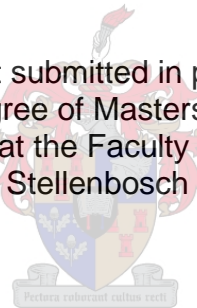


Physiotherapy Students' Perceptions of Clinical Reasoning

by

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Research assignment submitted in partial fulfilment of the requirements for the degree of Masters of Philosophy in Health Professions Education at the Faculty of Medicine and Health Sciences, Stellenbosch University



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Declaration

I, Noeline Fobian, hereby declare that the work contained in this assignment is my original work and that I have not previously submitted it, in its entirety or in part, at any university for a degree or other qualification.

Signature: Noeline Fobian

Date: March 2020

Abstract

Clinical reasoning is a vital competency of professional physiotherapy practice that contributes to the effectiveness of physiotherapy patient outcomes. Research on clinical reasoning and the physiotherapy student is limited. The purpose of this study was to explore physiotherapy students' perceptions of clinical reasoning and its development during clinical practice. This study used a qualitative research approach guided by a phenomenological framework. Individual semi-structured interviews were the chosen method of collecting data. An external interviewer conducted the interviews. The participants in the study were ten third- and fourth-year physiotherapy students from the Division of Physiotherapy, Stellenbosch University. Data were analysed applying an inductive, iterative process and using coding analysis to organise the data into themes and sub-themes. Students offered a conceptualisation of clinical reasoning that included the core dimensions of knowledge and cognition, elements of hypothetical deductive reasoning, and an interactive process of including the patient. Clinical exposure was expressed as critical to the development of clinical reasoning. Various factors were described as influencing the development of clinical reasoning, and especially the enabling Community of Practice, and a disabling lack of explicit teaching of clinical reasoning. The study concludes that the development of clinical reasoning in the physiotherapy student can be enhanced through clinical exposure and supported by an explicit and student-centred approach to teaching clinical reasoning.

Opsomming

Kliniese redenering is 'n noodsaaklike vaardigheid van professionele fisioterapiepraktyk wat bydra tot die effektiwiteit van fisioterapiepasiënt-uitkomst. Navorsing oor kliniese redenering en die fisioterapie-student is egter beperk. Die doel van hierdie studie was om fisioterapie-studente se persepsie van kliniese redenering en die ontwikkeling daarvan tydens kliniese praktyk te ondersoek. Hierdie studie gebruik 'n kwalitatiewe navorsingsbenadering, gelei deur 'n fenomenologiese raamwerk. Individuele semi-gestruktureerde onderhoude is gekies as die metode om data te versamel. Onderhoude is deur 'n eksterne onderhoudvoerder gedoen. Tien derde- en vierdejaar fisioterapiestudente van die Fisioterapie Afdeling by Stellenbosch Universiteit het deelgeneem aan die studie. Data is ontleed deur middel van 'n induktiewe, iteratiewe proses en koderingsanalise is gebruik om data in temas en subtemas te organiseer. Studente het 'n konseptualisering van kliniese redenering aangebied as 'n kerndimensie van kennis en kognisie, elemente van hipotetiese deduktiewe redenering asook 'n interaktiewe proses om die pasiënt in te sluit. Kliniese blootstelling is deurslaggewend vir die ontwikkeling van kliniese redenering. Verskeie faktore wat beskryf is het 'n invloed op die ontwikkeling van kliniese redenering, veral die bemagtigende Gemeenskap van Praktyk en die gebrek aan akkurate onderrig in kliniese redenering. Die studie kom tot die gevolgtrekking dat die ontwikkeling van kliniese redenering by die fisioterapie-student kan verbeter deur kliniese blootstelling en ondersteun word deur 'n akkurate en studentgesentreerde benadering tot die onderrig van kliniese redenering.

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Glossary

Disclaimer: the definitions provided are the interpretation of the author.

Clinical educator: The qualified and accredited physiotherapist employed by the Division of Physiotherapy, Stellenbosch University to offer clinical supervision for undergraduate physiotherapy students on the clinical platform. The Division of Physiotherapy and the students in the division refer to these persons as **clinical supervisors**. The literature uses the term clinical educator to denote any health professional involved with clinical teaching.

Clinician: A qualified physiotherapist employed by the Department of Health and working in any of the Department's health settings.

Facilitation sessions: Bi-weekly sessions of two and a half hours each, provided by the Division of Physiotherapy for third-year students during their clinical rotations, as extra support for their clinical practice.

Faculty development: Various activities provided by institutions to support faculty members in their roles.

Lecturer: The academic member of staff of the Division of Physiotherapy, Stellenbosch University responsible for the students' academic programme and mostly teaching in the classroom. Some lecturers are also clinical educators.

Evidence-based-practice: The practice of relying on scientific evidence for guidance and decision-making.

Patient-centred: The practice of providing health care that respects, responds to, listens to, and involves the patient in the care process. The patient is the focus of the care.

Reflective practice: The ability to reflect on one's actions so as to engage in a process of continuous learning.

Student-centred: Teaching practices that are focused on the students and their needs and not focused on the teachers and their teaching methods.

Abbreviations

CoP	Community of Practice
DPT	Division of Physiotherapy
HDR	Hypothetical Deductive Reasoning
HPCSA	Health Professions Council of South Africa
HPE	Health Professions Education
NQF	National Qualification Framework
SAQA	South African Qualification Authority
SU	Stellenbosch University
WCPT	World Confederation of Physical Therapists
WHO	World Health Organization

Chapter 1: Orientation of the Study

This chapter introduces the importance of clinical reasoning in physiotherapy and physiotherapy education programmes. It also provides the background and context to the study, building towards the motivation for the study, and concluding with the study question, aims and objectives.

1.1 Introduction

Inequalities in health systems globally and the failure of Health Professions Education (HPE) to keep pace with the ever-increasing burden on health systems were highlighted in the Lancet's Global Independent Commission report on Education of Health Professions for the 21st century (Frenk, Chen, Bhutta, Cohen, Crisp *et al.*, 2010). The report called for a redesign in HPE towards a transformative education that could ensure equitable health systems by training health professionals who meet the needs of those health systems more specifically. Shortly after this report, the World Health Organization (WHO) provided a guideline for the up-scale and transformation of HPE that calls for the training of health professionals who are competent and efficient, and able to be change agents to strengthen health systems (World Health Organization, 2013).

Detailed guidelines for entry-level physiotherapy education are provided by the World Confederation of Physical Therapy (WCPT) (WCPT, 2011). Physiotherapy is clearly defined by the WCPT as “services provided by physical therapists to individuals and populations to develop, maintain and restore maximum movement and functional ability throughout the lifespan” (WCPT, 2017:1). Clinical reasoning is a characteristic stated by the WCPT in their description of a physiotherapist (WCPT, 2017). The Board of Physiotherapy within the Health Professions Council of South Africa (HPCSA) calls for the training of physiotherapists of high quality that will have the knowledge, skills and attitudes needed for professional practice, that include independent critical thinking, self-directed learning, social responsibility and critical problem solving ability. The training of physiotherapists against these standards will ensure effective practice and the protection of the population, as well as the promotion of physiotherapy in South Africa (HPCSA, 2019).

With the demands of a changing health system as described by Frenk *et al.* (2010), physiotherapists are accountable for delivering clinically significant improvements in their patients' functional outcomes (Christensen, Black, Furze, Huhn, Vendrely & Wainwright, 2017). Clinical reasoning in the physiotherapist forms a critical component in achieving these effective and efficient outcomes in patients (Christensen *et al.*, 2017). Physiotherapy education aims to prepare physiotherapy students to be independent practitioners (Gilliland,

2014). A priority for physiotherapy educators must be the development of clinical reasoning, as it can be viewed as a practical demonstration or outcome of the professional entry programme evident in the new graduate (Christenson, Jones, Edwards & Higgs, 2008). An understanding of how students engage with clinical reasoning can be the first step towards teaching clinical reasoning (Gilliland & Wainwright, 2017). The way students reason clinically in the clinical setting could be influenced by their understanding and perceptions of clinical reasoning (Hendrick, Bond, Duncan & Hale, 2009).

1.2 Background and context

The Division of Physiotherapy (DPT) at Stellenbosch University (SU) offers a four-year undergraduate Bachelor of Science in Physiotherapy degree. The DPT is accountable to the accrediting body of South Africa, namely, the Board of Physiotherapy within the HPCSA, and has a responsibility to train physiotherapists who fit the scope of practice defined by the Board of Physiotherapy (HPCSA, 2019). The board also defines a minimum of clinical hours to be accumulated by the undergraduate physiotherapy student to qualify for graduation to independent professional practice.

Additionally, the National Qualification Framework (NQF) requires a minimum of 480 credits for the degree BSc in Physiotherapy, namely NQF level 8 (NQF, 2019). In line with the requirements for level 8 of the NQF, the South African Qualification Authority (SAQA) prescribes a minimum of 40 credits for the third year clinical programme and 96 credits for the fourth year clinical programme, to qualify as a professional degree (SAQA, 2019). The third and fourth year clinical modules of the DPT meet the required credits for level eight qualification. The DPT therefore aims to graduate physiotherapists that possess the knowledge, skills and attitudes to be able to practise independently as reflective practitioners within the complex health system of South Africa (DPT, 2019).

The clinical component of the programme at the DPT starts in second year when students are introduced to the importance, and the means of, communication with patients. However, this is classroom based. Clinical exposure within the clinical component of the programme occurs during the third and fourth years of study. The two years of academic, classroom-based study that precede the clinical years focus on the acquisition of the knowledge, skills and attitudes needed for practice in the clinical years. Once on the clinical platform, students are responsible for evaluating, treating and managing patients safely within the context of professional practice. Students in their third year of study are required to complete three five-week clinical rotations in the areas of orthopaedics, neurology and medical and surgical practice. Fourth-year students are required to complete five six-week clinical rotations in orthopaedics, cardio-

respiratory, neurology, community and a specialist paediatrics or sports practice. Fourth-year students must also complete an additional two-week elective in a practice of their choice (DPT, 2019). In order to comply with the minimum number of required clinical hours needed for accreditation, students spend a significant amount of time in the clinical areas learning experientially through workplace-based learning. Many of the clinical areas where students are placed are within the unique and resource constrained environment of the South African Health system (Coovadia, Jewkes, Barron, Sanders & McIntyre, 2009).

During their clinical rotations in the various clinical platforms, students will interact with both clinicians and clinical educators. Clinicians are qualified physiotherapists employed by the Department of Health that oversee students to ensure that patients are managed effectively and safely. The clinical educator (known as the clinical supervisor to students) is a qualified and accredited physiotherapist employed by the DPT to provide students with weekly supervision on the clinical platform (two-hour sessions for third-year students and one-and-half hour sessions for fourth-year students, per week of clinical rotation). The structure and nature of these supervision sessions are agreed by joint decision between the clinical educator and the student, but they include some required activities such as assessment of clinical practice. The researcher of this study is a clinical educator, employed by the DPT, involved with the supervision of both third- and fourth-year physiotherapy students on the clinical platform.

Additional support to the clinical rotations is provided for the third-year students in the form of bi-weekly group sessions called facilitation sessions. Those students on the same clinical rotation (i.e. orthopaedics, neurology or medical and surgical) meet together bi-weekly for two-and-a-half hour sessions to discuss clinically related issues with the staff member and with each other. These sessions are facilitated by a member of staff at the DPT. The group participates in two or three clinical visits together where the member of staff will demonstrate a physiotherapy-patient interaction.

1.3 Motivation for the study

As a clinical educator, it is the experience of the researcher of this study that many third- and fourth-year students, when faced with real-life patients on the clinical platform, struggle to reason clinically, despite the apparent evidence of the knowledge, skills and attitudes to be able to do so. This inability to clinically reason adequately often impacts the effectiveness of their physiotherapy interventions. The students also appear to be unsure of how to correct their errors in the clinical reasoning process, or how to develop their clinical reasoning. The researcher questioned whether students even know what clinical reasoning is, and the importance of developing it, and what they think is influencing their ability to reason clinically.

The researcher became interested in this dilemma, which led to a desire to explore this further, with the aim of being able to better facilitate this reasoning process in the students during the weekly supervision sessions.

1.4 Research question

How do third- and fourth-year physiotherapy students in the DPT, SU perceive clinical reasoning and its development?

1.5 Aim

The aim of the research was to explore SU physiotherapy students' perceptions of clinical reasoning and its development during their clinical practice in the third and fourth years of study.

1.6 Objectives

To explore third- and fourth-year physiotherapy students' perceptions of:

- the concept of clinical reasoning,
- the development of clinical reasoning during their clinical practice, and
- those factors that influence the development of clinical reasoning.

1.7 Assignment outline

The remaining chapters present a detailed report of this study. Chapter two considers the literature that was sourced to support this study. Chapter three describes the study design and research methodology. Chapter four presents the findings from the data. Chapter five discusses these findings in relation to the literature and the context of the study. Lastly, chapter six provides a conclusion to the study and the study question.

Chapter 2: Literature Review

This chapter discusses the literature sourced to support this study. The literature on clinical reasoning is vast; therefore, in line with the aim of this study to explore physiotherapy students' perceptions of clinical reasoning during clinical practice, and given the uniqueness of clinical reasoning in physiotherapy, the literature search focused primarily on clinical reasoning in physiotherapy and the physiotherapy student. This chapter first provides an overview of clinical reasoning with consideration given to the uniqueness of clinical reasoning in physiotherapy practice. This is followed by a description of those studies that explored clinical reasoning in the physiotherapy student. Also in alignment with the aim of this study to explore the development of clinical reasoning during clinical practice, the theories underpinning teaching and learning within the clinical environment are outlined in the last section of the review. The conclusion discusses how the studies in clinical reasoning and physiotherapy students influenced the conceptualisation of this study.

