

**INVESTIGATING THE IMPACT OF POSTGRADUATE
MUSCULOSKELETAL PHYSIOTHERAPY EDUCATION
ON PRACTITIONERS' CLINICAL REASONING SKILLS**

By

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A Thesis Submitted to

The University of Birmingham

For the degree of

DOCTOR OF PHILOSOPHY

April 2018

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ABSTRACT

Advancing clinical reasoning skills is one of the main outcomes of postgraduate master's level (M-level) programmes approved by the Musculoskeletal Association of Chartered Physiotherapists (MACP). While the outcomes of these programmes were investigated in multiple retrospective studies, there is a limited understanding of the learning culture that drives change. Thus, the aim was to examine the learning culture of an MACP approved programme to capture the sociocultural mediators that advance clinical reasoning skills.

An empirical longitudinal theory-seeking case study was conducted over a period of 18 months. A mixed-methods data collection process included qualitative document analysis, overt observations, semi-structured interviews and focus groups, as well as quantitative measurement of advancement in clinical reasoning skills. Seven educators and six students participated in the study. Data analysis was premised on the methods of a Constructivist Grounded Theory.

The study identified gradual and progressive advancement of clinical reasoning skills throughout the programme. Four conceptual categories of 1) raising awareness; 2) collegial knowledge exchange; 3) dynamic learning environment; and 4) the context of clinical reasoning advancement were constructed to illuminate how the programme's pedagogy supported professional learning. A model of convergence and synergy was constructed to explain the learning culture that drove professional learning. This model is novel in terms of conceptualising the relationship between students, the programme and the wider context. It demonstrates the value of the coherency of educational messages at the individual, institutional and organisational levels for professional learning.

This study offers a new conceptual understanding of advancing clinical reasoning through M-level education. Programmes that actively seek to create convergence and synergy may

have greater potential for achieving successful learning outcomes. The context-bounded knowledge provided in the thesis can aid educators to better design M-level curriculum. Future research may seek to test the model of convergence and synergy across other M-level programmes in physiotherapy and other healthcare professions. Moreover, A longitudinal research with five to seven years of follow-ups can provide further insight into how the programme-facilitated advancement of clinical reasoning skills impact on patient care.

DEDICATION

I lovingly dedicate this thesis to my dad Abdelfattah and mom Moyasser for raising me up. To my wife Hayat for the ongoing support and cups of tea. To my daughters Rose, Sama and Mariam for the joy they brought to my life. To my uncle Abdelhadi for the support he gave.

ACKNOWLEDGMENTS

I would like to send my gratitude to all people who supported me to complete this study. First, my sincere gratitude and appreciation go to my co-supervisors Dr. Mark Griffiths and Dr. Nicola Heneghan, for their guidance and genuine support in becoming an independent researcher. I would like also to thank my third supervisor Dr. Alison Rushton for her valuable insights in designing, conducting and reporting the study.

I would like to thank all individuals who participated in the study, for without their valuable contribution this study would not have seen the light.

I would like to thank Hayat Hamzeh for serving as a second reviewer of the systematic review in chapter two, and the valuable contribution in re-establishing the psychometric properties of the Diagnostic Thinking Inventory.

I would like to thank Najla and Taweewat for piloting my research tools.

I would like to thank Hadi Sama'na for aiding the construction of the Script Concordance Test items.

I would like to thank all of the clinicians who aided the validation and setting the scoring key of the Script Concordance Test.

My gratitude also extends to Keejoon, Anastasia and Alex for being such critical friends as they were.

My sincere gratitude goes to the Hashemite University for partially sponsoring me.

I would like to acknowledge John Wily & Sons, the copyright holder of the Diagnostic Thinking Inventory, for granting me the permission to use this tool.

I would like to acknowledge Scribbr for proofreading the thesis.

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LIST OF ABBREVIATIONS

AMP	Advanced Musculoskeletal Physiotherapy
CSP	The Chartered Society of Physiotherapy
CPD	Continuous Professional Development
DTI	Diagnostic Thinking Inventory
HCPC	Health and Care Professions Council
IFOMPT	The International Federation of Orthopaedic Manipulative Physical Therapists
MACP	Musculoskeletal Association of Chartered Physiotherapists
M-level	Master's level
NHS	National Health service of the UK
QAA	Quality Assurance Agency for Higher Education of the United Kingdom
SCT	Script Concordance Test
WCPT	World Confederation of Physical Therapy

CONFERENCE PRESENTATIONS

Hamzeh, H, **Madi, M**, and Hensman, M (2016) 'The use of diagnostic thinking inventory to evaluate musculoskeletal physiotherapy practitioners' clinical reasoning', *The 4th European Congress of the ER-WCPT*. Liverpool, United Kingdom. 11th – 12th November (*Poster Presentation*)

Madi, M, Griffiths, M, Rushton, A, Heneghan, N. (2016) 'Creating a learning culture for developing clinical reasoning through postgraduate manipulative physiotherapy education', *The International Federation of Orthopaedic Manipulation Physical Therapists (IFOMPT) Conference*. Glasgow, United Kingdom. 4th–8th July. (*Traditional platform presentation*)

Madi, M, Griffiths, M, Rushton, A, Heneghan, N. (2016) 'Advancing clinical reasoning through postgraduate manipulative physiotherapy education: A mixed methods longitudinal case study', *The International Federation of Orthopaedic Manipulation Physical Therapists (IFOMPT) Conference*. Glasgow, United Kingdom. 4th–8th July. (*Rapid 5 platform presentation*)

PUBLISHED ABSTRACTS

Hamzeh, H, **Madi, M**, and Hensman, M (2016) 'The use of diagnostic thinking inventory to evaluate musculoskeletal physiotherapy practitioners' clinical reasoning', *Physiotherapy*, 102: e169.

