A State of the Science Report. *International Journal of Nursing Education Scholarship*, *15*(1), 1–10. https://doi.org/10.1515/ijnes-

UNIVERSITY of the
WESTERN CAPE

http://etd.uwc.ac.za/

2016-0024

Hoque, D. M. E., Kumari, V., Hoque, M., Ruseckaite, R., Romero, L., & Evans, S. M. (2017). Impact of clinical registries on quality of patient care and clinical outcomes: A systematic review. *PLoS ONE*, *12*(9), 1–20. https://doi.org/10.1371/journal.pone.0183667

Humbert, A. J., Johnson, M. T., Miech, E., Friedberg, F., Grackin, J. A., & Seidman, P. A. (2011). Assessment of clinical reasoning: A Script Concordance test designed for pre-clinical medical students. *Medical Teacher*, *33*(6), 472–477. https://doi.org/10.3109/0142159X.2010.531157

Jones, M. A., & Rivett, D. A. (2004). Introduction to clinical reasoning. *Clinical Reasoning for Manual Therapists*. https://doi.org/10.1016/B978-0-7506-3906-4.50006-X

Kassirer, J. P. (2010). Teaching clinical reasoning: case-based and coached. *Academic Medicine : Journal of the Association of American Medical Colleges*, *85*(7), 1118–1124. https://doi.org/10.1097/acm.0b013e3181d5dd0d

Kautz, D. D., Kuiper, R., Pesut, D. J., Knight-Brown, P., & Daneker, D. (2005). Promoting clinical reasoning in undergraduate nursing students: Application and evaluation of the Outcome Present State Test (OPT) model of clinical reasoning. *International Journal of Nursing Education Scholarship*, *2*(1). https://doi.org/10.2202/1548-923X.1052

Killam, L. A., & Heerschap, C. (2013). Challenges to student learning in the clinical setting: A qualitative descriptive study. *Nurse Education Today*, *33*(6), 684–691. https://doi.org/10.1016/j.nedt.2012.10.008

Kononowicz, A. A., Hege, I., Edelbring, S., Sobocan, M., Huwendiek, S., & Durning, S. J. (2020). The need for longitudinal clinical reasoning teaching and assessment: Results of an international survey. *Medical Teacher*, *42*(4), 457–462. https://doi.org/10.1080/0142159X.2019.1708293

Lai, E. R. (2011). Critical Thinking: A Literature Review. *Always Learnoing Pearson*, *June*, 1–50. https://doi.org/10.1046/j.1537-2995.1995.35395184278.x

Lamartina, K., & Ward-smith, P. (2014). Developing critical thinking skills in undergraduate nursing students : The potential for strategic management simulations, *4*(9). https://doi.org/10.5430/jnep.v4n9p155

http://etd.uwc.ac.za/

Lapkin, S., Levett-Jones, T., Bellchambers, H., & Fernandez, R. (2010). Effectiveness of Patient Simulation Manikins in Teaching Clinical Reasoning Skills to Undergraduate Nursing Students: A Systematic Review. *Clinical Simulation in Nursing*, *6*(6), e207–e222. https://doi.org/10.1016/j.ecns.2010.05.005

Leijser, J., & Spek, B. (2021). Level of clinical reasoning in intermediate nursing students explained by education year and days of internships per healthcare branches: A cross – sectional study. *Nurse Education Today*, *96*(September 2020), 104641. https://doi.org/10.1016/j.nedt.2020.104641

Levett-jones, T. ;Bourgeois S. (2015). Clinical-Reasoning-Instructor-Resources.pdf.

Lizardo, O., Mowry, R., Sepulvado, B., Stoltz, D. S., Taylor, M. A., Van Ness, J., & Wood, M. (2016). What Are Dual Process Models? Implications for Cultural Analysis in Sociology. *Sociological Theory*, *34*(4), 287–310. https://doi.org/10.1177/0735275116675900

Lubarsky, S., Dory, V., Audétat, M.-C., Custers, E., & Charlin, B. (2015). Using script theory to cultivate illness script formation and clinical reasoning in health professions education. *Canadian Medical Education Journal*, *6*(2), e61-70. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/27004079%0Ahttp://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC4795084

UNIVERSITY of the WESTERN CAPE

Mok, H. T., So, C. F., & Chung, J. W. Y. (2016). Effectiveness of High-Fidelity PatieMok, H. T., So, C. F., & Chung, J. W. Y. (2016). Effectiveness of High-Fidelity Patient Simulation in Teaching Clinical Reasoning Skills. Clinical Simulation in Nursing, 12(10), 453–467. https://doi.org/10.1016/j.ecns.2. *Clinical Simulation in Nursing*, *12*(10), 453–467. https://doi.org/10.1016/j.ecns.2016.06.003