2.1 Introduction

Higgs and Jones (2008) define clinical reasoning as a complex, cognitive process of making clinical decisions in professional practice. It is a context-dependent process that requires core dimensions of knowledge, cognition, metacognition, and interaction with the patient, caregiver, and other health care team members. (Higgs & Jones, 2008; Gilliland, 2014; Gilliland & Wainwright, 2017). Higgs and Jones explain the three core dimensions. The knowledge dimension includes theoretical knowledge and knowledge gained from experience. The cognition dimension (thinking skills) is used to compare the data collected from the clinical interaction with the existing knowledge. Metacognition, or reflective self-awareness, bridges the gap between knowledge and cognition (Higgs & Jones, 2008). Gilliland (2014) describes three frequently mentioned models of clinical reasoning considered in the studies of clinical reasoning, namely: the hypothetical deductive reasoning (HDR) model; the pattern recognition model; and an interactive model of clinical reasoning that focuses on the patient. The HDR model suggests that a general problem-solving process can be applied to clinical reasoning, and is understood as the process of first generating a hypothesis (hypothesis generation) based on knowledge and clinical data generation (cue acquisition), followed by inductive reasoning towards the hypothesis (cue interpretation), and then deductive reasoning needed to test the hypothesis (hypothesis testing) (Hendrick *et al.*, 2009; Gilliland, 2014). Pattern recognition models view clinical reasoning as the process of perceiving and storing related information to be recalled and used as a pattern when a similar scenario presents (Hendrick *et al.*, 2009). The interactive model of clinical reasoning is a process centred more on the patients, their values and experiences, that involves the patient and caregivers, collaboratively

towards making clinical decisions (Gilliland, 2014). The pattern recognition and interactive models are models more evident in expert practice (Doody & McAteer, 2002; Wainwright, Shepard, Harman & Stephans, 2010; Gilliland, 2014).

Gilliland and Wainwright (2017) highlight three concepts unique to clinical reasoning in the expert physiotherapist. First, physiotherapists must not only diagnose a pathology for a patient, but they must also give reasons and consequences relating to the diagnosis and disease process. Second, unique to the clinical reasoning process of physiotherapists is the use of movement patterns, movement impairments and task requirements for movement, that is, movement analysis. Third, due to the ongoing and interactive nature of physiotherapy practice, physiotherapists work collaboratively with patients to determine ways to encourage and motivate the patients towards recovery. This requires gaining an understanding of the patient's context and their perception of their illness or injury (Gilliland & Wainwright, 2017).

Wainwright *et al.* (2010) go on to explain how important reflection is in the development of clinical reasoning consistent with expert practice. The results of their study with novice and experienced physiotherapists demonstrated a difference in the way reflection was used in practice. Both groups described using reflection to gain insight into their clinical decision making, but novice physiotherapists tended to reflect more on themselves and their own performance with patients. In contrast, the experienced therapists were reflective on their abilities within the scope of practice, and were able to integrate and use information from multiple sources. This reflection on professional experience was shaped by the nature of previous clinical experiences, and accumulating experience was seen to be vital to the development of expert practice. The main distinguishing factor between reflection in the two groups was the use of self-assessment during reflection-in-action by the experienced therapist. The experienced therapist used reflection-in-action not only to assess the patient's performance, but also their own thought processes and actions. The authors concluded that the use of effective self-assessment will lead to a change in the way the physiotherapist approaches patient management (Wainwright *et al.*, 2010).

Many of the studies on clinical reasoning in physiotherapy have researched professional practice. There is a limited number of studies focused on the clinical reasoning process of the physiotherapy student. A few of these studies are discussed below.

2.2 Studies in clinical reasoning and the physiotherapy student

Students' conceptualisations of clinical reasoning relative to their clinical practice were researched by Hendrick *et al.* (2009) in semi-structured interviews with physiotherapy students from the second, third and fourth years of study. Students were provided with explicit teaching on clinical reasoning in years two and three of their programme, and the interviews were

conducted at a point when this teaching was complete. The study findings showed that students conceptualised clinical reasoning differently across the three years of their physiotherapy programme, varying from simple to more complex. The simpler conceptualisations of clinical reasoning included the application of theoretical knowledge to the clinical problem and patient, using the knowledge to formulate a hypothesis followed by tests to confirm the hypothesis (a cyclical analytical process), and rationalising clinical decision making, that is, justifying what and why.

More complex reasoning processes involved combining all learned knowledge and experiences to reach a decision, with some pattern recognition applied to the process; and a problem-solving approach that relied on reflection on building patterns with more focus on the individual patient. The authors concluded that the results of the study showed a continuum of development of clinical reasoning, with mixed forms of reasoning being used, rather than a single particular model of clinical reasoning. There was also development towards being more patient focused, with the importance of accumulating clinical experience identified as crucial to the development of pattern recognition reasoning. Further research into the relationship between the development of clinical reasoning and students' clinical exposure is suggested in this study (Hendrick *et al.*, 2009).

Cruz, Moore and Cross (2012) similarly explored students' perceptions of clinical reasoning in final year physiotherapy students, through focus-group discussions. Students emphasised the cognitive nature of the process of clinical reasoning in making a diagnosis of the patient's problems. This thinking process was seen to belong to the therapist, with the patient's main role being the provision of useful information. Adequate theoretical knowledge, cognitive skill, and clinical experience were stated as important for effective clinical reasoning. The experience in different clinical situations and conditions contributed to increasing knowledge. The authors recommend the need for further research to explore the development of clinical reasoning and what the best strategies might be to enhance this development (Cruz *et al.*, 2012).

Gilliland (2014) studied the clinical reasoning of first- and third-year physiotherapy students through once-off direct observation of the students' reasoning in a standardised patient (paper patient), with students thinking out aloud and probing for more information from the written case. This was followed by semi-structured interviews to gain deeper understanding of the students' reasoning strategies used. The results of the study described the different strategies of reasoning demonstrated by the students, ranging from the simple trial and error strategy to the more complex HDR, and even some use of pattern recognition based on previous experiences with a similar case. The author concluded that the strategies used indicated a hierarchy of sophistication amongst the students (Gilliland, 2014). Gilliland and Wainwright

(2017) conducted a similar study with second-year physiotherapy students and identified similar reasoning strategies in the students. However, it was also discovered that students had made use of both reflection-in-action and reflection-on-action during the patient encounter. The authors of both these studies concluded that the students demonstrated development toward physiotherapy clinical reasoning, but the authors offered no insight into the factors that may influence this development. They advocated for further research into the developmental process of clinical reasoning and the factors that may influence this process (Gilliland, 2014; Gilliland & Wainwright, 2017).

A longitudinal study by Furze, Black, Hoffman, Barr, Cochran and Jensen (2015) explored students' clinical reasoning development in professional physiotherapy education. The authors developed a clinical reasoning questionnaire and collected responses to the questionnaire in a survey, from students across their physiotherapy programme. The results of this study demonstrated a progression in the development of clinical reasoning in physiotherapy students. Students progressed through the physiotherapy programme from scripted, procedural, self-focused clinical reasoning ability, to a more dynamic clinical reasoning process, focused on patients' needs and contexts. Additionally, students' reflective ability also showed a progressive development in insight and depth. Development over time was an important finding of this study. The authors' suggestion for further study is to determine the best practice for the enhancement of learning of clinical reasoning in the physiotherapy student (Furze *et al.*, 2015).

Wijbenga, Bovend'Eerd and Driessen (2018) conducted a study that explored both the development of clinical reasoning in the physiotherapy student, as well as the contributing factors to this development. The researchers used focus groups (participants were students) and semi-structured interviews (participants were clinical educators) as their methods for data collection. The results of the research present both the students' and the clinical educators' perspectives on clinical reasoning development. Both students and clinical educators stated that a key to the development of clinical reasoning is exposure to real-life patients in clinical practice. Through increased practical experience and clinical exposure, students were able to develop their clinical reasoning in much the same way as the development of clinical reasoning in students in the other studies discussed previously, namely, towards a more sophisticated approach of reasoning that included the patient. The role of the clinical educator had a profound effect on the learning of clinical reasoning in the students in this study. Development of clinical reasoning in the student was promoted when the clinical educator provided regular feedback on students' performance and asked questions about their reasoning to encourage reflection within the student. Clinical educators reported that those students that demonstrated critical and reflective behaviours were more proficient in their clinical reasoning. A call for

further research in the development of clinical reasoning in the physiotherapy student was echoed in this study (Wijbenga *et al.*, 2018).

Some of the studies discussed above highlight how clinical reasoning development is dependent on exposure to, and experience gained in, clinical practice (Cruz *et al.*, 2012; Wijbenga *et al.*, 2018). Wijbenga *et al.* (2018) believe that learning clinical reasoning is limited in the pre-clinical years of study because its application is bound to real-life contexts. Therefore, in an attempt to gain insight into how clinical reasoning may be developed and facilitated in the clinical environment, and in line with the aim of this study to explore physiotherapy students' perceptions of clinical reasoning and its development during their clinical practice, the following section will outline the teaching-learning theories of clinical education and how learning is facilitated in the clinical learning environment.

2.3 Clinical education in physiotherapy

Clinical education is central to physiotherapy undergraduate programmes. It aims to produce autonomous entry-level physiotherapists who are able to engage in self-assessment and lifelong learning towards the development of professional practice (Patton, Higgs & Smith, 2013). Patton *et al.* (2013) believe that an understanding of the learning theories that underpin clinical education could assist the clinical educator to plan and implement effective educational practices to enhance the learning experiences of physiotherapy students.

2.3.1 Learning in the workplace

Clinical workplaces are unique and complex environments (Patton *et al.*, 2013) that allow for learning that is focused on real problems and motivate students through their active participation (Spencer, 2003). Only in the workplace will the student learn and integrate important skills such as history taking, physical examination, clinical reasoning and decision making, empathy, and professionalism (Spencer, 2003). There are a number of learning theories to be considered in workplace learning, as discussed below.

Behavioural orientations to learning state that learning is the result of a change in behaviour, and such changes are the result of external environmental influences on the individual (Taylor & Hamdy, 2013; Morris & Blaney, 2014). In a behaviourist approach, learning is by doing, with frequent opportunities provided to practise in varied contexts, and reinforcement is provided as a motivator (Morris & Blaney, 2014).

Cognitive learning theories focus on the internal world of the learner, namely, their cognitive structures, and is characterised by learners seeking to understand the structure of knowledge (Torre, Daley, Sebastian & Elnicki, 2006). Cognitive learning focuses on the acquisition of knowledge and skills (Morris & Blaney, 2014). An important component to the cognitivist

approach to learning is the development of critical thinking through reflection. Reflection serves as a gap to bridge theory and practice and allows for theories to be tested and revised in professional practice (Kauffman & Mann, 2014). *Reflection-in-action* is thinking during an experience, while *reflection-on-action* occurs after the event and is thinking back on the event to make sense of the learning that occurred (Schön, 1983; Kauffman & Mann, 2014).

A significant learning theory approach underpinning learning in the workplace, is social cognitive theory (Patton *et al.*, 2013; Morris & Blaney, 2014), which acknowledges that learning is social in nature (Kauffman & Mann, 2014). Kauffman and Mann (2014) propose that this approach to learning combines the behavioural and cognitive orientations to learning. Therefore, social cognitive theories of learning consider both the internal and external worlds of the learner and the interactions between the individual and others within the learning environment (Morris & Blaney, 2014). Key to this learning approach is observation and role modelling whereby learners acquire a cognitive representation of observed and role modelled behaviour of others (Torre *et al.*, 2006). Consequently, relationships are central to this approach to learning, and the 'others' in the learning environment can be the clinical educator (Patton *et al.*, 2013). Within this observation and role modelling approach, lies the *zone of proximal development*, described by (Vygotsky, 1978) as that which a learner can do with the support of a more knowledgeable other, contrasted with the *zone of actual development*, which is what a learner can do independently. Learning happens in the *zone of proximal development* through guidance, support and assistance (Morris & Blaney, 2014).

The social-cultural theory of learning (or situated learning) is built on social learning theory, and views learning as occurring via the active participation of learners in a community of practice, that is, learning takes place when learners are situated in authentic contexts (Patton *et al.*, 2013; Kauffman & Mann, 2014; Morris & Blaney, 2014). Lave and Wenger (1991) were the first to propose the term 'Communities of Practice' (CoP). Learning in this model is described as a gradual movement from peripheral participation towards full participation in a CoP (Lave & Wenger, 1991; Patton *et al.*, 2013; Kauffman & Mann, 2014). Social interaction is therefore a vital component of situated learning where learners are constructing their professional identities in relation to the CoP (Patton *et al.*, 2013).

The workplace offers the opportunity for real life experiences for the student, therefore experiential learning must also be considered as an approach to learning. Simply stated, experiential learning refers to how learners learn from real life experiences (Bass, 2012). Taylor and Hamdy (2013) explain Kolb's (1984) experiential learning theory which offers a learning cycle for learners to reflect on their experience. The cycle commences with the concrete experience. Through reflection on this experience learners can formulate abstract concepts and generalisations gained from the experience. Their understanding of the

experience can then be consolidated through the testing of the abstract concepts in new situations which brings them to the beginning of the cycle again. Learning is optimal when learners access all stages of the reflective cycle (Taylor & Hamdy, 2013).

Last of the learning theories that underpin learning in the workplace to be considered, is that of self-directed learning. Self-directed learning is a process whereby individuals take the initiative to independently define their own learning needs and goals, identify the various resources needed to achieve these learning outcomes, and evaluate the achievement of the learning outcomes in relation to the goals (Knowles, 1975). In self-directed learning theory, learners are motivated towards autonomy through a desire to become all that they are capable of becoming, and take responsibility for their own learning (Torre *et al.*, 2006). Related to self-directed learning, Entwistle and Peterson (2004) describe how learners approach learning differently depending on the learning event. When learners work towards a deep understanding of what they are learning in an attempt to make meaning of the learning event, they exhibit a deep approach to learning. At other times, learning is superficial in its approach and the focus is on fact learning or reproduction of content. Occasionally, learning is strategic in its approach when the learner will gauge the amount of effort needed to do well and meet the course requirements (Entwistle & Peterson, 2004).