Madi, M, Griffiths, M, Rushton, A, Heneghan, N. (2016) 'Creating a learning culture for developing clinical reasoning through postgraduate manipulative physiotherapy education', *Manual Therapy*, 25: e54-e55.

Madi, M, Griffiths, M, Rushton, A, Heneghan, N. (2017) 'Advancing clinical reasoning through postgraduate manipulative physiotherapy education: A mixed methods longitudinal case study', *Musculoskeletal Science and Practice*, 28: e3-e4.

PREAMBLE

With a view to making my stance explicit to the reader, I shall offer a reflexive summary in which I describe the personal context that informed my decision in the writing of this thesis (Greenbank, 2003, Shenton, 2004). In my undergraduate curriculum, the need for clinical reasoning, critical thinking and patient-centred practice were not emphasised. This was not at odds with physiotherapy practice in my home country, Jordan, where we lacked professional autonomy. I spent almost two years after my undergraduate qualification taking orders from doctors without understanding the reasons for these orders, or being at liberty to challenge them. My practice was about seeking recipes and exercise regimes that I could uncritically prescribe for my patients.

However, this changed in 2006 when I engaged in a Masters of Manual Therapy programme in Australia, which was a life-changing and rewarding experience that advanced my capabilities at the professional, personal and career levels, an outcome that have been reported within the field of musculoskeletal physiotherapy (Perry et al., 2011). In particular, I noticed a tremendous advancement in my clinical reasoning skills. I was puzzled as to how such drastic changes had been achieved by only a one-year programme. Thereafter, I spent six years teaching at two of the major universities in Jordan and Saudi Arabia, in which I promoted the need for reflection and clinical reasoning in the undergraduate physiotherapy curriculum and in practice.

The idea of researching the advancement of clinical reasoning skills by participating in a Musculoskeletal Physiotherapy M-level¹ programme approved by the Musculoskeletal Association of Chartered Physiotherapists (MACP) did not come into focus until I had

¹ M-level education/programme is used in this thesis to refer to Postgraduate (Pg.) diploma and Master of Sciences (M.Sc.) levels of education.

decided to embark on doctoral studies. I was not fully aware of the importance of researching this topic for the profession. I initially proposed conducting a randomised controlled trial to investigate the effect of thoracic spine manipulation on cervicogenic headaches. Instead, I was advised to do this study because my supervisors believed it matched my interests, and that it corresponded with internationally identified research priorities within the field of musculoskeletal physiotherapy (Rushton and Moore, 2010).

This represented an initial challenge, or alternatively critical learning incident (Soini, 2012), for me as I lacked prior background in educational research. I was reluctant to accept the PhD offer. However, I soon came to understand the value of this research for the physiotherapy profession, as well as for my own personal and professional career development. Thus, I accepted this challenge. Thereafter, I spent my first year of study investigating this idea; identifying gaps in knowledge, developing research objectives and proposing a line of inquiry that would result in an original contribution to our understanding of advancement of clinical reasoning. This was followed by literature reviews related to advancement of clinical reasoning skills, evaluating programme impact and theories of learning (Appendix 1.1), all of which have shaped the theoretical framework that informed the thesis (Flick, 2009).

The second major critical learning incident in this journey was an outcome of my ontological and epistemological assumptions (Hofer and Pintrich, 1997). I was influenced by a positivist research culture in my undergraduate and M-level qualifications. I perceived impact evaluation as a process of quantitative data collection, in which I would administer certain tests and questionnaires to ‘measure’ the advancement of clinical reasoning. However, this changed because of the research culture at the School of Sport, Exercise and Rehabilitation at the University of Birmingham, which offered a breadth of exposure to multiple research paradigms. Based on my supervisors’ suggestion, I

registered for a mixed-methods research module that was an eye-opening experience. The module was not only my first exposure to qualitative research, but also introduced to me the existence of a research paradigm that involved a combined use of quantitative and qualitative data. From that point on, my exposure to research paradigms has grown tremendously, which shaped the design of this study. This impact of academic environment and pedagogical practices on doctoral students' transitions were also identified in the literature (Evans and Stevenson, 2010).

With this in mind, I was also critical of the strengths and limitations within programme evaluation literature. My methodological decision for a mixed-methods longitudinal examination of the M-level programme in a single theory-seeking case study was informed by identifying this as a gap in the research on the impact of M-level musculoskeletal physiotherapy programmes (Chapter 2). While doing a comparative study was considered at an early stage, I thought that a longitudinal single theory-seeking case study would yield a greater depth of understanding of M-level learning culture, instead of making short visits to multiple universities. I believed that this design would capture the complexities associated with measuring the impact of programmes such as M-level education, in terms of how and why changes in clinical reasoning skills occurred (Rogers, 2008, MacLeod, 2016).