Mukhalalati, B. A., & Taylor, A. (2019). Adult Learning Theories in Context: A Quick Guide for Healthcare Professional Educators. *Journal of Medical Education and Curricular Development*, *6*, 238212051984033. https://doi.org/10.1177/2382120519840332

Nurse, M., Continue, E., Teach, T. O., They, A. S., Taught, W., Rearranging, S., … Students, T. O. (2010). Constructivism Theory Analysis and Application to Curricula AtHER tHAn HEEding CAllS FoR REFoRM in nuRSing EduCAtion , (April), 1–4.

Osman, M. (2004). An evaluation of dual-process theories of reasoning. *Psychonomic*

http://etd.uwc.ac.za/

Bulletin & Review, *11*(June), 988–1010. https://doi.org/10.3758/BF03196730

Panadero, E. (2017). A review of self-regulated learning: Six models and four directions for research. *Frontiers in Psychology*, *8*(APR), 1–28. https://doi.org/10.3389/fpsyg.2017.00422

Patton, N., Higgs, J., & Smith, M. (2013). Using theories of learning in workplaces to enhance physiotherapy clinical education, *29*(7), 493–503. https://doi.org/10.3109/09593985.2012.753651

Pelaccia, T., Tardif, J., Triby, E., & Charlin, B. (2011a). An analysis of clinical reasoning through a recent and comprehensive approach: The dual-process theory. *Medical Education Online*, *16*(1). https://doi.org/10.3402/meo.v16i0.5890

Pelaccia, T., Tardif, J., Triby, E., & Charlin, B. (2011b). approach : the dual-process theory, *1*, 1–10. https://doi.org/10.3402/meo.v16i0.5890

Pestiaux, D., Charlin, B., Junod Perron, N., Vanpee, D., Dory, V., Audétat, M.-C., & Nendaz, M. (2012). What is so difficult about managing clinical reasoning difficulties? *Medical Education*, *46*(2), 216–227. https://doi.org/10.1111/j.1365-2923.2011.04151.x

Peters, M. D. J., Godfrey, C. M., Khalil, H., McInerney, P., Parker, D., & Soares, C. B. (2015). Guidance for conducting systematic scoping reviews. *International Journal of Evidence-Based Healthcare*, *13*(3), 141–146. https://doi.org/10.1097/XEB.0000000000000050

Plackett, R., Kassianos, A. P., Timmis, J., Sheringham, J., Schartau, P., & Kambouri, M. (2021). Using virtual patients to explore the clinical reasoning skills of medical students: Mixed methods study. *Journal of Medical Internet Research*, *23*(6). https://doi.org/10.2196/24723

Popay1, J., Roberts2, H., Sowden3, A., Petticrew4, M., Arai2, L., Rodgers3, M., … Duffy, K. R. and S. (2006). Guidance on the Conduct of Narrative Synthesis in Systematic Reviews. *A Product from the ESRC Methods Programme*, *1*, 1145–1148. https://doi.org/10.1001/archderm.1985.01660090059014

Reeves, S., Albert, M., Kuper, A., & Hodges, B. D. (2008). Qualitative research: Why use theories in qualitative research? *Bmj*, *337*(7670), 631–634. https://doi.org/10.1136/bmj.a949

UNIVERSITY of the WESTERN CAPE

http://etd.uwc.ac.za/

Richmond, A., Cooper, N., Gay, S., Atiomo, W., & Patel, R. (2020). The student is key: A realist review of educational interventions to develop analytical and non-analytical clinical reasoning ability. *Medical Education*, *54*(8), 709–719. https://doi.org/10.1111/medu.14137

Rochmawati, E., & Wiechula, R. (2010). Education strategies to foster health professional students ' clinical reasoning skills, (June 2009), 244–250. https://doi.org/10.1111/j.1442-2018.2009.00512.x

Rush, S., Acton, L., Tolley, K., Marks-Maran, D., & Burke, L. (2010). Using simulation in a vocational programme: Does the method support the theory? *Journal of Vocational Education and Training*, *62*(4), 467–479. https://doi.org/10.1080/13636820.2010.523478

Schmidt, H. G., & Mamede, S. (2015). How to improve the teaching of clinical reasoning: A narrative review and a proposal. *Medical Education*, *49*(10), 961–973. https://doi.org/10.1111/medu.12775

Schunk, D. H. (2012). *Learning Theories An Educational Perspective*. *Pearson* (Vol. 1). https://doi.org/10.1007/BF00751323

Spencer, J. A., & Jordan, R. K. (1999). Learner centred approaches in medical education. *British Medical Journal*, *318*(7193), 1280–1283. https://doi.org/10.1136/bmj.318.7193.1280

Stewart, M. (2016). Understanding learning: theories and critique', in L.Hunt and D. Chalmers (eds) "University teaching in focus: a learning- centred approach", London, Routledge. In *university Teaching in Focus* (1st ed., Vol. 1, pp. 1–20). London, Routledge: ResearchGate.