2.3.2 Teaching in the workplace

Clinical teaching is teaching and learning focused on the patient and often directly involves the patients and their problems (Spencer, 2003). Clinical educators have a dual role in providing patient care and teaching (Irby & Bowen, 2004). Harden and Crosby (2000) define a good clinical educator as one who is able to share their thoughts as a reflective practitioner, helping to highlight the process of clinical decision making for the student. Ramani and Leinster (2008) expand this definition and provide a list of qualities that make a clinical educator excellent. These include having a passion for teaching; being accessible, compassionate and supportive; able to establish a rapport with students; provide direction and feedback; use many different teaching strategies; and being student-centred. Supervision provided within the clinical workplace is defined as providing guidance and feedback to a trainee on all matters of their educational development in the context of their own experience, while providing safe patient care (Kilminster, Cottrell, Grant & Jolly, 2007). Morris and Blaney (2014) advocate for regular access to high quality supervision for successful learning in the workplace. Irvine and Martin (2014) further explain that clinical supervision is vital for the transference of knowledge and skills to the clinical setting, and when effective will boost student confidence and improve professional performance. When providing supervision, learning is facilitated by the clinical educator using a variety of methods, including role modelling, and providing feedback (Irby & Bowen, 2004; Ramani & Leinster, 2008).

Learners develop their professional role through the observation of role models (Ramani & Leinster, 2008). Three characteristic categories of clinical role models are described by Cruess, Cruess and Steinert (2008), and Passi, Johnson, Peile, Wright, Hafferty and Johnson (2013), namely clinical competence, teaching skills, and personal qualities. The clinical educator must role model clinical competence by demonstrating an excellent level of clinical knowledge and skills, with sound clinical reasoning ability, and be patient centred in their approach to patient care. The teaching skills needed for role modelling this professional behaviour include being able to establish a rapport with learners, create a positive and supportive learning environment, and be learner-centred in their teaching approach. Enthusiasm for teaching and good interpersonal skills make up the personal attributes for effective role modelling (Cruess *et al.*, 2008; Passi *et al.*, 2013). Clinical educators can improve their role modelling impact by increasing their awareness of being a role model; protecting teaching time; and making the implicit explicit through the thorough explanation of actions, thinking aloud, and facilitating reflection in the learner (Cruess *et al.*, 2008).

Feedback provided by clinical educators on improved performance is a valuable aspect to clinical teaching (Cantillon & Sargeant, 2008; Ramani & Leinster, 2008; Morris & Blaney, 2014). For feedback to be effective, the following principles must be considered, namely: that feedback must be timely; not deliver too much information at once; focus on specific behaviours and not general performance; be non-judgemental; and that it must encourage learners to reflect on their own performance (Cantillon & Sargeant, 2008). Most importantly, feedback must ensure the completion of a feedback loop with clear evidence that the feedback given has been incorporated into later practice. The student must provide a clear plan for incorporating the feedback in future practice (Cantillon & Sargeant, 2008; Boud, 2015).

2.4 Conclusion

The studies discussed in this chapter that have explored clinical reasoning in physiotherapy students have provided valuable insight and background to this study. The studies are unanimous in their call for further research on students' perceptions of clinical reasoning, and especially the development of clinical reasoning and best practice for enhancing the learning and development of clinical reasoning. There is a definite gap in the literature of the possible factors that could influence the development of clinical reasoning. The response to this call, and the gap identified in the literature, significantly influenced the conceptualisation and design of this study and contributed to its aims, objectives and methods. Furthermore, the studies discussed in this chapter were all within the context of developed countries. The current study was conducted within the unique and resource constrained environment of the health system of South Africa (Coovadia *et al.*, 2009).

Chapter 3: Research Methodology

3.1 Introduction

Chapter three details the methodology chosen and applied to complete this study. The chapter presents the research question, aims of the study, research design, data collection method and analysis. The data management processes and ethical considerations for the study are also stated.

3.2 Research question

How do third- and fourth-year physiotherapy students in the DPT, SU perceive clinical reasoning and its development?

3.3 Aim

The aim of the research was to explore SU physiotherapy students' perceptions of clinical reasoning and its development during their clinical practice in the third and fourth years of study.

3.4 Objectives

To explore third- and fourth-year physiotherapy students' perceptions of:

- the concept of clinical reasoning;
- the development of clinical reasoning during their clinical practice; and
- those factors that influence the development of clinical reasoning.

3.5 Research design

The study used a qualitative research approach within a constructivist paradigm. Constructivism holds the view that knowledge and meaning are socially constructed, and embraces both interpretive and phenomenological perspectives (Illing, 2014). Phenomenology seeks to gain understanding of the world through the experiences of others and the meaning they attribute to their experiences (Ramani & Mann, 2016). The researcher wished to gain insight into students' perceptions of clinical reasoning through their clinical experience; therefore, the research methods were guided by a phenomenological framework. Furthermore, an inductive process was applied whereby the researcher first gained the perspectives of the participants in order to generate a theory which was grounded in the experiences of the participants and which highlighted the phenomenon being researched (Tavakol & Sandars, 2014).

3.6 The role of the researcher

In constructivist research, the researcher is regarded as both a facilitator and participant in the research (Illing, 2014). At the time of the study, as the researcher, I was employed as a clinical educator in the DPT at SU, responsible for facilitating learning on the clinical platform, as well as being responsible for the assessment of clinical practice, for both third- and fourth-year physiotherapy students. Although I did not personally conduct the interviews for the study, I was responsible for analysing the data. I applied a reflective stance to the interpretation of the data, cognisant of personal bias and interest in the research question.

3.7 Research method

Individual semi-structured interviews were chosen as the method of collecting data (Tavakol & Sandars, 2014). Interviews are appropriate when sensitive issues are explored, where participants may not feel comfortable discussing in a group situation (Gill, Stewart, Treasure & Chadwick, 2008). The researcher felt that students might view clinical reasoning to be a competency linked to their clinical performance, leading to such a sensitivity.

A set of pre-determined questions (Addendum A) guided the interviews whilst allowing both the interviewer and participant to pursue additional topics that arose (Ng, Lingard & Kennedy, 2014). The questions were based on the interview schedule of the study by Hendrick *et al.* (2009) as the questions fitted well with the aims and objectives of this study and needed only minor adaption to support the research question of the study.

The researcher was known to the participants; therefore an external interviewer, who had experience in conducting semi-structured interviews and who was in no way affiliated to the DPT at SU, or known to the participants, conducted the interviews. This created the opportunity for participants to be more open with their responses. The interviewer was asked to sign a confidentiality agreement before the start of the interviews. The researcher and interviewer together discussed the questionnaire prior to commencement of the interviews and following completion of the first interview, in order to gain consensus regarding prompting, and to refine the questions.

3.8 Study population

The study population consisted of third- and fourth-year undergraduate physiotherapy students registered with the DPT at SU, in the 2019 academic year. It is only in their third and fourth years that students participate in clinical rotations. At the time of sampling for the study,

there were 55 third-year students and 50 fourth-year students rotating through the clinical platform.

3.9 Sampling

Students in the population group were invited to participate in the study via email. The email explained the purpose and objectives of the study, and the proposed method of data collection. Voluntary participation was emphasised, and students were assured that their responses would be treated confidentially. No coercion or influence was applied to the process. The informed consent forms were included in the emails.

Invitations to participate yielded 24 responses. Ten students were purposively sampled to ensure a diverse group of participants based on gender, academic performance (using the academic results from the first clinical rotation of 2019), home language, race (as per the university's administrative classification of the student) and year of study. A grid table was used which attempted to populate as many of the fields in the grid as possible (Addendum B). Ensuring diversity was purely for the purposes of contributing to the richness and variability of data collected. The researcher was not intending that data collected would be generalised, nor was the researcher looking to make correlations to any of the groupings used to ensure diversity.

The ten students were emailed to inform them of their inclusion in the study and to clarify arrangements for the interviews. Students were informed that they could withdraw from participation in the study at any point, and that participation would neither benefit nor harm their academic performances. They were also informed that they could refuse the use of the data collected from their interviews.

3.10 Data collection

Interviews were scheduled with the selected participants at a time convenient for them. Prior to commencement of the interviews, informed consent was explained and obtained from all participants to be interviewed, and for the interviews to be recorded (Addendum C). The interviews were conducted in English, in a quiet office, in the Centre for Health Professions Education, Tygerberg campus. Interviews were audio-recorded using a digital audio-recorder. The interviewer made notes during the interviews and communicated with the researcher following interviews, for clarification of the process.

3.11 Data management

Audio-recorded data files were downloaded to a password protected computer accessed by the interviewer only, who randomly assigned a number from one to ten to ensure anonymity

of participants. The interviewer was then responsible for outsourcing the numbered audio-recorded data files to a transcriber. The transcriber signed a confidentiality agreement before commencement of the transcription of the data. Transcribed data files were allocated the same number as those of the audio-recorded data files. The transcriber emailed the numbered and anonymised transcribed files back to the interviewer and both deleted all files from their computers.

The interviewer deleted the audio-recorded data from the digital audio-recorder once the transcribed data file was checked for accuracy against the same audio-recorded file. The anonymised, transcribed files were then shared with the researcher and downloaded to a folder on a password protected computer accessed by the researcher only. The interviewer deleted all audio-recorded and transcribed data from her computer on completion of all data being transcribed, and forwarded to the researcher. Hard copies of consent forms, transcriptions and all other relevant data were stored in a file in a secure location.

3.12 Data analysis

All data collected from the interviews were analysed by the researcher applying an inductive, iterative process and using coding analysis to organise the data into similar sub-themes and themes (Ng *et al.*, 2014; Ramani & Mann, 2016). Data analysis occurred in three stages described by Hanson, Balmer and Giardino (2011).

In phase one, the researcher read through the data numerous times, familiarising herself with the data, highlighting and noting initial codes. The codes were then applied iteratively to the data. Codes and supporting quotations were then entered in a codebook. Coded data were grouped together into sub-themes and themes in the second phase of the analysis process. These themes and sub-themes were the assertions and interpretations of the researcher based on the data. In this second phase the researcher consulted the literature relevant to the study phenomena for ideas and comparisons on the themes. Data analysis was completed in the third phase when the researcher searched for relationships between themes, and referred to the data to test the themes. In this final stage of data analysis, the researcher could make inferences from the study and suggest possible hypotheses (Hanson *et al.*, 2011). In all three stages of data analysis, the researcher consulted with, and received input from, the two research supervisors.

3.13 Ensuring trustworthiness and research quality

The researcher considered the four concepts of qualitative research for trustworthiness and quality of research, namely, credibility, transferability, dependability and confirmability (Tavakol & Sandars, 2014).

3.13.1 Credibility

Credibility refers to the extent to which the findings of the study can be trusted and are believable to others (Frambach, van der Vleuten & Durning, 2013). The credibility of this study was enhanced through detailed collection of data and the skilful interviewing of the interviewer. Time constraints and the small-scale nature of this study did not allow for triangulation or prolonged collection of data.

3.13.2 Transferability

Transferability refers to how well the study findings can be applied in a different setting or transferred to another context (Frambach *et al.*, 2013; Tavakol & Sandars, 2014). To support the transferability of this study, the researcher provided a detailed report on all aspects of the study, including the study setting, methods used to collect data, and sampling processes. The researcher could also provide clear and detailed information on the context of the study as the researcher was personally involved in the clinical rotations of some of the participants and was a staff member of the DPT at SU at the time of the study.

3.13.3 Dependability

Dependability describes the extent to which the findings of the study are consistent with the contexts in which the data were collected (Frambach *et al.*, 2013). The researcher needs to determine whether the study, when repeated, will obtain the same results (Tavakol & Sandars, 2014). The dependability of this study was strengthened by applying an inductive and iterative process to the analysis of the data. The researcher was flexible in the data analysis process to allow for emerging themes not initially considered by the researcher. During thematic analysis of the data, emerging sub-themes and themes were discussed with the two research supervisors (peer debriefing).

3.13.4 Confirmability

Confirmability is the last concept to be considered for quality research in qualitative research and is understood to be the degree to which the results of the findings of the participants and the setting in which data were collected can be confirmed as accurate, and are not due to biases of the researcher (Frambach *et al.*, 2013; Tavakol & Sandars, 2014). The confirmability of this study was strengthened through careful collection and management of all data and establishing an audit trail by keeping a detailed record of all processes.

3.14 Ethical considerations

The research protocol was granted ethical approval by the Health Research Ethics Committee, SU, reference number #S19/03/050. Permission was granted by the Institutional Planning

Division, SU, institutional reference number IRPSD-1310. Permission to conduct the study was also obtained from the chair of the Undergraduate Committee of the DPT.

Ethical considerations to protect the participants of the study have been discussed under the sampling, data collection and data management sections above.

Chapter 4: Results

Chapter four presents the findings of the semi-structured interviews, and the themes and sub-themes that developed from the data analysis. The relationship between themes is discussed. Direct quotations are provided from the data to support individual themes. Participants are quoted according to gender, male or female (M or F), the number assigned to their data, and the year of study (A denotes third-year and B fourth-year).

4.1 Introduction

The themes and sub-themes that developed from the inductive process of data analysis are the researcher’s interpretation of the main ideas expressed by the participants in the interviews. Initial codes were studied and grouped into three themes with sub-themes. It became evident from the analysis of the data that the students’ descriptions of the process of learning and development of clinical reasoning were underpinned by their understanding of the concept of clinical reasoning. The process of learning and development was influenced by factors that were both extrinsic and intrinsic. These factors either enabled or disabled the learning process. These findings are represented in Table 4.1.