To conclude, the significance of this narrative is that I can see that my development in this study was similar to that of the students who participated in this study. Albeit our degrees are at different levels, I believe that going through these cycles of facing challenges and embracing learning opportunities had an impact on data analysis, and the development of the model of synergy and convergence proposed in this thesis. While this can be interpreted as a bias toward preferred theoretical analysis (Creswell, 2012), data analysis was rigorous and grounded in data collection as examined in Chapter five.

Chapter one: Introduction

The UK has seen a significant growth in the number of healthcare practitioners pursuing M-level study (House, 2010), with a raise of 33% and 63% between the academic years of 2003 and 2008 for UK and non-UK nationals, respectively. This reflects the importance of this provision of professional development in delivering formalised professional learning opportunities which, according to several researchers, is the foundation for developing clinical expertise (Beeston et al., 1998, Gosling, 1999, Milidonis et al., 1999, Rushton and Lindsay, 2010, Petty, 2015). Within the field of musculoskeletal physiotherapy, in 2014 an estimated 200 physiotherapists engaged in one of the M-level programmes leading to MACP membership (MACP, 2014).

The MACP is a clinical interest group of the Chartered Society of Physiotherapy (CSP) formed in 1968 to promote advanced practice and specialisation in musculoskeletal physiotherapy. It is the UK member organisation of the International Federation of Orthopaedic Manipulative Physical Therapists (IFOMPT), a non-governmental organisation that sets standards of practice and education for musculoskeletal physiotherapists worldwide (IFOMPT, 2016). Currently, there are over 1200 MACP members, with nine approved routes to membership, hosted within Higher Education institutions, and quality monitored by the MACP (Rushton et al., 2016). This involvement in M-level musculoskeletal physiotherapy education is associated with an increase in the number of practitioners seeking an extended scope of practice², senior, specialist and consultant roles (Green et al., 2008), through which they are expected to demonstrate advanced level of practice (CSP, 2016).

²An extended scope physiotherapist is a specialist who demonstrates advanced level of practice and expertise beyond the currently recognised scope of practice (Stanhope et al., 2012, p.37).

The development of advanced levels of clinical reasoning skills is a cornerstone to such advanced level practice in musculoskeletal physiotherapy (Rushton and Lindsay, 2010, Petty et al., 2015). Clinical reasoning is conceptualised in this thesis as the context-specific processes of thinking and decision making that inform clinical practice (Edwards et al., 2004). Through these processes the practitioner looks for signs and symptoms, perform physical examination, process data, understand the patient's problem, plan and implement appropriate management, and evaluate outcomes (Doody and McAteer, 2002). Considering the wide-range of assessment and treatment techniques that practitioners are using in practice, sound clinical reasoning skills are essential for safe, efficient, and effective patient care (Thomson et al., 2014a). Errors in clinical reasoning can lead to adverse effects especially when a practitioner is attempting to use a treatment procedure with a patient with serious pathology (Greenhalgh and Selfe, 2009). These errors in clinical reasoning may rise from cognitive biases or limited working memory, with evidence is suggesting that advancement of knowledge can reduce these errors (Croskerry, 2009, Norman et al., 2017).

Moreover, the advancement of clinical reasoning skills supports musculoskeletal physiotherapy practitioners in meeting the demands of increasingly complex and ill-defined clinical environment (Petty et al., 2011a). Patients with problems, such as those with chronic pain conditions, require a high level of clinical reasoning to unravel the complexity and uncertainty associated with it (Sweeney and Doody, 2010, Chowdhury and Bjorbækmo, 2017). Emerging evidence in musculoskeletal physiotherapy practice suggests that M-level qualified practitioners who are working in advance practice settings utilise intuitive processes of reasoning (Langridge et al., 2015). In particular, during the assessment of the psychosocial status of patients (Singla et al., 2015). However, it is not

clear how M-level qualification in musculoskeletal physiotherapy supports the advancements in clinical reasoning skills.

In spite of the fact that the development of advanced levels of clinical reasoning skills is an identified key dimension in the educational standards of MACP approved M-level education (IFOMPT, 2016), there is limited evidence of how the learning culture of MACP approved M-level education drives the advancement of clinical reasoning in practice. Physiotherapy educators are reported to utilise a range of educational approaches to advance clinical reasoning skills, such as problem-based learning, guided observation, capturing and reflecting on therapists' reasoning style (Ryan and Higgs, 2008), using actual or simulated patients (Edwards and Rose, 2008), case reports (Rivett and Jones, 2008) and professional socialisation (Christensen et al., 2008). The evidence for using, and the influence of, these educational approaches in M-level musculoskeletal physiotherapy education is lacking (Rushton and Moore, 2010). Researchers tended to examine the outcomes and impact of M-level musculoskeletal physiotherapy programmes without focusing on the learning culture that mediated changes (Stathopoulos and Harrison, 2003, Green et al., 2008, Perry et al., 2011, Petty et al., 2011a, Petty et al., 2011b, Constantine and Carpenter, 2012).