Taylor, D. C. M., & Hamdy, H. (2013). Adult learning theories : Implications for learning and teaching in medical education : AMEE Guide No . 83, 1561–1572. https://doi.org/10.3109/0142159X.2013.828153

Thomas, A., Lubarsky, S., Durning, S. J., & Young, M. E. (2017). Knowledge syntheses in medical education: Demystifying scoping reviews. *Academic Medicine*, *92*(2), 161–166. https://doi.org/10.1097/ACM.0000000000001452

Thomas, A., Lubarsky, S., Varpio, L., Durning, S. J., & Young, M. E. (2020). Scoping

UNIVERSITY of the WESTERN CAPE

http://etd.uwc.ac.za/

reviews in health professions education: challenges, considerations and lessons learned about epistemology and methodology. *Advances in Health Sciences Education*, *25*(4), 989–1002. https://doi.org/10.1007/s10459-019-09932-2

Torre, D. M., Hernandez, C. A., Castiglioni, A., Durning, S. J., Daley, B. J., Hemmer, P. A., & LaRochelle, J. (2019). The Clinical Reasoning Mapping Exercise (CResME): a new tool for exploring clinical reasoning. *Perspectives on Medical Education*, *8*(1), 47–51. https://doi.org/10.1007/s40037-018-0493-y

Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K., Colquhoun, H., Kastner, M., … Straus, S. E. (2016). A scoping review on the conduct and reporting of scoping reviews. *BMC Medical Research Methodology*, *16*(1), 1–10. https://doi.org/10.1186/s12874-016-0116-4

Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K. K., Colquhoun, H., Levac, D., … Straus, S. E. (2018). PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. *Annals of Internal Medicine*, *169*(7), 467–473. https://doi.org/10.7326/M18-0850

Vaisey, S. (2009). Motivation and justification: A dual-process model of culture in action. *American Journal of Sociology*, *114*(6), 1675–1715. https://doi.org/10.1086/597179

van Wyngaarden, A., Leech, R., & Coetzee, I. (2019). Challenges nurse educators experience with development of student nurses' clinical reasoning skills. *Nurse Education in Practice*, *40*(September), 102623. https://doi.org/10.1016/j.nepr.2019.102623

Vergnes, J. N., Marchal-Sixou, C., Nabet, C., Maret, D., & Hamel, O. (2010). Ethics in systematic reviews. *Journal of Medical Ethics*, *36*(12), 771–774. https://doi.org/10.1136/jme.2010.039941

Voges, T. L., & Frantz, J. M. (2019). Clarifying the role of clinical supervisors according to physiotherapists at a higher education institution. *South African Journal of Physiotherapy*, *75*(1), 1–6. https://doi.org/10.4102/sajp.v75i1.523

Vyas, D., Ottis, E. J., & Caligiuri, F. J. (2011). Teaching clinical reasoning and problem-solving skills using human patient simulation. *American Journal of Pharmaceutical Education*, *75*(9), 189. https://doi.org/10.5688/ajpe759189

Wager, E., & Wiffen, P. J. (2011). Ethical issues in preparing and publishing systematic

http://etd.uwc.ac.za/

reviews, *4*, 130–134. https://doi.org/10.1111/j.1756-5391.2011.01122.x

Weller, J. M., Nestel, D., Marshall, S. D., Brooks, P. M., & Conn, J. J. (2012). Simulation in clinical teaching and learning. *Medical Journal of Australia*, *196*(9), 1–5. https://doi.org/10.5694/mja10.11474

Yazdani, S., & Abardeh, M. H. (2019). Five decades of research and theorization on clinical reasoning: A critical review. *Advances in Medical Education and Practice*, *10*, 703–716. https://doi.org/10.2147/AMEP.S213492

Young, M. E. (2018). ACADEMIC MEDICINE | AM Last Page How Different Theories of. *Academic Medicine*, *93*, 1415.