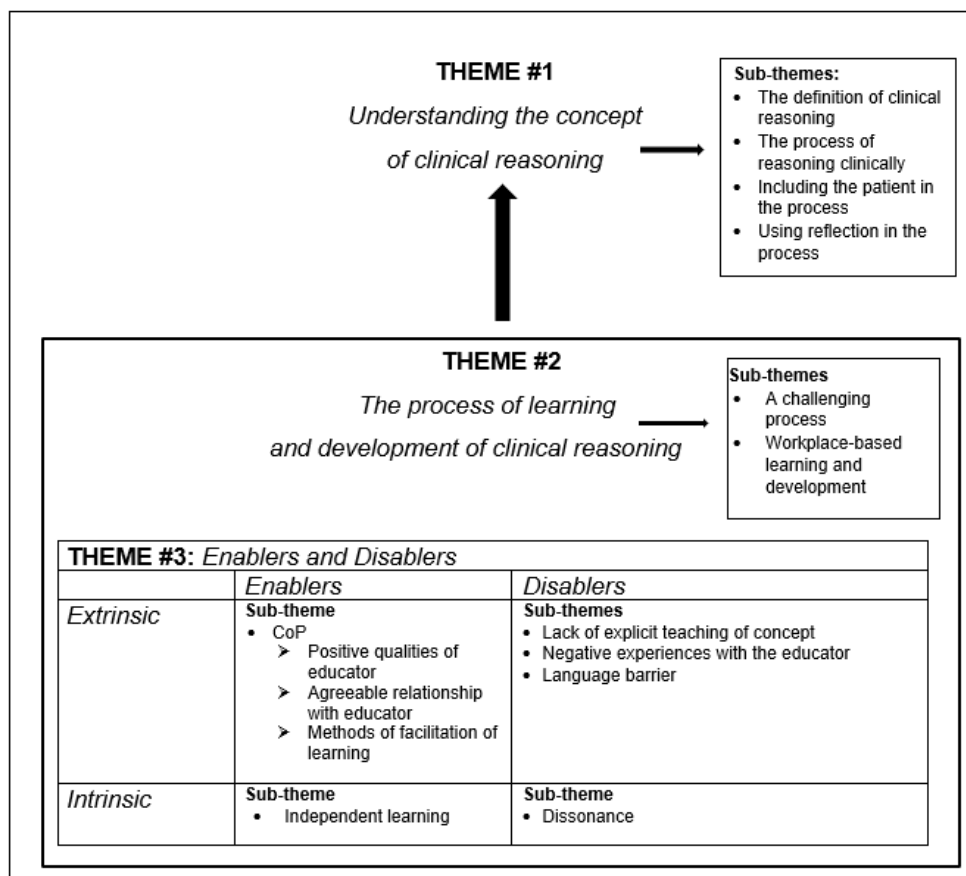


Table 4.1: Themes and sub-themes developed from the data

These findings are discussed below, and supporting quotations from the participants are provided.

4.2 Theme 1: Understanding the concept of clinical reasoning

Theme 1 describes the students' understanding of the concept of clinical reasoning. Four sub-themes developed within this theme, namely: the definition of clinical reasoning; the process of reasoning clinically; including the patient in the process; and using reflection in the process.

4.2.1 Sub-theme 1: The definition of clinical reasoning

Students offered a variety of definitions of clinical reasoning. Clinical reasoning was mostly defined as the application of theory to practice and the rationale behind the choice of physiotherapy intervention.

Integrating theory and knowledge and applying them to clinical practice were solid expressions of students' understanding of what clinical reasoning is.

"...based on information that you have gathered in your studies, as well as applying that to the specific case for the actual patient." (F1A)

"...to take what has been taught to us, to figure out a little bit more, and then apply that to a specific treatment plan, more specific evaluation of a patient that is in front of us." (F6B)

"For me, clinical reasoning is assessing a situation with your clinical knowledge and theory. So, whatever you have learnt in class as well as situations that you have been in yourself, and then deciding, based on that knowledge and experiences, basing decisions upon that." (F8B)

"...clinical reasoning is when you take your theory and your knowledge that you have gained over the course of your studies, and you see what is applicable to your patient's picture and condition, and then you take out of that knowledge what is best for them." (F10B)

Students also defined clinical reasoning as providing justification for the choice of physiotherapy intervention.

"...is how to explain...what exactly you have done with a patient, why you have chosen to work in such a way with a patient and to do certain exercises..." (F5A)

"...so what I understand of clinical reasoning is for example you are doing something in clinical, you have to have a reason behind why you are doing it, because if not, will it be beneficial for the patient..." (F9B)

Some students offered a more complex understanding of clinical reasoning when they described it as the formulation and testing of a hypothesis against their choice of intervention.

"I would obviously evaluate to see what could be possibly the underlying cause, but it might not necessarily be as straightforward...So, I would then test my hypothesis by doing tests, and that's how I would use my clinical reasoning to make a diagnosis."
(F6B)

Lastly, clinical reasoning was understood by students to be part of their daily clinical practice.

"I feel clinical reasoning is something that we as therapists use every single day."
(F8B)

"...so, what I understand of clinical reasoning is for example you are doing something in clinical..." (F9B)

"So, I've used it with almost every patient. It's something you should use with everyone..." (F10B)

4.2.2 Sub-theme 2: The process of reasoning clinically

Students described how they went about reasoning and the various methods they incorporated in the process of reasoning clinically.

Most students recognised the need to be flexible in their choice of intervention, adapting existing knowledge and moving away from applying a recipe.

"...you won't just do a textbook to every patient." (F1A)

"They [patients] present the same, but you have to adapt it because the pathology is different." (F4A)

"Your safety net is basically going through a recipe that you get taught according to theory. Later on down the line, you kind of see that you can't always follow a recipe, you have to go with what you see, what the patient presents with." (M7A)

Some students considered the precautions and contra-indications to physiotherapy interventions in the clinical reasoning process.

"...and we had to make the decision whether it's still good for us to actually treat that patient. So what's the risk versus the benefit for this person maybe getting treatment..." (F8B)

"...then based on our knowledge, you want to mobilise your patient...You would think, okay, do I have any precautions, any contraindications, are there any reasons why not, what are the most appropriate exercises to do?" (F10B)

Students recognised the importance of careful and thorough collection of all relevant data from multiple sources including the patient, the patient's file, and the findings on the day, for the process of reasoning clinically.

"...I had a patient with...but then during the subjective interview, I also found out he had a..." (M2A)

"Learning from what you have gathered from the evaluation, and their diagnosis and from the medical files." (F5A)

"...if you did a good evaluation from the beginning, you will know what is wrong with your patient and ways in which you can better the patient's condition." (F9B)

In the process of reasoning, there were students who reasoned what the benefits of the physiotherapy intervention would be for their patients.

"...is this going to benefit my patient..." (F8B)

"...if you are doing something that's not beneficial for the patient, you are wasting your time and you're wasting the patient's time." (F9B)

Consulting and incorporating the latest evidence in research, in deciding the best intervention for the patient, was seen as important for many students in the process of reasoning.

"...this is what the research is saying, this is the approach that you should use." (F1A)

"...with clinical reasoning comes like articles and evidence, evidence-based learning basically." (F4A)

"...it actually makes so much sense, because you have articles, you have research that backs up why you are doing it for the patient..." (F9B)

Students regarded the process of reasoning to be happening continuously.

"So, I think it's definitely a continuous process, to continuously almost back yourself and back your treatment..." (F5A)

4.2.3 Sub-theme 3: Including the patient in the process

Students explained how they included the patient in the process of reasoning. Students considered the patient's specific factors for deciding on the physiotherapy intervention of their patients.

Students recognised that they needed to be flexible in their reasoning process to be able to tailor their interventions specifically to their patients, giving more consideration to the patients, their presentation and their needs.

"...you're not just going to apply everything the same way with a patient. You are going to actually understand their case and that their presentation is..." (F1A)

"...your clinical reasoning would come in whether or not to treat the patient, how far you push them in their activities, if things are indicated for them, instead of just doing it." (F3B)

When tailoring the interventions for their patient, students contemplated the biopsychosocial factors.

"...because maybe they [patients] had their own psychological or mental barriers to stop them from or protect them from not doing treatment because they are scared, or they don't want to or something like that." (F1A)

"...So taking the patient as a holistic approach..." (M7A)

"...that's also very important with like you evaluate the patient, you just understand their circumstances and so forth, and then you do your subjective or objective, and then your treatment." (F9B)

"...in terms of what they [patients] tell you...you need to take everything into account... But then you think for them, what are the other factors...taking their whole picture into account..." (F10B)

Some students realised the significance of collaboration with the patient in the reasoning process, by including the patient in the reasoning and decision making.

"If they [patients] know why they're doing it, they will be more willing to participate in the physio sessions." (F4A)

"...also asking them [patients], and in collaboration with your patient, then making the decision on what is the best treatment for them...So like in terms of my reasoning, it's not just what I think is best, but also what they think is best for them and what they prefer, and if they actually understand what I am doing, the effect it has on them." (F10B)

4.2.4 Sub-theme 4: Using reflection in the process

Some students described how they incorporated the use of reflection in the reasoning process. Three areas of reflection were described by some students, namely, reflection-in-action; reflection-on-action; and reflection on the students' own capabilities.

Reflection-in-action was applied particularly when faced with complex situations where the student was required to think of alternatives to the conventional physiotherapy interventions.

"I had a unilateral amp, but he also had two strokes, represented with ataxia, and his balance is very poor. So now, I am on orthopaedic block, so I had to start thinking, I can't just treat the patient as a normal amputee patient, but I had to focus on the stroke and address that first and work on that." (M2A)

One student reflected (reflection-on-action) on their learning of clinical reasoning between blocks and the need to do things differently.

"I followed the recipe and then changed it up, because I knew that's something I did in my previous block, and it wasn't something I want to do again, because then there's no learning happening at all...The big difference between first and second block is the ability, or I'm not there yet, but the ability not to follow a recipe basically. So that's where I made some mistakes with my first block, and then learnt from that with my first block into my second block." (M7A)

Reflection also included awareness of the students' own capabilities.

"...reasoning out why you wouldn't take them [patients] further and get what's best for them, versus like your own restraints and your own capacities." (F10B)

4.3 Theme 2: The process of learning and development of clinical reasoning

Theme 2 developed as the process of learning and development of clinical reasoning in the context of clinical practice. The two sub-themes within this theme are discussed below.

4.3.1 Sub-theme 1: A challenging process

Students experienced the learning and development of clinical reasoning in their clinical practice as challenging.

"To be honest, I don't use it all the time, especially this year. Sometimes I didn't fully understand how to use it." (F4A)

"To be honest, it was very difficult. It was hard for me in the beginning, because like I said, you kind of want to do everything, and you get taught so many techniques, and it's a matter of also prioritising your time..." (M7A)

The process of learning and development was described as continuous.

"So I think my wheels are still getting polished." (F1A)

"I think I have definitely developed it so far this year. But it's definitely an ongoing process. I mean, I continuously learn with every treatment I give, or with every new block that I enter, and every new supervisor and clinician." (F5A) ¹

"...and if I even look back now, where now, a year back, how my clinical reasoning has grown tremendously. So I can see into the future how that is also going to change and improve as well. Obviously, we want to have our clinical reasoning at a level when we end this degree, to be able to practice, but also realising that it is going to take time, but with like constant input from all the people around us, as well as sharpening your knowledge of areas and conditions and everything." (F8B)

"I think it's something that you also develop with experience and over time, the more you see things, the more you understand. Because if you asked me the same question in third year, I would have probably given you a totally different explanation. So, I think it's something that also develops over time." (F10B)

The process was also perceived to be slow.

"But it's slowly developing."(F1A)

"...it took a lot of time and practice to build up." (F8B)

4.3.2 Sub-theme 2: Workplace-based learning and development

"Clinical reasoning started the first day I walked into the clinical platform" (F6B)

Students recognised that the learning and development of clinical reasoning happened within the context of clinical experience. For many, it was only when faced with the real-life patient in the workplace that learning to reason clinically began to develop.

"...like I can't remember half of my second year work, but I remember things a lot better, and I will never forget anything that I have done on a patient now. If you do it, you remember it." (M2A)

"I think for me, that's exactly how I experienced it [learning to reason clinically]. I can't talk for anyone else, but that's definitely how I experienced it, moving from my second year into my third year, into the hospitals, and actually practicing." (F5A)

"...but until you have an actual patient in front of you, your clinical reasoning skills aren't going to be that great." (F6B)

¹ Students understand a supervisor to be that accredited physiotherapist employed by the DPT to provide weekly clinical supervision. A clinician is understood as the physiotherapist employed by the Department of Health in the various provincial health settings. The researcher uses the term clinical educator to denote the supervisor.

"I think it [learning to reason clinically] comes back to when I started like interacting with patients. So, having that physical interaction where it moves away from the theory and more into the practical, when I started realising, I was doing it without even noticing it, or starting to practice it..." (F8B)

4.4 Theme 3: Enablers and disablers

It became evident from analysis of the data that there were factors that influenced the process of learning and development of clinical reasoning. These factors were clearly either enabling or disabling of the process. The enablers and disablers came from two sources, namely, extrinsically (coming from outside of the student) or intrinsically (coming from within the student). Extrinsic enablers were the CoPs and the intrinsic enabler was independent learning. Extrinsic disablers were the lack of explicit teaching of the concept of clinical reasoning, negative experiences with the clinical educator and the clinician, and a language barrier. The intrinsic disabler was the feeling of dissonance.

4.4.1 Sub-theme 1: Communities of Practice

Students described a CoP that extrinsically enabled the process of learning and development of clinical reasoning and included clinical educators, clinicians, lecturers and peers.

The weekly supervision sessions with the clinical educator were invaluable for students.

"Without the supervision sessions, I wouldn't learn how to do clinical reasoning" (F4A)

"...supervisors and clinicians as well. For me, I found they are like the backbone of your clinical block, especially for third year, because you don't have much experience dealing with patients. So the importance of a supervisor, I don't know if a lot of people in my class or my year actually don't value the supervisors as much, but I actually value them quite a bit." (M7A)

Students described three ways in which the CoP enabled learning, the first being the positive qualities of the clinical educator and the clinician.

The clinical educator and clinician were seen to be the experts, people with experience, that the student could learn from.

"They [supervisors and clinicians] are qualified, they know what's cooking most of the time. Like they've got a real idea and picture of how to apply certain things for certain patients." (F1A)

"...and just deciding on whether the way we see a patient, someone with more experience, is that also the way that they [supervisor] see a patient. That has kind of shaped how we also decide on like clinical reasoning and things." (F8B)

First, learning was strongly facilitated when the clinical educator and the clinician were supportive and approachable.

"...she [supervisor] comes in to spend time with you. It's very nice, where you and the other person, like we just had sessions once a week, just to like calm you down...so just someone to calm you down and you are in capable hands." (M2A)

"So, they [supervisors and clinicians] also had this like open door policy, where if I was stuck with something, I didn't feel like okay, I couldn't ask." (M7A)

Second, learning is facilitated when there is an agreeable relationship between the student and the clinical educator or clinician.

"So the supervisors, so my first block, basically it's like a physio mother. That's what it felt like. She is someone who is just there..." (M2A)

"But definitely, the approachability, or the relationship between me as a student and the supervisor also played a big role of how much I was willing to actually ask or question. So that definitely influenced how likely I was to actually go to them with a problem or something." (F8B)

Third, students described the various methods used by the CoP to facilitate learning. One method used by clinical educators, clinicians and lecturers, was facilitating thinking through questioning and probing for information.