In their Delphi consensus study of ninety-one musculoskeletal physiotherapy M-level educators and expert practitioners, Rushton and Moore (2010) identified that understanding the processes and educational approaches that facilitate the development of clinical reasoning skills was the first research priority in the domain of professional learning. Such a limited focus on examining how the learning culture of M-level education advances clinical reasoning skills has been identified as well in the wider healthcare context, with some researchers have explored professional learning in terms

of receiving and applying knowledge (Chaboyer and Retsas, 1996, Calvert and Britten, 1999, Conneeley, 2005).

While these studies, which are further examined in chapter two, provided an insight on some programmes' activities, they did not examine the sociocultural mediators of change. That is, there was limited examination of the influence of learners' biographies (i.e. micro level of influence), the programme activities (i.e. meso level of influence) and wider organisational cultures (i.e. macro level of influence) on professional learning (Hodkinson et al., 2008). Such an examination of these three levels of influence is significant as it avoids the dualist (i.e. individual versus social) approach to professional learning that is evident in leaning theories cognitive, participatory, and situated (Elkjaer, 2004, Hager, 2005, Gherardi, 2010). Thus, a sociocultural approach offers an in-depth and comprehensive insights that account for professional learning in general, and advancing clinical reasoning skills in particular.

With an increasing number of institutions and special interest groups that are working worldwide under the umbrella of IFOMPT (Rushton et al., 2016), understanding the learning culture of an MACP approved M-level programme can offer valuable learning opportunities that can impact how educators plan and implement strategies for advancing clinical reasoning skill. This would ensure the delivery of safe, efficient and effective level of patient care through minimising errors in clinical reasoning and maximising practitioners ability to manage complex patient presentations (Gosling, 1999, Milidonis et al., 1999, Rushton and Lindsay, 2010, Petty, 2015).

In Summary, the two main gaps in examining M-level musculoskeletal physiotherapy education are: 1) the limited focus on examining how clinical reasoning skills are advanced at M-level, and 2) the lack of detailed analysis of how learner's biography, the programme environment, and the wider learning culture can mediate changes in clinical

reasoning skills. These gaps in literature created a need for widening the evaluative lens used in examining advancement of clinical reasoning skills through M-level musculoskeletal physiotherapy education. In particular, how and why the learning culture of M-level healthcare programmes mediates change (Rogers, 2008, Pommier et al., 2010, MacLeod, 2016).

The following section explores how these gaps underpinned the research question and the focus on exploring the learning culture of an MACP approved musculoskeletal physiotherapy programme. This is followed by:

-) Introducing the sociocultural conceptual framework that framed data collection and analysis;
-) Illuminating the thesis's original contribution; and finally,
-) Outlining the structure of the thesis.

1.1. Research question and objectives

In response to the above mentioned gaps in the literature, and in consistent with a pragmatic research approach, whereby the nature of the research question is not influenced by the researcher's fixed ontological and epistemological assumptions (Morgan, 2007, Punch, 2014), the central research question in this study was to understand:

How does the learning culture of M-level musculoskeletal physiotherapy education facilitate the advancement of clinical reasoning skills?

To answer this central research question, five interconnected objectives were set:

- 1. To capture the advancement of clinical reasoning skills throughout and after participating in an MACP approved musculoskeletal physiotherapy programme.**

While the constructs of M-level musculoskeletal physiotherapy education suggested that advancing clinical reasoning was one of the main intended learning outcomes (Rushton and Lindsay, 2010), the aim was to capture changes empirically by means of a longitudinal mixed-methods data collection.

2. To examine how an MACP approved musculoskeletal physiotherapy programme advances clinical reasoning skills.

In capturing the advancement of clinical reasoning skills, there is a need to explore how the programme culture drove changes. In particular, exploring programme pedagogies, processes, relationships, social interactions and contexts that modulated change.

3. To understand how learners' biographies and learning dispositions influence how they engage in M-level education.

Learners biographies and learning dispositions have been found to influence professional learning (Hodkinson et al., 2008). Factors such as previous experience, learning preferences, expectations and motivation potentially modulate learning engagement. Therefore, understanding learners' biographies and learning dispositions is expected to contextualise the various areas of programme impact.

4. To examine the potential of an MACP approved musculoskeletal physiotherapy programme in enhancing the professional learning of participants.

This objective is about understanding the programme's impact on how an individual learner bridges between theory and praxis and between knowledge and action (Huber, 2011). Thus it is about understanding the sustainability of outcomes and how the learning culture supports continued learning beyond the programme lifespan.

5. To develop an explanatory model that captures how the learning culture of M-level musculoskeletal physiotherapy education advances clinical reasoning skills.

Developing a theoretical model is expected to bridge our limited understanding of learning cultures that drive the advancement of clinical reasoning skills. Such a model is expected to provide a simple and systematic overview of a complex processes, relationships and fields that are at interplay in relation to advancing clinical reasoning at M-level (Illeris, 2004, Hager, 2005).

1.2. Introducing the concept of ‘learning culture’

The focus of this study is to explore the learning culture of an MACP approved musculoskeletal physiotherapy programme. The term ‘culture’ is conceptualised in the literature as the product of collective social interaction between human beings (Mason, 2007a). Based on this conceptualisation, a learning culture is not limited to the learning site (e.g. University) and includes individual and organisational sociocultural factors such as participants attitudes and behaviours that modulate and shape the learning experiences (Gherardi, 2010). Moreover, although this conceptualisation implies outlining the shared values, beliefs, behaviours and understandings of a group of human beings, a learning culture may also contain patterns of conflict and dissonance between group members (Pratt and Schrewe, 2016).