ADDENDA

ADDENDUM 1: Search terms used in combination with search strings in chosen databases

UNIVERSITY of the WESTERN CAPE

Clinical reasoning	Critical thinking	Clinical decision-making
Clinical reasoning AND educators	Critical thinking AND educators	Clinical decision-making AND educators
Clinical reasoning AND educators and health professional student	Critical thinking AND educators AND health professional students	Clinical decision-making AND educators AND health professional students
Clinical reasoning AND educators AND health professional student AND development	Critical thinking AND educators AND learning theory	Clinical decision-making AND novice
Clinical reasoning AND lectures	Critical thinking AND lectures	Clinical decision-making AND learners
Clinical reasoning AND clinical supervisors	Critical thinking AND clinical supervisors	Clinical decision-making AND health professional student
Clinical reasoning AND development	Critical thinking AND development	Clinical decision-making AND lectures
Clinical reasoning AND development AND health professional student	Critical thinking AND novice	Clinical decision-making AND clinical educator

http://etd.uwc.ac.za/

Clinical reasoning AND development AND learning theory	Critical thinking AND novice AND development	Clinical decision-making AND learning theory
Clinical reasoning AND novice	Critical thinking AND learning theory	Clinical decision-making AND development
Clinical reasoning AND health professional student	Critical thinking AND health professional student	
Clinical reasoning AND learner		
Clinical reasoning AND learner AND development		
Clinical reasoning AND learner AND learning theory		
Clinical reasoning AND learning theory		

http://etd.uwc.ac.za/

ADDENDUM 2: Full text articles excluded and reasons for exclusion

	Author	Title	Reason for exclusion
1.	TC Postma, JG White – European Journal of Dental Education, 2015 – Wiley Online Library	Developing clinical reasoning in the classroom–analysis of the 4 C/ID-model	No theory included
2.	TC Postma, JG White – European Journal of Dental Education, 2016 – Wiley Online Library	Developing integrated clinical reasoning competencies in dental students using scaffolded case-based learning–empirical evidence	No theory included
3.	M Gillespie, BL Peterson – Nursing education perspectives, 2009 – journals.lww.com	Helping novices' nurses make effective clinical decisions: the situated clinical decision-making framework	No indication of an improvement in clinical reasoning
4.	SA Lisko, V O'dell – Nursing Education Perspectives, 2010 – journals.lww.com	Integration of theory and practice: Experiential learning theory and nursing education	No theory included
5.	MR Davids, ML Halperin, UME Chikte – African Journal of Health …, 2015 – ajol.info	Optimising cognitive load and usability to improve the impact of e-learning in medical education	No theory included
6.	RA Kuiper, DJ Pesut – Journal of advanced nursing, 2004 – Wiley Online Library	Promoting cognitive and metacognitive reflective reasoning skills in nursing practice: self-regulated learning theory	No theory included
7.	KJ Kim, C Kee – Medical Teacher, 2013 – Taylor & Francis	Evaluation of an e-PBL model to promote individual reasoning	No theory included
8.	AH White – 2003 – journals.healio.com	Clinical decision-making among fourth-year nursing students: An interpretive study	No theory included
9.	J Harbison – Journal of Advanced Nursing, 2001 – Wiley Online Library	Clinical decision-making in nursing: theoretical perspectives and their relevance to practice	No theory included
10.	SJ Durning, S Lubarsky, D Torre… - … Education in the …, 2015 – Wiley Online Library	Considering "nonlinearity" across the continuum in medical education assessment: supporting theory, practice, and future research directions	Not meeting research question and PICO