"She [lecturer] would model it and stimulate our thinking. So she would ask more questions...What must you think about...So ja, just thinking more than just pure treatment..." (M2A)

"...the supervisors see how you interact and help you think through what it is, the thought process that you go through when you see a patient, or what you do with them." (F3B)

"So you are in a manner of thinking, and even if it's the wrong answer, then they [supervisors and clinicians] will come and say okay, what about this, what about that? Not giving you the answer, but like prompting you in the direction and making you think, because you don't really learn if somebody is just going to be like here's the answer." (M7A)

"They [clinical supervisors] are always challenging you; they're always asking you these questions. They never kind of just give it to you like on a platter... They always give you the opportunity to express your own ideas and opinions." (F10B)

Demonstrating and role modelling physiotherapy practice was another valuable method used by clinical educators, lecturers and peers, to facilitate learning.

"Observing, I feel like it's one of the best ways [enabler to learning]..." (F1A)

"...I think mostly in my observation with the lecturers and other supervisors, and even some of the fourth year students, how they worked with patients. That's where I definitely learnt most of mine [clinical reasoning] from." (F5A)

"...that did help me, being able to see how somebody [clinical supervisor] from a more experienced background treats a patient, and then they would ask me questions afterwards about the patient to see if I had an idea of what was going on..." (F6B)

Clinical educators provided feedback to students as a method of facilitating learning.

"...when the supervisor is there, is when you get feedback on whether you are doing it correctly or not..." (F3B)

"...discussing patients with them [clinical supervisor], doing evaluation forms and then they are giving us feedback on that, helps a lot with our clinical reasoning..." (F8B)

Learning was also facilitated through validation from the clinical educator, which helped in building confidence within the student.

"I think it helps build, sometimes you have clinical reasoning, but you don't have the confidence. You wait for the validation from someone [supervisor] who has the experience." (F3B)

Students described how some clinical educators used discussion as a method of facilitating learning of clinical reasoning.

"I think that [learning to reason clinically] has been shaped through communicating a lot with our clinical supervisors on the different rotations...So, just discussing situations and patients, and deciding on what is going to be the most appropriate treatment for these types of patients, that's mostly how I think that is shaped." (F8B)

Peer learning was the last method of facilitating learning in the CoP described by students.

"...but also with facilitation where all the people in that certain block talk about their experiences...I was like okay, learning through you...Thank you for giving me your own experience." (F1A)²

"All the students on ortho, they all come together, because we see different types of patients.which is a totally different ballgame. So it's good to hear their experiences and how they think." (M2A)

4.4.2 Sub-theme 2: Independent learning

The intrinsic enabler assisting in the process of learning and development of clinical reasoning was described as independent learning. Students recognised the importance of taking responsibility for their own learning, especially when they were alone in the workplace.

"I think also maybe the preparedness, before like a block or before entering, just being aware of what I know and what I'm a bit unsure about, and from the beginning, then making sure that I find the time to either speak to someone that I feel like is going to help me in the correct direction." (F8B)

"I always love asking about like my feedback, because obviously as an almost physiotherapist, I just want to grow in the right direction. I don't want to be the same...For me, like for my own personal growth, I had to ask about feedback, where can I improve." (F9B)

"I think just the experience, like being in clinical, having to choose your treatments, being given that independence and saying here are your patients, go see them. You are in charge of that. You have to take responsibility. So you kind of just use the concept [clinical reasoning] to figure out what's best for them [patients]." (F10B)

"I know some students...they are always supervised. It's good, but you don't always get the independence to make the decision yourself...sometimes you also want that freedom to be able to reason it out yourself, and be like okay, this is best. Or maybe even ask, like should I do this, but you came up with that idea." (F10B)

Some students consulted with the latest evidence in research for their own learning and development of clinical reasoning.

² Facilitation: the DPT provides third-year students with bi-weekly group sessions as extra clinical support, made up of the students currently on their clinical rotation in their specific physiotherapy areas i.e. neurology / orthopaedics / medical and surgical.

"I need to also look at the most recent research, and to just find out where physio is heading, because I can't just base it off what we have learnt in theory, because the research is always changing." (F1A)

"...then you go and do research about it, and the evidence says something different." (M2A)

Finding themselves alone in the workplace was disconcerting for some students but they were able to recognise the learning opportunity this presented.

"...it's a good learning curve to be like thrown into the deep end, figure it out, because you do learn a lot." (M7A)

"That's where I was like on my own. I was like I've got to think for myself now, and now what?" (F1A)

4.4.3 Sub-theme 3: Lack of explicit teaching of concept

A lack of explicit teaching of the concept of clinical reasoning developed from the data as an extrinsic disabler to the process of learning and development of clinical reasoning.

Students explained how they struggled to make sense of what they were taught in the pre-clinical years and how it linked to clinical practice.

"But if the department would just maybe teach us why we do certain things, then it's easier to remember, and when you get to third year, it makes it a bit easier and it's more enjoyable for your learning also." (F4A)

"What I felt was I didn't see the whole picture, and it would have made so much sense if I could see the whole picture from the beginning, and see just how everything fits into that" (M2A)

"...but I think it's also a nice learning curve to see what your lecturers are capable of doing and seeing their clinical reasoning and seeing their understanding and learning from that. Because we don't see much of that in second year. It's mainly theory, it's mainly books, and it's mainly information getting shoved in your head." (M7A)

Students described how the concept of clinical reasoning was not explicitly taught.

"But they [lecturers] have never formally taught it to us. I think it's a skill that kind of just develops. They kind of here and there tell you a little bit about it...I think never directly. Like, they have taught us the components of it and how to clinically reason, but they have never actually told us, so this is what clinical reasoning is." (F10B)

*"...maybe emphasising like the term 'clinical reasoning' more. It's like you are doing it subconsciously, but maybe just emphasising it more, and the actual definition."
(F10B)*

Some students admitted to hearing the term clinical reasoning but not fully understanding the importance of the concept.

"I didn't necessarily understand how important it was necessarily in our everyday practice, but we were definitely taught about the term and what it meant, but not necessarily exactly how it impacts." (F8B)

Students suggested that the concept of clinical reasoning be explicitly promoted prior to the clinical years.

"...it [clinical reasoning] could have been promoted earlier. That's what I would have loved to see...it could have been brought up earlier, and the importance of it a lot earlier, giving us experience earlier. From the beginning....even in first year, but second year definitely. Just wrapping our heads around just why you are learning what you are learning." (M2A)

4.4.4 Sub-theme 4: Negative experiences with the clinical educator

The qualities of the clinical educator and clinician as well as the relationship that exists between the student and the clinical educator or clinician were described as extrinsic enablers earlier. However, students also expressed these as extrinsic disablers. The process of learning and development of clinical reasoning was negatively influenced when the clinical educator or clinician were unapproachable or when the relationship between the student and the clinical educator or clinician was a disagreeable one.

"...then you get to the next setting where the supervisor is intense, and wants to go, go, go. So then, like I said, the panic, and then you switch off." (F3B)

"...sometimes I think your clinical reasoning is also hindered when, you know, supervisors just think differently, and the supervisor isn't open-minded to what it is that you would have...and I think that can also then put in self-doubt, where you don't want to, so you just don't think." (F3B)

"Barriers were if I wasn't able to form a good connection to a supervisor or a clinician, or I didn't feel comfortable going to them and asking them for help or asking them for advice on certain things." (F6B)

"...but also other clinicians that don't necessarily like assisting, or especially sometimes are like 'you should know this by now'...The attitude, and then I am not necessarily willing to go to them again with questions." (F8B)

Poor role modelling of clinical practice by the clinical educator or clinician was also experienced as an extrinsic disabler.

"You're [clinical educator and clinician] like I just said I must think and reason, but now you are just plugging everything in. I'm like oh goodness." (F1A)

4.4.5 Sub-theme 5: Language barrier

Some students experienced a lack of language proficiency as an extrinsic disabler when the student did not understand the patient's language and there was no alternative way of communicating with the patient.

"In the clinical setup, I think my biggest barrier was a language barrier...So that will prevent you from the information that you need to be able to clinically reason...but then because of that break in communication, you lose a lot of the information that's actually important. So then you struggle from there to make an educated decision on where you are going to go from the treatment." (M7A)

4.4.6 Sub-theme 6: Dissonance

Students described a feeling of dissonance as an intrinsic disabler to the process of learning and development of clinical reasoning. Dissonance is understood to be those times when the student felt that their knowledge, or their ability to adequately apply their knowledge, was lacking.

"I think for me, a barrier in a sense is not having enough knowledge, that much, not enough knowledge with as much conditions...or like how to apply it. Like we've got as much physiotherapy knowledge for now, like to take us through for now, but it's also like bringing in pathology and bringing it all together. I think that's where I struggled a lot." (F1A)

"We just don't think broad enough...not understanding what it is that you are doing and why you are doing it." (F3B)

"It doesn't necessarily help that you have the theory, but you don't know how to apply it...Even though we might know the theory, we don't know how to connect the theory with the practice". (F8B)

Students described the emotions related to the feeling of dissonance.

"Because it makes us very anxious in a way. A lot of people are very anxious, like there is only one right way. Am I doing the right thing?" (M2A)

*"...my first block...it's the first time we obviously see patients...When you get there the first time round, it's very overwhelming, so you are there and you kind of like freeze."
(M7A)*

"...it's very emotional being in clinical because you're thinking why am I here? I know absolutely nothing". (F9B)

Some students experienced anxiety from not understanding the role of physiotherapy.

"...for me a big issue is what is a physiotherapist actually? What is our scope of practice? Nobody shows you what it looks like, what a physio's role is in a multidisciplinary team, or you know, what should I focus on? When should I refer and things like that...because then I know what I should be doing, or what the standard is, or what is expected...would definitely make so much more sense of clinically reasoning, this is what I should be doing, this is my role, and then fulfilling that role in an interdisciplinary practice. If I know this is my limit, this is not what I should be doing..." (M2A)

4.5 Conclusion

The data analysis provided valuable insight into physiotherapy students' perceptions of clinical reasoning and especially on the three objectives of the study, namely: to explore physiotherapy students' concept of clinical reasoning; the perceived development of clinical reasoning during clinical practice; and the factors that influence this development. Of particular significance for the researcher was the relationship between the themes that became evident from the data analysis, that is, that the process of learning and development was underpinned by the understanding of the concept of clinical reasoning, and that this process was influenced by a variety of factors.

Chapter 5: Discussion

This chapter discusses the findings of the study in light of the three objectives, namely: to explore the perceptions of the concept of clinical reasoning; the development of clinical reasoning during clinical practice; and the factors that influenced this development. The limitations and strengths of the study and its contribution are then discussed.

5.1 Introduction

This study set out to explore physiotherapy students' perceptions of clinical reasoning, and its development within the context of their clinical practice in the third and fourth years of study. From the findings it became apparent that students' perceptions of the development of clinical reasoning were underpinned by their understanding of the concept of clinical reasoning. This development was described as being influenced by a number of factors that were both extrinsic and intrinsic. Furthermore, these factors either enabled or disabled the process of learning and development of clinical reasoning. The significance of these findings is discussed in more detail below, and the relationship between the findings and those of the literature are highlighted.

5.2 Understanding the concept of clinical reasoning

5.2.1 The definition of clinical reasoning

For many of the students in this study, clinical reasoning was understood and defined simply as the application of theoretical knowledge to clinical practice and the justification for the choice of physiotherapy intervention. Starting with knowledge, and then thinking about the application of that knowledge, incorporates the two core dimensions of clinical reasoning described by Higgs and Jones (2008), namely, knowledge and cognition. Understanding clinical reasoning on a more advanced level as the formation of a hypothesis (HDR) was offered only by a few. Furthermore, clinical reasoning was defined as part of daily practice. The researcher was encouraged by these findings that students could offer some explanation of clinical reasoning and that students recognise it to be part of daily practice. Also encouraging is that the definitions incorporate some of the defined elements of clinical reasoning, such as, knowledge and cognition, and the HDR model (Higgs & Jones, 2008; Hendrick *et al.*, 2009; Gilliland, 2014). Providing justification for the choice of physiotherapy intervention, which forms part of the cognitive aspect of clinical reasoning and where students are thinking 'the why' behind their actions, can therefore be seen as part of hypothesis generation and the inductive reasoning of the HDR model. Those few students that defined

clinical reasoning in line with the HDR model reported that the hypothesis was tested, and so they demonstrated a fuller understanding of the entire model.

These findings are similar to those reported by students in the Hendrick *et al.* (2009) study where students also conceptualised clinical reasoning as the application of theoretical knowledge to the clinical problem and the patient; rationalising the clinical decision process; and using the knowledge to formulate and test a hypothesis. The importance of knowledge in the effectiveness of the clinical reasoning process was also expressed by the students in the Cruz *et al.* (2012) study. The students in the Wijbenga *et al.* (2018) study considered clinical reasoning as the justification behind clinical decisions. Gilliland (2014), and Gilliland and Wainwright (2017) in their studies of clinical reasoning in the physiotherapy student likewise found a range of clinical reasoning processes in students, from the simple trial and error, to the more complex HDR process. However, the results of these two latter studies must be interpreted in the light of their methods, whereby the researchers categorised students' reasoning processes by observation of students' reasoning performance. Their studies were not an exploration of students' perceptions of clinical reasoning.

That students did not define clinical reasoning as pattern recognition was not surprising to the researcher, given that this model of reasoning is described as belonging to the expert (Doody & McAteer, 2002; Wainwright *et al.*, 2010; Gilliland, 2014). In contrast however, Hendrick *et al.* (2009) and Gilliland (2014) reported some, although limited, conceptualisation of clinical reasoning as pattern recognition. An explanation for this could be that the students in the Hendrick *et al.* (2009) study received explicit teaching on HDR and pattern recognition of clinical reasoning in the musculoskeletal component of their undergraduate programme, with reinforcement of these concepts by clinical educators in their clinical practice. Perhaps the students were in a better position to recognise when they were indeed reasoning by pattern recognition. An explanation for the contrast to the Gilliland (2014) study is again in light of the methods of this study, and that the researcher defined how students reasoned based on observation of reasoning performance.