The use of a sociocultural theoretical lens to evaluate professional learning moves the research process beyond narrow accounts of learning that fail to recognise the interaction between individual learner and the social structure (Sfard, 1998, Elkjaer, 2004, Mason, 2007b, Gherardi, 2010). It also bridges the divide between the individual and the social dimensions of learning (Watling, 2015), which provides a more nuanced understanding

of how learning occurs, and why some students engage in the learning process while others do not (Hodkinson et al., 2008).

For example, in programme evaluation literature, the sociocultural mediators within a learning culture are believed to modulate the nature of the interaction between programmes' output, outcomes and impact (Kellogg, 2004, Leithwood and Levin, 2005, Coldwell and Simkins, 2010). Although Marchal et al. (2012) stressed that these mediators are external to programme activities, they are arguably part of its learning culture (Peim and Hodkinson, 2007). To illustrate, Merriam (2008), suggested that context, as an external structure, changes learners' perspectives and learning processes. That is, the perception of a positive and supportive learning environment drives learners' engagement and therefore maximises the potential for positive outcomes and impacts. However, what is missing in Merriam's notion of context is that learners, being part of a learning culture, are able to actively restructure the learning context (Berkhout et al., 2016). As such, learners' biographies and learning dispositions (i.e. attitudes, motivations, interests, and sense of reality of what is possible) modulate how they engage with a programme's learning opportunities (Bloomer and Hodkinson, 2000, Huber, 2011). Therefore, examining learners' biographies and learning dispositions, the programme culture and the wider organisational practice culture have the potentials to yield better insights about professional learning.

1.3. Significance and original contribution

Multiple studies have explored M-level musculoskeletal physiotherapy education in terms of its effects on professional and career progression (Stathopoulos and Harrison, 2003, Green et al., 2008, Perry et al., 2011, Petty et al., 2011a, Constantine and Carpenter, 2012); understanding differences in clinical reasoning between novices and M-level qualified experts (King and Bithell, 1998, Doody and McAteer, 2002); and how M-level

qualified physiotherapists clinically reason around pain mechanisms (Smart and Doody, 2007). This study takes their work further by examining the learning culture of an MACP approved programme, and focusing on the advancement of clinical reasoning as a primary outcome. This is significant in the field of M-level musculoskeletal physiotherapy education as it extends our understanding of the learning culture through which MACP approved M-level programmes can advance clinical reasoning skills. Such an understanding would inform how M-level educators plan and implement effective strategies for advancing clinical reasoning skills which leads to an improved level of patient care.

The originality of this thesis is claimed at both theoretical and methodological levels. At the theoretical level, this study provides plausible evidence to suggest that synergistic interaction across various fields contributes to the advancement of clinical reasoning skills. It indicates the dynamic and multi-layered nature of learning through the model of convergence and synergy. The successful achievement of outcomes is not dependant only on cultivating effective programme pedagogy, but also on how learners respond and interact with programme activities. Learners' biographies and working environments have been identified as modulators of learning outcomes. Therefore, originality is claimed by unpacking how multiple dimensions and levels of interactions that support the advancement of clinical reasoning skills.

By drawing on a sociocultural learning lens, these interactions are presented at the levels of individual students i.e. micro level of influence, the programme activities i.e. meso level of influence and the context of students' physiotherapy practice i.e. macro level of influence. In line with Hodkinson et al.'s (2008) theory of learning culture and cultural theory of learning, these levels were found influential for understanding professional learning and advancement of clinical reasoning skills. The credibility of this theoretical

understanding arises from comprehensive communication of this learning model in a way that avoids disconnected analytical categories; therefore this thesis offers a storyline that narrates what is going on in this case study in terms of how students advance their clinical reasoning skills (Thomas, 2016).

At the methodological level, this is the first study to:

-) Widen the evaluative lens and draw on both students' and educators' perspectives in a longitudinal research study. Exploring both perspectives led to a comprehensive understanding of the learning culture of the programme under study.
-) Use a longitudinal research design, where programme impact was evaluated over 18 months from students' enrolment. Therefore, there is an ethnographic dimension in terms of real-time data collection and immersion within the case, unlike other studies in which M-level education was examined retrospectively. This longitudinal design made it possible to capture the temporal dimension of change in clinical reasoning skills. Observational data offered a rich, first-hand data source to understand how the programme effectively achieved outcomes and how students interacted with the programme's pedagogy.
-) Use mixed methods research to measure changes in clinical reasoning skills. In the context of M-level programme evaluation, this is the first study in which the advancement of clinical reasoning skills is quantitatively measured by using the Script Concordance Test (SCT) and the Diagnostic Thinking Inventory (DTI). Previous researchers utilised only qualitative data collection by means of either interviews or focus groups to understand programme outcomes.
-) Use multiple methods of data collection to understand the programme's learning culture, in particular using programme documents and observation in addition to

focus groups and semi-structured interviews. These methods added a richness and a depth of understanding of the M-level learning culture and supported various phases of data collection.