UNIVERSITY of the WESTERN CAPE

http://etd.uwc.ac.za/

11.	AF Brandon, AC All – Nursing education perspectives, 2010 – journals.lww.com	Constructivism theory analysis and application to curricula	No specific teaching strategy – theoretical paper.
12.	G Maudsley, J Strivens – Medical education, 2000 – Wiley Online Library	Promoting professional knowledge, experiential learning and critical thinking for medical students	Opinion based
13	A Linn, C Khaw, H Kildea, A Tonkin – Australian family physician, 2012 – search.informit.org	Clinical reasoning: A guide to improving teaching and practice	No theory included
14.	MM Hayes, S Chatterjee… - Annals of the American …, 2017 – atsjournals.org	Critical thinking in critical care: five strategies to improve teaching and learning in the intensive care unit	No theory included
15.	WB Cutrer, WM Sullivan, AE Fleming – Current problems in pediatric and …, 2013 – Elsevier	Educational strategies for improving clinical reasoning	No theory included and opinion based
16.	M Gillespie – Nurse Education in Practice, 2010 – Elsevier	Using the situated Clinical Decision-Making framework to guide analysis of nurses' clinical decision-making	Opinion based
17.	MR Davids, ML Halperin, UME Chikte – African Journal of Health …, 2015 – ajol.info	Optimising cognitive load and usability to improve the impact of e-learning in medical education	Opinion based
18.	A Smith – International Emergency Nursing, 2013 - Elsevier	Using a theory to understand triage decision-making	Opinion based
19.	M Mancinetti, S Guttormsen, C Berendonk - … journal of internal medicine, 2019 - Elsevier	Cognitive load in internal medicine: What every clinical teacher should know about cognitive load theory	Opinion based
20.	N Patton, J Higgs, M Smith - Physiotherapy Theory and Practice, 2013 - Taylor & Francis	Using theories of learning in workplaces to enhance physiotherapy clinical education	Opinion based
21.	CM Harris, S Zha - Education, 2017 - ingentaconnect.com	Concept mapping for critical thinking: efficacy, timing and type	No theory
22.	I Hege, AA Kononowicz, NB Berman… - GMS journal for …, 2018 - ncbi.nlm.nih.gov	Advancing clinical reasoning in virtual patients–development and application of a conceptual framework	Educators included in data collection

UNIVERSITY of the WESTERN CAPE

http://etd.uwc.ac.za/

ADDENDUM 3: Self-developed data extraction form

Adapted by the researcher from a form adapted by Hoque et al., 2017

Citation:	Date: Name:

Methods

Aim of the article	
Study design	
Data analysis	
Tool to collect data	

Population and setting

Methods of recruitment	
Number of participants/sample size	
Detailed description of the population	
Age of participants	
Country /nationality	

UNIVERSITY of the
WESTERN CAPE

http://etd.uwc.ac.za/

Citation:	Date: Name:

Eligibility – PICO (**P**opulation – Health prof students; **I**ntervention – Theory that underpins teaching strategy to improve **C**linical reasoning; **O**utcome – Improvement in clinical reasoning)

Health profession students' discipline	
Theory that underpins teaching strategy to improve clinical reasoning	
How theory was used by educators	
Teaching strategy used	

UNIVERSITY of the
WESTERN CAPE

http://etd.uwc.ac.za/

Citation:	Date: Name:

Measurement of the outcomes	
Results of the study / outcome – improvement of clinical reasoning	
Rigour of the article (appraisal)	
Key conclusions made by study authors	

UNIVERSITY of the
WESTERN CAPE

http://etd.uwc.ac.za/

ADDENDUM 4: JBI qualitative methodological appraisal tool

JBI qualitative checklist questions	(Rush et al., 2010) using simulation in a vocational programme: does the method support the theory?	(Torre et al., 2019), the clinical reasoning mapping exercise a new tool for exploring clinical reasoning
1. Is there congruity between the stated philosophical perspective and the research methodology	No	No
2. Is there congruity between the research methodology and the research question or objectives	Yes	No
3. Is there congruity between the research methodology and the methods used to collect data	Yes	No
4. Is there congruity between the research methodology and the representation and analysis of data	Yes	No
5. Is there congruity between the research methodology and the interpretation of results	Yes	No
6. Is there a statement locating the researcher culturally or theoretically	No	No
7. Is the influence of the research on the research, and vice-versa, addressed	No	No
8. Are participants, and their voices, adequately represented	Yes	No
9. Is the research ethical according to current criteria or, for recent studies, and is there evidence of ethical	Yes	No

UNIVERSITY of the WESTERN CAPE

http://etd.uwc.ac.za/

approval by an appropriate body		
10. Do the conclusions drawn in the research report flow from the analysis, or interpretation of the data	Yes	No

UNIVERSITY of the
WESTERN CAPE

http://etd.uwc.ac.za/

ADDENDUM 5 Preffered items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	Title page
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	Pg ii
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	Pg 1-6
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	Pg 6
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	n/a
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	Pg 24,25
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	Pg 25- last search 2020
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	Pg 32
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	Pg 34
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	Pg32,35
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	Pg 6
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	Pg 26,48
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	Pg 27,28

http://etd.uwc.ac.za/

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	Pg33
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	Pg36
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	Pg48,49
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	Pg36
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	Pg37-
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	Pg32-52
Limitations	20	Discuss the limitations of the scoping review process.	Pg56
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	Pg54
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	Pg viii

UNIVERSITY of the
WESTERN CAPE

http://etd.uwc.ac.za/

http://etd.uwc.ac.za/