The findings suggest that students have some understanding of the concept of clinical reasoning. Gravett (2001) believes that new knowledge is constructed on prior knowledge. This belief, together with the findings described above, suggest that establishing students' prior knowledge of clinical reasoning should precede any teaching of clinical reasoning. However, this is premised on the assumption that those involved with teaching and facilitating students' clinical reasoning understand the concept of clinical reasoning themselves, which was not explored in this study and would be a suggestion for further research.

5.2.2 The process of reasoning clinically

Building on this knowledge of clinical reasoning, students described various methods they used in the process of reasoning clinically, which was experienced as an ongoing process. Students relied on thorough data collection from multiple sources including the patient, the patient's medical file and the clinical findings on the day, in their reasoning process. Included in this data collection process of clinical reasoning was a consideration of the precautions and possible contra-indications to physiotherapy intervention, as well as the benefits for the patient of the chosen intervention. Some students considered the importance of incorporating the latest evidence in research in deciding the best intervention for the patient, which was similarly found by Gilliland and Wainwright (2017). All these processes suggest a rudimentary attempt at formulating a hypothesis based on knowledge and data generation, again incorporating the cognitive aspect of clinical reasoning. There is evidence that students in other studies also generated data from various sources (Hendrick *et al.*, 2009; Gilliland & Wainwright, 2017). That students are incorporating the latest evidence in research is a significant finding for the researcher and the DPT which is committed to an evidence-based approach to physiotherapy in the undergraduate programme. The findings suggest that this is being translated successfully into the students' practice and therefore the current approach to teaching evidence-based practice should continue.

The findings demonstrated that students recognised the need to be flexible when choosing a physiotherapy intervention for patients, and not always to follow a recipe. This is consistent with the findings of other studies (Hendrick *et al.*, 2009; Furze *et al.*, 2015; Gilliland & Wainwright, 2017; Wijbenga *et al.*, 2018), where students also demonstrated a flexible approach to their clinical reasoning, not only following protocols but considering the individual cases of patients; and seeing clinical reasoning as a continuous process of planning and doing (Hendrick *et al.*, 2009). This flexibility described by the students, together with the ability to adequately gather data, and their reliance on the latest evidence in research, suggests the beginnings of a patient-centred approach to clinical reasoning. It also suggests that students apply an inquiry approach to their existing knowledge to identify and cognitively reason the gaps in their knowledge in relation to the patient. To support students' reasoning processes therefore, clinical educators should encourage a thorough process of relevant data generation, continue to emphasise evidence-based practice, and nurture flexibility in the student by challenging the use of protocols or recipes. These teaching practices would then reinforce the practice of patient-centred care.

5.2.3 Including the patient in the process

In line with patient-centred care, students explained how they included the patient in the process of reasoning clinically. The students considered the patient and his/her specific needs,

which needed a flexible approach to the process of reasoning so that the physiotherapy intervention could be personalised with the aim of providing holistic patient-specific care. In this regard, students considered the individual patient's presentation, their biopsychosocial factors, and the significance of collaboration with the patient in the reasoning process. These findings suggest a reasoning process that is more interactive and centred on the patient, usually evident with expert practice (Wainwright *et al.*, 2010; Gilliland, 2014). What is not clear from the findings is how consistently the students included the patient in the reasoning process, and whether this happened with every patient. This is definitely an aspect of the process that needs to be explored further. Nonetheless, it is encouraging that students are considering the patient in the process, with some students even collaborating with the patient.

Hendrick *et al.* (2009) found a progression of the clinical reasoning process in students, from being simple and internally focused to more complex and externally focused to include the patient. Furze *et al.* (2015) had similar findings of progression from being therapist focused to patient focused in the reasoning process. However, Gilliland and Wainwright (2017) concluded from their study that students showed limited understanding of patient-centred care. Students in the Cruz *et al.* (2012) study perceived the main outcome of clinical reasoning to be a clear understanding of the patient's clinical problems and the probable cause. The authors concluded that students tended to use a disease-orientated model as their framework for reasoning clinically, with the exclusion of integrating the patient's problems with their needs and context (Cruz *et al.*, 2012). The findings of these two latter studies are in contrast with the findings of this study.

Gilliland and Wainwright (2017) highlight that the unique characteristic of clinical reasoning in physiotherapy is the importance of gaining an understanding of the patient's needs and context. This means that teaching and facilitating clinical reasoning must explicitly and consistently incorporate patient-centred care with a focus on the patient's needs and context, as well as collaborating with the patient in the clinical decision process.

5.2.4 Using reflection in the process

The findings demonstrated some, albeit limited, use of reflection in the clinical reasoning process. Reflection-in-action was applied when faced with complex situations requiring the student to think of alternatives for the conventional physiotherapy intervention. This is linked to the need for flexibility in the clinical reasoning process discussed earlier, but where reflection is understood to aid in that flexibility. Reflection-on-action was used to reflect on the progression of learning that had taken place between clinical rotations. There was also an inclusion of reflection on the capabilities of the individual student in the clinical reasoning process, indicating a degree of reflection-in-action, but where the focus is on the therapist.

Both Furze *et al.* (2015) and Gilliland and Wainwright (2017) reported the use of reflection in clinical reasoning. Gilliland and Wainwright (2017) concluded that those students that made use of reflection-in-action demonstrated a greater ability to adapt their physiotherapy intervention, and those students with more clinical experience demonstrated a greater degree of reflection on professional experience, enabling them to draw on previous patient experiences to guide their decision-making process. Clinical educators in the Wijbenga *et al.* (2018) study reported that students that were reflective were the most proficient learners of clinical reasoning.

Wainwright *et al.* (2010) highlight the importance of reflection in developing clinical reasoning consistent with expert practice, and believe that developing the skill of reflection is necessary to take physiotherapy intervention in the clinical setting beyond theoretical knowledge to patient management that recognises the patient's needs and contexts. In light of this, the researcher is concerned with the limited use of reflection in the clinical reasoning process reported in the findings. It suggests that students do not recognise the importance of reflective practice, or the core dimension of metacognition in the process of clinical reasoning. This will need further exploration to support this assumption, and is a significant finding for the DPT programme developers to consider. It suggests a need for a greater emphasis on the importance of reflective practice within the programme, and for clinical educators to facilitate better reflective practice in students. Further research could establish whether clinical educators know how to facilitate reflective practice in the students and the extent to which they are doing it.

5.2.5 Conclusions to understanding the concept of clinical reasoning

The findings have provided valuable insight into the first objective of this study, namely, to explore physiotherapy students' concept of clinical reasoning. From the findings it can be concluded that students' definition of clinical reasoning, and their descriptions of the process, showed the use of knowledge, cognition and the incorporation of some elements of the HDR model. Flexibility, the ability to gather data, incorporation of latest evidence, and patient inclusion in the reasoning process all demonstrated an element of a patient-centred approach, and a more interactive model of clinical reasoning. The use of evidence-based practice is particularly encouraging and has significance for the DPT. Concerning is the limited use of reflection in the process, and the seeming lack of recognition of the importance of reflective practice. In order to teach clinical reasoning as a concept, what students know about clinical reasoning should first be established to reinforce correct clinical reasoning approaches. In order to facilitate students to develop a more patient-centred and interactive reasoning process, clinical educators must nurture flexibility, encourage greater and explicit inclusion of

the patient, with an understanding of the patient's needs and context, and ensure greater use of reflective practice.

5.3 The process of learning and development of clinical reasoning

5.3.1 A challenging process

The findings provided an explanation of how students experienced the process of learning and development of clinical reasoning in their clinical practice. This was described as challenging, slow and continuous over time. It is not surprising that it was experienced as challenging given that clinical reasoning is defined as a complex process (Higgs & Jones, 2008; Gilliland & Wainwright, 2017). The finding that clinical reasoning develops over time is consistent with the findings in other studies that also found clinical reasoning development to be a gradual progression over time (Hendrick *et al.*, 2009; Gilliland, 2014; Furze *et al.*, 2015; Gilliland & Wainwright, 2017; Wijbenga *et al.*, 2018). These are important findings for programme developers. The process of learning and development of clinical reasoning needs time and consistent support across the programme. Programme developers should therefore consider what this support looks like, and if there are any gaps where students are not supported in this process. Clinical educators should adopt a student-centred approach to their clinical teaching to understand where the student is in the developmental process of clinical reasoning, in order to provide them with the appropriate support they need.

5.3.2 Workplace-based learning and development

For most of the students in this study, the process of learning and development of clinical reasoning began only when they were exposed to real-life patients in the clinical environment, that is, experiential learning in the workplace. This exposure to clinical experience afforded them the opportunity to put into practice the knowledge gained in the classroom years. These findings support the findings of Wijbenga *et al.* (2018) where students also reported clinical exposure as being key to the development of clinical reasoning. Repeated practical experience, and specifically exposure to a wide variety of patients, strongly influenced this development in these students, as well as students in the Cruz *et al.* (2012) study, while the students in the Henrick *et al.* (2009) study viewed prior experience as an important contributing factor to the process of clinical reasoning and especially to pattern recognition. The impact of clinical exposure on the learning and development of clinical reasoning is reinforced by Spencer (2003) who stated that only in the workplace will the student learn all the necessary skills of professional practice including clinical reasoning. Morris and Blaney (2014) explain that the workplace can be a supportive environment where knowledge and skills are fostered and developed by partaking in active clinical experience.

That students in this study reported that the learning and development of clinical reasoning as happening in the context of clinical practice, was perhaps the most significant finding for the researcher. It suggests that while clinical reasoning may be an outcome for many of the modules within the undergraduate programme, it is only in the clinical modules that this outcome is actually achieved. Programme developers and clinical programme co-ordinators should consider this finding in the planning and structuring of the programme. Specifically, they would need to consider the minimum time necessary for clinical exposure to impact significantly on the learning and development of clinical reasoning. Consideration should also be given to the quality of that clinical exposure that will allow for as much exposure to a variety of pathologies and clinical scenarios as is possible. It is a valuable finding for the DPT. Providing students with clinical exposure involves significant planning, human resources and time, and the findings suggest that these efforts have a substantial impact on the learning and development of clinical reasoning.

5.3.3 Conclusion to the process of learning and development of clinical reasoning

The second objective of this study was to explore physiotherapy students' perceptions of the development of clinical reasoning during their clinical practice. The findings provide valuable insight into this objective and explain the process of learning and development of clinical reasoning to be challenging, slow and continuous. Furthermore, exposure to clinical practice and workplace-based learning was seen to be vital to this process. This suggests that clinical practice must continue as the backbone of physiotherapy undergraduate programmes. When planning this clinical exposure, consideration should be given to the time and quality of that exposure. Given its complexity, clinical educators supporting students in clinical practice should use a student-centred approach to appropriately support the slow and challenging process of learning and development of clinical reasoning.

5.4 Enablers and disablers

It became evident from the findings that there was a variety of factors that influenced the process of learning and development of clinical reasoning in the students. These factors were clearly either enabling or disabling of the process, and the source of these factors was both extrinsic and intrinsic. Extrinsic enablers were the CoP and the intrinsic enabler was independent learning. Extrinsic disablers were the lack of explicit teaching of the concept of clinical reasoning, negative experiences with the clinical educator and clinician, and a language barrier. The intrinsic disabler was the feeling of dissonance. Comparison of these findings to the studies that explored clinical reasoning in the physiotherapy student can be made only with the Wijbenga *et al.* (2018) study as theirs was the only study to consider the influencing factors on the development of clinical reasoning. Therefore, the researcher of this

study suggests that these findings are significant and could possibly contribute to the overall body of knowledge of clinical reasoning and the physiotherapy student.

5.4.1 Communities of practice

Students described a CoP as an extrinsic enabler to the process of learning and development of clinical reasoning. Clinical educators, clinicians, lecturers and peers were listed as the members within this CoP. These findings strongly support the theory of social-cultural learning that views learning as occurring via the active participation of learners in a CoP (Patton *et al.*, 2013; Kauffman & Mann, 2014; Morris & Blaney, 2014). Through active participation and social interaction in these CoP, students construct their professional identities (Patton *et al.*, 2013). That students recognise the contribution of all members of the CoP in their learning and development of clinical reasoning, suggests that students access as many opportunities for their learning as possible. This is important for all involved with teaching the student to realise that their individual roles are in fact contributing to the overall learning and development of clinical reasoning in the student.

Students described learning from their peers in relation to the bi-weekly facilitation sessions provided by the DPT. Mallows and Francis-Wright (2016) report that students participating in peer coaching found it to be a beneficial and productive method for developing clinical reasoning. This is a valuable finding for the DPT. Facilitation sessions have been included in the clinical programme for the past few years, and this is possibly the first researched feedback to support the impact of these sessions. The findings therefore suggest that these sessions should continue.

Described in this CoP and of particular value to the students were the weekly supervision sessions with the clinical educators. Irvine and Martin (2014) explain that effective, clinical supervision will boost student confidence and improve professional performance. This is another valuable finding for the researcher and the DPT. The provision of these sessions by the DPT involves significant planning and human resources, so knowing that they are valuable to the students in the learning and development of clinical reasoning provides feedback on the need for the continuation of these sessions.

Students described three ways in which the CoP enabled learning, namely: the positive qualities of the clinical educator and clinician; an agreeable relationship with the clinical educator and clinician; and a variety of methods used to facilitate learning.

The positive qualities of the clinical educator and clinician that enabled learning were that they were seen to be the expert (someone with experience), were supportive and approachable, and there was an agreeable relationship between them and the student. Wijbenga *et al.*

(2018) similarly found that clinical educators who adopted an open attitude towards the students were most appreciated by the students of their study. The students furthermore reported that their individual development of clinical reasoning depended greatly on the personal rapport they had with their clinical educator. Ramani and Leinster (2008) list the qualities of a good clinical educator which include being accessible, compassionate and supportive, able to establish a rapport with students, and being student-centred. Ernstzen (2013) agrees that learning is facilitated when the clinical educator is approachable, recognises students' abilities and has good communication skills. In light of these findings, clinical educators and clinicians should take cognisance of the qualities they have, and the nature of their relationship with students in terms of the effect on the students' learning.