1.4. Thesis structure

The thesis is presented in ten chapters.

Chapter one has comprised an introduction to the significance of advancing clinical reasoning skills within a musculoskeletal physiotherapy context, a contextualisation of the study's main research question and objectives, the sociocultural conceptual framework of the study, and finally, an account of the significance of this study and its original contribution.

Chapter two is a systematic review of healthcare M-level education literature to synthesise M-level programme theory and to understand how programme philosophy, pedagogical activities and context interacted to produce outcomes and impact. The manner in which the evaluation of impact is approached is also examined to guide the development of a coherent longitudinal study design.

Chapter three comprises a critical review and analysis of the literature pertaining to clinical reasoning in the context of musculoskeletal physiotherapy, including: the concept of expertise and its relation to clinical reasoning, methods of assessing clinical reasoning skills and the types of practice knowledge that inform clinical reasoning processes were reviewed.

In **Chapter four**, several learning theories are evaluated. The purpose of this appraisal was to develop a theoretical framework to structure data collection and analysis; and to understand how professional learning is perceived in the literature in the context of sociocultural theories of learning.

Chapter Five comprises a description of the research methodology. It begins with an explanation of the philosophical underpinning of the study and a critical analysis of the research paradigms. The longitudinal, mixed-methods, theory-seeking case study research approach adopted in this study is then explained. This is followed by a description of the sampling process, the study design and rounds of data collection. Afterwards, methods of data collection and analysis are outlined and the general principles of each method are explained, with examples of how these methods were utilised. Ethical considerations within the case study approach are then noted. The chapter concludes with an outline of the relativist, non-foundational strategies that were employed to ensure the research quality.

Chapters six, seven, eight and nine collectively constitute the report on the results of the study, beginning with an outline of the study participants.

Chapters six offers a synopsis of the overall study findings and reports dimensions of change in relation to advancement of clinical reasoning skills.

Chapter seven is an examination of the programme culture and pedagogy that supports professional learning and the advancement of clinical reasoning skills. Concerns raised in the literature related to ‘How’ and ‘Why’ a programme achieved (or failed to achieve) the planned outcomes are addressed. Four conceptual categories were inductively constructed to reflect the shared beliefs and experience of the programme lead, educators and students as well as the researcher’s observations.

Chapter eight consists of six student case vignettes, that illustrate a distinctive feature of their experience. An interpretation of students’ actions is offered, as well as a description of incidents that demonstrate influential variables in each student’s context in terms of how they interacted with the programme.

Chapter nine comprises an explanation of the model of convergence and synergy. It examines the impact of the learners, the programme and wider context in which clinical reasoning skills are advanced. Data were carefully chosen to warrant the claims made and to reflect the wide range of data sources utilised in the study.

Chapter ten is a theoretical discussion of the three findings' chapters in relation to the relevant literature and the research objectives. The limitations and strengths of the study are also discussed. The chapter also comprises the conclusions of the study and its implications for professional practice, pedagogy and future research.

Chapter Two: Masters' Level Education in Healthcare: A Systematic Review of Literature

2.1. Introduction

This chapter is a systematic review of M-level education for healthcare professions. The focus of the review was to synthesise and critique empirical studies on how M-level education supports practitioners' professional development. The evidence from this review was synthesised in an M-level programme theory Logic Model (Kellogg, 2004) to guide processes of data collection. The three main aims of the review were:

- 1) To identify the outputs, outcomes and impact of M-level education in supporting healthcare practitioners.
- 2) To understand the programme pedagogy and context that supports learning.
- 3) To identify how M-level programme evaluation has been approached in the literature.

2.2. Materials and Methods

A systematic review of literature using the guidelines of the Cochrane collaboration handbook was conducted (Higgins and Green, 2011). The review is reported in line with the preferred evidence-based minimum set of items for reporting systematic reviews (PRISMA) guidelines (Moher et al., 2009). Whilst PRISMA guidelines are not an instrument to assess the quality of systematic reviews, following these guidelines ensures robust reporting and avoidance of publication biases.

2.2.1. Eligibility criteria

- 1) Studies that evaluated M-level healthcare programmes were included. M-level education was defined as Postgraduate diploma and Master of Science levels of education.

- 2) Qualitative, quantitative and mixed-methods research designs were included, provided they addressed any of the main review aims identified in the introduction.
- 3) Studies that were published in the English language.

2.2.2. Exclusion criteria

Studies were excluded if they:

- 1) Discussed the potential outcomes or impact of M-level education i.e. theoretical paper.
- 2) Evaluated online, long distance M-level courses to map out a Logic Model that draws on homogenous M-level learning cultures, which would make it relevant to the focus of the thesis.
- 3) Did not meet the minimum methodological quality assessment identified in section 2.2.6.

2.2.3. Information sources and search strategy

Two independent reviewers (M-level qualified physiotherapists) searched:

-) Medline (Ovid), ERIC, Web of Science, ProQuest, and CINAHL Plus databases from inception to 14th November 2016.
-) Reference lists of retrieved articles, websites (Google Scholars, Science Direct, and Taylor and Francis) and grey literature (dissertations and theses).

Informed by the research objectives, the following is an example of the search strategy used in Medline (Ovid) from 1946 until 14th November 2016:

1. Postgraduate education.mp.
2. Master's level education.mp.
3. Masters programme.mp.
4. Masters degree.mp.
5. professional development.mp.
6. 1 or 2 or 3 or 4 or 5
7. Evaluation.mp. or Evaluation Studies as Topic/

8. Impact.mp.
9. Outcome.mp.
10. output.mp.
11. Output.mp.
12. 7 or 8 or 9 or 10 or 11
13. 6 and 12

2.2.4. Study selection

After searching, the two independent reviewers evaluated the retrieved studies against the pre-specified eligibility criteria and rated each study as ‘eligible’, ‘not eligible’ or ‘might be eligible’. With the absence of any disagreements, there was no need for a third reviewer. The full process of study selection is shown in Figure 2.1 below. One hundred and twelve records were initially identified after removing duplicates and articles that the title clearly suggests that it did not meet the inclusion criteria.

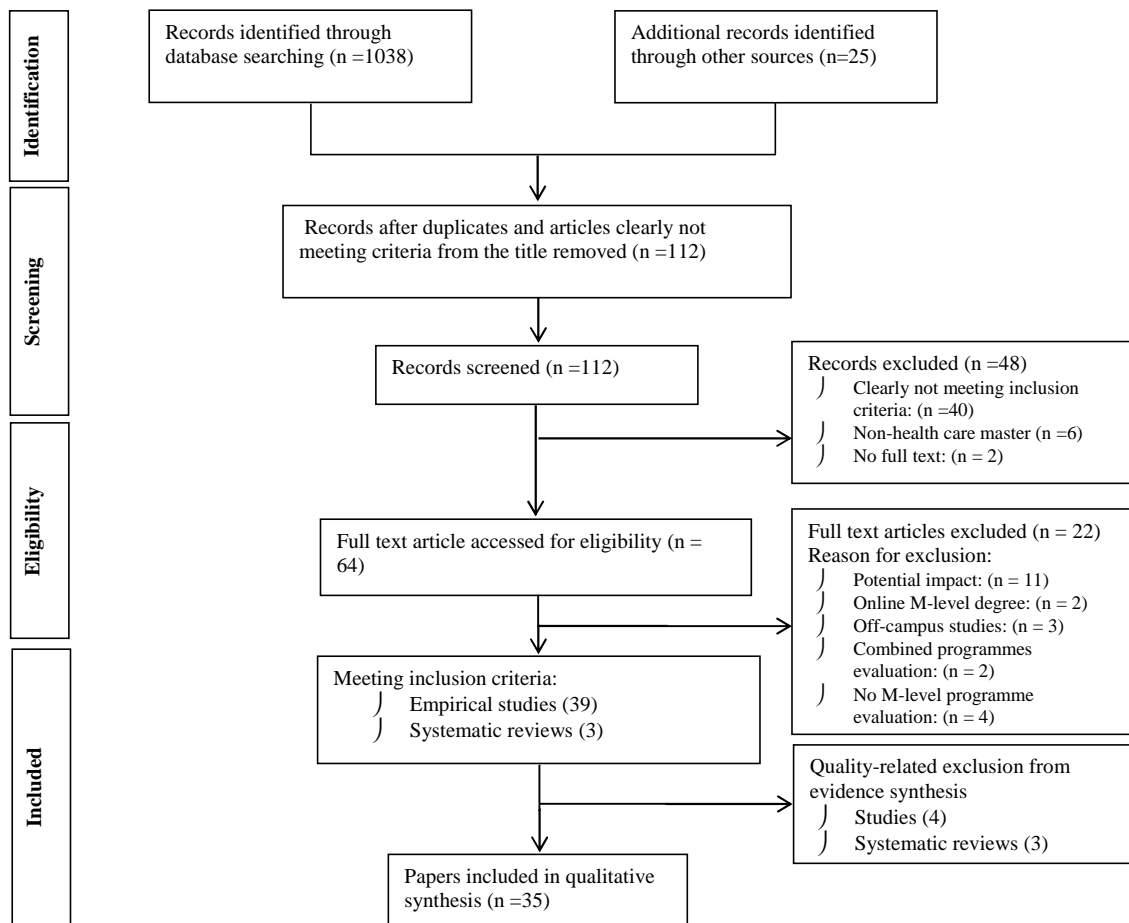


Figure 2.1: PRISMA Flow Diagram: Data selection process

2.2.5. Data extraction process

One reviewer extracted data that was checked by the second reviewer. An adapted Cochrane Collaboration's data extraction form was used (Appendix 2.1). The form was initially piloted on four identified studies. The extracted data included: reference details, country, study funding source, conflicts of interest, level of the programme, title of the programme, aims of the programme, study design, outcome measures, aim of the study, population description and characteristics, and response rate, method/s of participant recruitment, ethical approval, obtained consent, programme activities and pedagogy, point of approaching graduates, evaluation model used, programme outputs, outcomes, and impact. The authors of a selected studies were contacted to retrieve missing data or clarify ambiguous elements. To ensure consistent data extraction, W.K. Kellogg's (Kellogg, 2004) Logic Model definitions of programme output, outcome and impact were used (Table 2.1).