Within the CoP, students listed the various methods used to facilitate the process of learning and development of clinical reasoning. One method used was to facilitate thinking in the student by means of questioning the student and probing for more information, often in the form of a discussion with the student. The clinical educators in the Wijbenga *et al.* (2018) study similarly used questioning as a method of facilitating learning of clinical reasoning. This method of facilitating learning links to the cognitive learning theories as it encourages the development of critical thinking in the student, and the social-cognitive learning theory, as the learning is in the context of social interaction (Kauffman & Mann, 2014). This method of questioning to facilitate thinking supports the cognitive aspect of clinical reasoning and will also contribute to the development of reflection in the student, highlighted earlier as an important component to clinical reasoning. Therefore, clinical educators should incorporate this method into the teaching of clinical reasoning.

Another method used was demonstrations and the role-modelling of physiotherapy practice by the CoP. This method of facilitating learning is also positioned within the social-cognitivist approach to learning (Torre *et al.*, 2006). The positive qualities of the clinical educator and clinician as described by the students, and discussed above, will significantly contribute to the impact of role-modelling in the context of clinical practice as these are similar to the qualities of good role-modelling described in the literature (Cruess *et al.*, 2008; Passi *et al.*, 2013), namely, demonstration of clinical competence, establishing a rapport with students, creating a positive learning environment, and being student-centred. The students also listed the provision of feedback as a method of facilitating learning used by the clinical educators, and when this feedback provided validation of their clinical reasoning, it boosted their confidence. Similarly, the clinical educators in the Wijbenga *et al.* (2018) study provided students with regular feedback on performance to foster their development of clinical reasoning. The importance of providing feedback to students in clinical education and the principles of

effective feedback have been well established in the literature (Cantillon & Sargeant, 2008; Ramani & Leinster, 2008; Morris & Blaney, 2014; Boud, 2015).

Students provided detailed descriptions of how the learning and development of clinical reasoning was enabled in a CoP. From the findings, it became evident that learning had taken place within the *zone of proximal development* through the provision of guidance, support and assistance (Vygotsky, 1978; Morris & Blaney, 2014) from the members listed within this CoP. Therefore, clinical educators should be supported in their role by the DPT through faculty development to highlight those qualities that define a good clinical educator, and to emphasise the importance of role-modelling and effective feedback.

Related to this finding, students reported negative experiences with the clinical educator and clinician as an extrinsic disabler to the process of learning and development of clinical reasoning. Learning was negatively influenced when the clinical educator or clinician was unapproachable, when the relationship between the student and the clinical educator or clinician was disagreeable, and when there was a demonstration of poor role modelling of professional behaviour by either. These findings support the suggestions made previously, namely, that clinical educators and clinicians should take cognisance of the qualities they have, and the nature of their relationship with students, in terms of the effect it has on students' learning.

5.4.2 Independent learning

From the findings of the study it was evident that students used independent learning as an intrinsic enabler to the process of learning and development of clinical reasoning. Students realised the need to be responsible for their own learning, especially when they were alone in the workplace and were feeling unsettled as a result. One method of facilitating their own learning was to consult the latest evidence in research. They also spoke about consulting with others and asking for feedback. This finding suggests that, while not supportive of the full definition of self-directed learning (Knowles, 1975), students did independently take responsibility for identifying their learning needs and finding ways to meet those needs. It was not evident from the findings whether the students' approach to learning was one of a superficial, deep or strategic approach as described by Entwistle and Peterson (2004). The researcher was pleasantly surprised that students recognised the need for independent learning. This is an important finding and suggests that clinical educators must adopt a student-centred approach when teaching clinical reasoning and provide support to the students collaboratively as the students indicate their needs. Clinical educators should allow students the opportunity for independent practice whilst providing guided feedback. As mentioned earlier, evidence-based practice should continually be supported and encouraged as it was highlighted as one of the methods used for independent learning.

Related to independent learning is the intrinsic disabler to the process of learning and development of clinical reasoning that students described as the feeling of dissonance, that is, those times when they felt that their knowledge or their ability to adequately apply this knowledge to clinical practice, was lacking. This feeling of dissonance resulted in further feelings of anxiety. Students in the Wijbenga *et al.* (2018) study also struggled to bridge the gap between theory and practice and the authors concluded from their findings that this was probably most evident in the first clinical rotation due to a lack of clinical experience.

The researcher of this study again suggests a student-centred approach to teaching clinical reasoning that will enable the student to identify their points of dissonance and set goals to overcome them. Role-modelling professional practice, providing adequate feedback, and supporting reflective practice, would also have an influence on giving students the confidence they need for independent practice.

5.4.3 Lack of explicit teaching of concept

From the findings it was clear that students strongly identified a lack of explicit teaching of the concept of clinical reasoning as an extrinsic disabler to the process of learning and development of clinical reasoning. Students described their struggles in making sense of the knowledge taught in the pre-clinical years and how this linked to clinical practice. Students explained that while the concept of clinical reasoning was mentioned, they experienced the teaching of the concept as implicit. Students felt that an earlier exposure to the concept of clinical reason, together with explicit teaching of the concept, would significantly contribute to their learning and development of clinical reasoning, especially in their clinical years. Ryan and Higgs (2008) recommend that the development of clinical reasoning should not be left to chance and that curricula should be infused with clinical reasoning principles throughout the entire programme. They further explain that the educators in these programmes should be committed to this goal and not simply include clinical reasoning as an outcome of the programme. This will require systematic planning of activities and opportunities across the entire programme for delivering these principles of clinical reasoning. The researcher echoes these recommendations. This finding can be considered immensely significant for the DPT as they suggest that support for the learning and development of clinical reasoning is not provided in the entirety of the programme. As an outcome for the undergraduate programme, the programme co-ordinators could consider how they can add explicit teaching of clinical reasoning across the programme, as suggested by Ryan and Higgs (2008). Educators involved in the pre-clinical years could be mindful of these findings to make the link to clinical practice more explicit than what is taught in the classroom.

5.4.4 Language barrier

Some students experienced a lack of language proficiency as an extrinsic disabler when the student could not understand the patient's spoken home language. This was an unexpected finding that was also found in the Wijbenga *et al.* (2018) study when students experienced a language barrier as inhibiting their learning process of clinical reasoning. The DPT is currently committed to equipping students to cope with language barriers by providing instruction in the mainstream languages in the context of this study. This finding suggests that the DPT should evaluate the effectiveness of this practice. Further research is needed to fully explore the relationship between communication with the patient and clinical reasoning. It does, however, form part of patient-centred care discussed earlier.

5.4.5 Conclusion to enablers and disablers

Students provided comprehensive descriptions of the various factors that influenced the process of learning and development of clinical reasoning which was valuable for gaining insight into the third objective of this study, namely, to explore physiotherapy students' perceptions of those factors influencing the development of clinical reasoning. Learning in a CoP was extensively explored and possibly the main influencing factor evident from the findings. Within these CoP, the provision of clinical supervision and facilitation sessions should continue as these were valuable sessions for the students. Support and faculty development are important for clinical educators to know what qualities of the clinical educator and teaching methods best facilitate the learning of clinical reasoning in clinical practice within these CoP, specifically, how to facilitate thinking; role-modelling professional practice; and providing effective and quality feedback. Clinical educators should adopt a student-centred approach to the teaching of clinical reasoning to support students' intrinsic enabler of independent learning, as well as to assist them to overcome their feelings of dissonance. The language barrier to clinical reasoning needs further exploration, but for now the DPT should continue providing students with instruction in those languages specific to the context of this study. Lastly, the DPT and the programme developers should consider ways to make the teaching of clinical reasoning more explicit, especially in the pre-clinical years, but also across the programme.

5.5 Limitations and strengths

The results of this study are the interpretations of the researcher. As a qualitative study, the results cannot be generalised to all physiotherapy students due to the small-scale nature of the study, and the small sample size. However, the researcher has provided a detailed description of the study methods and results which could allow for transferability to similar contexts. The credibility of the study is strengthened in that the study is aligned with what is evident in the literature both in terms of clinical reasoning in physiotherapy and the

physiotherapy student, and HPE literature; and through the researcher's personal experience of clinical reasoning and physiotherapy students. A strength of the study is that the findings of the factors that influence the development of clinical reasoning are valuable in light of the limited research that has been conducted on this matter, and they have the potential to contribute to further research. A limitation, and suggestion for further research, was that the study did not explore clinical educators' perceptions of clinical reasoning in physiotherapy students. This could provide an alternative perspective to understanding students' clinical reasoning practice. Acknowledging that the development of the reasoning process is influenced by clinical exposure and experience, a longitudinal study of the factors that influence the development of clinical reasoning, with a comparison of the different student year groups of study, is another suggestion for further research that could contribute to a better understanding of how to facilitate the learning and development of clinical reasoning in physiotherapy students across the undergraduate programme. The decision to not analyse data according to the selection criteria of participants was a limitation of this study, necessitated by the nature of the study, but it would be a useful area for further study, particularly the relationship between academic performance and the perception of clinical reasoning.

5.6 Contributions

The results of this study provide valuable insight into how third- and fourth-year physiotherapy students in the undergraduate programme at SU understand the concept of clinical reasoning, and how they perceived its development during their clinical experience. Of particular value to the DPT is a better understanding of those factors that influence the development of clinical reasoning and provide some reinforcement of aspects of the clinical programme in the DPT. The findings highlight a gap in the programme, namely the apparent lack of explicit teaching to the concept of clinical reasoning, and provide an opportunity for the programme developers to consider this in the next curriculum renewal process.

Chapter 6: Conclusion

Clinical reasoning is a vital competency of professional physiotherapy practice that contributes to the effectiveness of physiotherapy patient outcomes. Physiotherapy education must incorporate the development of clinical reasoning in its aim of preparing independent practitioners. Research on clinical reasoning and the physiotherapy student is limited, especially in the area of the development of clinical reasoning in the physiotherapy student and the factors that may influence this development. Therefore, this study set out to explore physiotherapy students' perceptions of clinical reasoning, including their perceived development of clinical reasoning and the factors that may influence it during clinical practice. Students understood clinical reasoning to include the two core dimensions of knowledge and cognition and also elements of the HDR. There was also some evidence of a patient-centred and interactive approach to clinical reasoning. However, there was limited incorporation of reflective practice in their understanding of clinical reasoning. Students perceived clinical exposure to be critical to the development of clinical reasoning and described the development process as challenging, slow and continuous. A number of factors that either enabled or disabled the process of development of clinical reasoning were described. The support provided by the CoP was experienced as the most influential enabler for the development of clinical reasoning, while the lack of explicit teaching of the concept of clinical reasoning was seen to be the main influencing disabler. Students described other factors influencing the development of clinical reasoning which included independent learning, lack of language proficiency, and experiencing feelings of dissonance.

From the results of the study, the researcher recommends the continued support, and faculty development of both lecturers and clinical educators, of the concept of clinical reasoning and the best practices for the enhancement of the learning and development of clinical reasoning. Explicit teaching of the concept of clinical reasoning, especially in the pre-clinical years; incorporating reflective practice more; reinforcement of critical clinical education concepts such as good clinical educator qualities, role-modelling and feedback; and a student-centred approach to teaching should especially be considered. Further research is needed to understand students' perceptions of clinical reasoning and especially the development of clinical reasoning and the factors that may influence this development.

References

- Bass, C. 2012. Learning theories and their application to science instruction for adults. *The American Biology Teacher*, 74(6):387–390.
- Boud, D. 2015. Feedback: Ensuring that it leads to enhanced learning. *Clinical Teacher*, 12(1):3–7.
- Cantillon P., & Sargeant J. 2008. Giving feedback in clinical settings. *BMJ*, 337:1292-1294.
- Christensen, N., Black, L., Furze, J., Huhn, K., Vendrely, A., & Wainwright, S. 2017. Clinical reasoning: Survey of teaching methods, integration, and assessment in entry-level physical therapist academic education. *Physical Therapy*, 97(2):175-186.
- Christensen, N., Jones, M. A., Edwards, I., & Higgs, J. 2008. Helping physiotherapy students develop clinical reasoning capability, in Higgs, J., Jones, M.A., Loftus, S., & Christensen, N. (eds) *Clinical reasoning in the Health Professions*. Amsterdam: Elsevier. 390-395.
- Coovadia, H., Jewkes, R., Barron, P., Sanders, D. & McIntyre, D. 2009. The health and health system of South Africa: historical roots of current public health challenges. *The Lancet*, 374(9692):817-834.
- Cruess, S. R., Cruess, R. L., & Steinert, Y. 2008. Teaching rounds: Role modelling - Making the most of a powerful teaching strategy. *BMJ*, 336:718–721.
- Cruz, E. B., Moore, A. P., & Cross, V. 2012. A qualitative study of physiotherapy final year undergraduate students' perceptions of clinical reasoning. *Manual Therapy*, 17(6):549–553.
- Division of Physiotherapy, Department of Health and Rehabilitation Sciences. 2019. *Staff Manual*. Stellenbosch University.
- Doody, C., & McAteer, M. 2002. Clinical reasoning of expert and novice physiotherapists in an outpatient orthopaedic setting. *Physiotherapy*, 88(5):258–268.
- Entwistle, N. J., & Peterson, E. R. 2004. Conceptions of learning and knowledge in higher education: Relationships with study behaviour and influences of learning environments. *International Journal of Educational Research*, 41:407–428.
- Ernstzen, D. V. 2013. Roles and attributes of physiotherapy clinical educators: Is there agreement between educators and students?. *African Journal of Health Professions Education*, 5(2):91.
- Frambach, J. M., van der Vleuten, C. P. M., & Durning, S. J. 2013. AM Last Page: Quality criteria in qualitative and quantitative research. *Academic Medicine*, 88(4):552.
- Frenk, J., Chen, L., Bhutta, Z.A., Cohen, J., Crisp, N., et al. 2010. Health professionals for a new century: Transforming education to strengthen health systems in an interdependent world. *The Lancet*, 376(9756):1923–1958.
- Furze, J., Black, L., Hoffman, J., Barr, J. B., Cochrain, T. M., & Jensen, G. M. 2015. Exploration of students' clinical reasoning development in professional physical therapy education. *Journal of Physical Therapy Education*, 29(3):22-33.
- Gill, P., Stewart, K., Treasure, E. & Chadwick, B. 2008. Methods of data collection in qualitative research: interviews and focus groups. *British dental journal*, 204(6):291-295.
- Gilliland, S. 2014. Clinical reasoning in first- and third-year physical therapist students. *Journal of Physical Therapy Education*, 28(3):64–80.

- Gilliland, S., & Wainwright, S. F. 2017. Patterns of clinical reasoning in physical therapist students. *Physical Therapy*, 97(5):499–511.
- Gravett, S. 2001. *Adult learning. Designing and implementing learning events. A Dialogic Approach*. Pretoria: Van Schaik.
- Hanson, J. L., Balmer, D. F., & Giardino, A. P. 2011. Qualitative research methods for medical educators. *Academic Pediatrics*, 11(5):375–386.
- Harden, R. M., & Crosby, J. 2000. AMEE Guide No 20: The good teacher is more than a lecturer - The twelve roles of the teacher. *Medical Teacher*, 22(4):334-347.
- Health Professions Council of South Africa. 2018. [Online]. Available: <https://www.hpcsa.co.za/Uploads/PPB/HPCSA%20Student%20Staff%20ratio%20Updated%20April%20%202016%20docx.pdf>. [November 01, 2019].
- Hendrick, P., Bond, C., Duncan, E., & Hale, L. 2009. Clinical reasoning in musculoskeletal practice: Students' conceptualizations. *Physical Therapy*, 89(5): 430-442.
- Higgs, J., & Jones, M. 2008. Clinical decision making and multiple problem spaces, in Higgs, J., Jones, M., Loftus, S., & Christensen, N. (eds). *Clinical Reasoning in the Health Professions*. Amsterdam: Elsevier. 3-17.
- Illing, J. 2014. Thinking about research: Theoretical perspectives, ethics and scholarship, in Swanwick, T. (ed.). *Understanding Medical Education: Evidence, Theory and Practice*. London: Wiley Blackwell. 331-347.
- Irby, D. M., & Bowen, J. L. 2004. Time efficient strategies for learning and performance. *The Clinical Teacher*, 1(1):23–28.
- Irvine, S., & Martin, J. 2014. Bridging the gap: From simulation to clinical practice. *The Clinical Teacher*, 11:94-98.
- Kauffman, D. M., & Mann, K. V. 2014. Teaching and learning in medical education: How theory can inform practice, in Swanwick, T. (ed.). *Understanding Medical Education: Evidence, Theory and Practice*. London: Wiley Blackwell. 7-29.
- Kilminster S., Cottrell D., Grant J., & Jolly B. 2007. AMEE Guide No. 27: Effective educational and clinical supervision. *Medical Teacher*, 29:2-19.
- Knowles, M. S. 1975. *Self-Directed Learning: A Guide for Learners and Teachers*. New York: Association Press.
- Kolb, D. A. 1984. *Experiential Learning: Experience as the Source of Learning and Development*. New Jersey: Prentice Hall.
- Lave, J., & Wenger, E. 1991. *Situated Learning: Legitimate Peripheral Participation*. New York: Cambridge University Press.
- Mallows, A. J. & Francis-Wright, M. 2016. Perceptions of the usefulness of peer coaching to facilitate clinical reasoning – a survey of physiotherapy students. *MedEdPublish*, 5(2):1-11
- Morris, C., & Blaney, D. 2014. Work-based learning, in Swanwick, T. (ed.). *Understanding Medical Education: Evidence, Theory and Practice*. London: Wiley Blackwell. 97-109.
- National Qualifications Framework. 2019. [Online]. Available: <https://www.westerncape.gov.za/service/national-qualifications-framework-nqf-qualifications-and-unit-standards>

- Ng, S., Lingard, L., & Kennedy, T. J. 2014. Qualitative research in medical education: Methodologies and methods, in Swanwick, T. (ed.). *Understanding Medical Education: Evidence, Theory and Practice*. London: Wiley Blackwell. 371-384.
- Passi, V., Johnson, S., Peile, E., Wright, S., Hafferty, F., & Johnson, N. 2013. Doctor role modelling in medical education: BEME Guide No. 27. *Medical Teacher*, 35(9):e1422–e1436.
- Patton, N., Higgs, J., & Smith, M. 2013. Using theories of learning in workplaces to enhance physiotherapy clinical education. *Physiotherapy Theory and Practice*, 29(7):493–503.
- Ramani, S., & Leinster, S. 2008. AMEE Guide no. 34: Teaching in the clinical environment. *Medical Teacher*, 30(4):347–364.
- Ramani, S., & Mann, K. 2016. Introducing medical educators to qualitative study design: Twelve tips from inception to completion. *Medical Teacher*, 38(5):456–463.
- Ryan, S., & Higgs, J. 2008. Teaching and learning clinical reasoning, in Higgs, J., Jones, M., Loftus, S., & Christensen, N. (eds). *Clinical Reasoning in the Health Professions*. Amsterdam: Elsevier. 379-387.
- Schön, D. A. 1983. *The Reflective Practitioner*. New York: Basic Books.
- South African Qualifications Authority. 2019. [Online]. Available: <http://www.saq.org.za/>
- Spencer, J. 2003. ABC of learning and teaching in medicine. Learning and teaching in the clinical environment. *BMJ*, 326:591–594.
- Tavakol, M., & Sandars, J. 2014. Quantitative and qualitative methods in medical education research: AMEE Guide No 90: Part I. *Medical Teacher*, 36(10):746-756.
- Tavakol, M., & Sandars, J. 2014. Quantitative and qualitative methods in medical education research: AMEE Guide No 90: Part II. *Medical Teacher*, 36(10):838–848.
- Taylor, D. C. M., & Hamdy, H. 2013. Adult learning theories: Implications for learning and teaching in medical education: AMEE Guide No. 83. *Medical Teacher*, 35(11):e1561-e1572.
- Torre, D. M., Daley, B. J., Sebastian, J. L., & Elnicki, D. M. 2006. Overview of current learning theories for medical educators. *The American Journal of Medicine*, 119(10):903–907.
- Vygotsky, L. 1978. *Mind and Society: The Development of Higher Psychological Processes*. Cambridge: Harvard University Press.
- Wainwright, S. F., Shepard, K. F., Harman, L. B., & Stephans, J. 2010. Novice and experienced physical therapist clinicians: A comparison of how reflection is used to inform the clinical decision-making process. *Physical Therapy*, 90(1):75–88.
- Wijbenga, M. H., Bovend'Eerdt, T. J. H., & Driessen, E. W. 2018. Physiotherapy students' experiences with clinical reasoning during clinical placements: A qualitative study. *Health Professions Education*, 5(2):1-10.
- World Confederation for Physical Therapy (WCPT). 2011. *Policy statement: Guideline for physical therapist professional entry level education*. [Online]. Available: <http://www.wcpt.org/guidelines/entry-level-education>. [November 01, 2019].
- World Confederation for Physical Therapy (WCPT). 2017. *Policy statement: Description of physical therapy*. [Online]. Available: <http://www.wcpt.org/policy/ps-descriptionPT>. [November 01, 2019].

World Health Organization (WHO). 2013. *Transforming and scaling up health professionals' education and training: World Health Organisation Guidelines 2013*. [Online]. Available: http://apps.who.int/iris/bitstream/10665/93635/1/9789241506502_eng.pdf. [November 01, 2019]

Addendum A (Chapter 3)

Interview question schedule:

1. Can you define or explain what is meant by the term “clinical reasoning”?

Possible probes:

Can you tell me more about . . . ?

Help me to understand what you mean by . . . ?

Why do you think / say that?

(Should the participant not be able to provide a reasonable definition of clinical reasoning, the following definition must be read to the participant: “*Clinical reasoning can be defined as the process by which a physiotherapist interacts with a patient, collects information, generates and tests hypotheses, and determines then optimal diagnosis in treatment, based on the information obtained*”)

2. Can you provide an example of how you have used clinical reasoning in your clinical practice?

Possible probes:

Tell me about the situation; what happened then . . . ?

How did that come about?

Why did you think that?

3. How did you learn to reason clinically?

Possible probe:

How did you develop this competency?

4. Was there anything that influenced your learning and development of clinical reasoning, either positively or negatively?
5. In what ways did sessions with your clinical educators / supervisors affect that development?
6. Do you have any other comments or questions?

(Adapted from questions used in a study: Hendrick *et. al.*, 2009).

Addendum B (Chapter 3)

Participants diversity grid table

Participant #	Gender		Academic performance		Year of study		Home language			Race			
	M	F	Strong	Average	3rd	4th	English	Afrikaans	isiXhosa or other	White	Coloured	African	Indian
1		x		x	x				isiXhosa			x	
2		x		x	x		x						x
3	x			x	x		x				x		
4	x			x	x			x		x			
5		x	x		x			x		x			
6		x		x		x	x			x			
7		x	x			x	x				x		
8		x	x			x		x		x			
9		x	x			x	x						x
10		x		x		x	x				x		

Addendum C (Chapter 3)

PARTICIPANT INFORMATION LEAFLET AND CONSENT FORM

TITLE OF RESEARCH PROJECT:	
Physiotherapy students' perceptions of Clinical Reasoning	
DETAILS OF PRINCIPAL INVESTIGATOR (PI):	
Title, first name, surname: Mrs Noeline Fobian	Ethics reference number: 9299
Full postal address: PO BOX 2993, Paarl, 7620	PI Contact number: 0727403397

I would like to invite you to take part in a research project. Please take some time to read the information presented here, which will explain the details of this project. Please ask me any questions about any part of this project that you do not fully understand. It is very important that you are completely satisfied that you clearly understand what this research entails and how you could be involved.

Your participation is **entirely voluntary**, and you are free to decline to participate. In other words, you may choose to take part, or you may choose not to take part. You will in no way be disadvantaged academically, or in any other way, should you choose not to participate. Refusal to participate will involve no penalty or adverse consequences to you. Should you volunteer to participate, you are also free to withdraw from the study at any point, even if you do agree to take part initially. If you do agree to take part, you may also refuse the use of the data collected from your involvement. Furthermore, should you choose to participate in the study, it will not affect your academic evaluation in any way.

This study has been approved by the **Health Research Ethics Committee at Stellenbosch University**. The study will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, the South African Guidelines for Good Clinical Practice (2006), the Medical Research Council (MRC) Ethical Guidelines for Research (2002), and the Department of Health Ethics in Health Research: Principles, Processes and Studies (2015).

The study has also been approved by the University of Stellenbosch (internal institutional approval) as well as the Division of Physiotherapy, Stellenbosch University.

What is this research study all about?

As a physiotherapy clinical educator, I am intrigued by the concept of clinical reasoning in physiotherapy practice. More so, I have been inquiring how to best facilitate the development of this skill in the physiotherapy students that I teach on the clinical platform. Therefore, my research will be to explore how students understand the concept of clinical reasoning and how

they think they develop this skill. If I can determine the students' understanding of clinical reasoning and how they reason the development of it, it may assist us as clinical educators to improve the facilitation of developing the skill during clinical education.

Who am I asking to be a part of my study?

I am inviting all third- and fourth-year physiotherapy students within the division to participate in the study. I hope to get between 8 and 10 students to voluntarily participate.

How will I answer my research question?

If you choose to participate, you will be interviewed by an external interviewer not affiliated with the physiotherapy division. The interviewer will ask you some questions around clinical reasoning. The interview will be audio-recorded, with your consent. The recorded interview will be assigned a serial number. The audio-recording will then be typed up into a hard copy and a digital copy by a transcriber and the recording deleted once this is done. The transcribed data will have the same serial number as your audio-recording. The hard copies and the digital copies of the interview will be kept safe in a locked cupboard and on a password protected computer. I as the researcher, will receive the transcribed data identified by the serial number only and will not be able to link the serial number of the data to your name.

Where will the study be conducted?

The interview will be done on campus (Tygerberg) either in an office in the division or a room in the library. You will be given you some date and time suggestions for the interview and you can choose one most suited to your availability. If the interview occurs during your lunch time, you will be provided with some lunch and it can be decided closer to the time your preference for this.

Why am I inviting you to participate?

You have already had some clinical experience working with patients and so will have engaged with the concept of clinical reasoning. Therefore, you have experience that you can contribute to the study.

What will your responsibilities be?

All I ask of you if you choose to participate is to be willing to be interviewed in an interview of between 30 and 45mins. Further than that, you will not be required to do anything else.

Are there any risks involved in your taking part in this research?

There are no risks involved if you choose to partake

Who will have access to your information?

As explained earlier, your interview will be given a serial number. Your name and its link to your interview will therefore be anonymous to me, the researcher.

Will you be paid to take part in this study and are there any costs involved?

There will be no travel costs involved as we will schedule the interview at a time when you are on campus. You will not have to pay for anything, if you do take part. I will provide you with refreshments or lunch on the day of the interview including a juice or coffee.

Is there anything else that you should know or do?

- You can contact me, Noeline Fobian, if you have any further queries or encounter any problems:

- 0727403397 (cell)
- nfobian@sun.ac.za (email)
- You can phone the Health Research Ethics Committee at 021 938 9677/9819 if you have a complaint regarding this study.
- You will receive a copy of this information and consent form for you to keep safe.

Declaration by participant

By signing below, I agree to take part in a research study entitled ‘Physiotherapy students’ perceptions of Clinical Reasoning’.

I declare that:

- I have read this information and consent form, or it was read to me, and it is written in a language in which I am fluent and with which I am comfortable.
- I have had a chance to ask questions and I am satisfied that all my questions have been answered.
- I understand that taking part in this study is **voluntary**, and I have not been pressurised to take part.
- I may choose to leave the study at any time and nothing bad will come of it – I will not be penalised or prejudiced in any way.
- I may be asked to leave the study before it has finished, if the researcher feels it is in my best interests, or if I do not follow the study plan that we have agreed on.
- I agree to the interview been audio-recorded.

Signed at (*place*) on (*date*) 2019.

.....
Signature of participant

.....
Signature of witness

Declaration by investigator

I (*name*) declare that:

- I explained the information in this document in a simple and clear manner to
- I encouraged him/her to ask questions and took enough time to answer them.
- I am satisfied that he/she completely understands all aspects of the research, as discussed above.
- I did/did not use an interpreter. (*If an interpreter is used then the interpreter must sign the declaration below.*)

Signed at (*place*) on (*date*) 2015.

.....
Signature of investigator

.....
Signature of witness