Table 2.1. Logic Model definitions of programme output, outcome, and impact. Adapted from definition of W.K. Kellogg Foundation (Kellogg, 2004).

Outputs	The direct products of programme activities and may include types, levels and targets of services to be delivered by the programme
Outcomes	The specific changes in participants' behaviour, knowledge, skills, status and level of functioning
Impact	The fundamental intended or unintended change occurring in organizations, communities or systems as a result of programme activities within 7 to 10 years

2.2.6. Methodological quality assessments

The two reviewers independently assessed the methodological quality of the included studies. Due to the wide range of methodological approaches and designs used in retrieved studies, methodological quality was evaluated using the Mixed Method Appraisal Tool (MMAT), a valid, reliable (ICC=0.80) and efficient (15 minutes per

study) tool to critically appraise qualitative, quantitative and mixed-method study designs (Pluye et al., 2011, Pace et al., 2012, Pluye and Hong, 2014). The assessment checklist can be found in Appendix 2.2. The methodological quality of the retrieved systematic reviews was assessed using AMSTAR, an 11 items tool that has good face and content validity to assess the methodological quality of systematic reviews (Shea et al., 2007). The quality of each of the included studies and systematic reviews was rated low, medium, and high based on the score of MAAT and AMSTAR, respectively. The Weight of Evidence (WoE) Framework (Gough, 2007) was used to evaluate the overall quality of the synthesised evidence. Relativist, non-foundational and pre-specified criteria of three domains was used to identify the level of evidence across retrieved studies (Table 2.2).

Table 2.2. Specification of Weight of evidence criteria			
Weight of evidence	WoE A: Methodological quality	WoE B: Appropriateness of study design for answering the review question	WoE C: Relevance of the study focus to the review
High	MMAT more than 50%	Longitudinal pre-post study of multiple cohorts	Defined primary outcomes, clear description of specific programme pedagogy
Medium	MMAT 50%	Longitudinal Pre-post one cohort	Defined primary outcomes, no specific description of pedagogy
Low	MMAT less than 50%	Post hoc evaluation of impact	No defined outcomes, no description of programme pedagogy

2.2.6. Data synthesise and analysis

Due to the heterogeneity of the studies' designs and outcomes, statistical analysis was not possible. Therefore, the extracted data were tabulated and synthesised using qualitative content analysis, through which data were categorised and synthesised into a Logic Model

M-level programme theory across multiple healthcare disciplines. This approach has been used in the evaluation literature to map out programme design, structure, output, outcomes and impact (Armour and Makopoulou, 2012). In relation to systematic reviews of literature, Logic Model provides an innovative method to synthesise wide-ranging literature (Baxter et al., 2014). As such, it offers a unified lens to not only synthesis what works (i.e. programme outcomes and impact), but also to synthesis how and why an educational intervention works (Rogers, 2008, MacLeod, 2016).

2.3. Results

2.3.1. Characteristics of included studies

Thirty-five eligible studies were included in the qualitative synthesis. These studies drew on the accounts of 2834 graduates and a total of 87 programme educators, clinical managers and workplace colleagues. A list of excluded studies and reasons for exclusion can be found in Appendix 2.3. The detailed characteristics of these studies are presented in Table 2.3. In summary, the evaluated programmes were in Nursing (n=19), Physiotherapy (n=6), General and family medicine (n=4), Public health (n=3), Dentistry (n=1), interdisciplinary (n=1), and Occupational therapy (n=1). These programmes were based in the UK (n=16), USA (n=3), Australia (n=4), Ireland (n=3), New Zealand (n=3), Canada (n=2), Jordan (n=1) and Vietnam (n=1). The remaining two studies were evaluations of internationally-based programmes (Gerstel et al., 2013, Zwanikken et al., 2014). One study (Conneeley, 2005) intended to follow up students after graduation. Contacting the author revealed that s/he was not able to do that. Three systematic reviews were also retrieved (Gijbels et al., 2010, Cotterill-Walker, 2012, Zwanikken et al., 2013), with the most recent one including studies up to November 2011.

Table 2.3. Characteristics of included studies

Reference	Study aim	Country	Specialty	Study design	Methods	Population
Barnhill et al. (2012)	Investigate impact on clinical practice	New Zealand	Nursing	Quantitative: descriptive	Postal survey	Registered nurses (n=27) / Senior nurses (manager & educator) (n=23) / Response Rate (RR)=47.7%
Baron et al. (2006)	Investigate effects on career development	UK	General Practice	Quantitative: Descriptive	Questionnaire with open ended questions	GP graduates from 1997-2003 / A total of 150 questionnaires were sent out and 81 were returned (RR=54%) / Total population is not stated
Bearn and Chadwick (2010)	Evaluate students' experiences	UK	Orthodontic	Qualitative	Focus groups and semi-structured interviews	12 postgraduate students / First cohort of the programme
Calvert and Britten (1999) Calvert and Britten (1998)	Exploring outcomes on professional and personal development	UK	General Practice	Qualitative	Free writing feedback	71 of 76 graduates from the first 9 cohorts (RR=93%)
Chaboyer and Retsas (1996)	Evaluate programme outcomes	Australia	Nursing	Mixed: concurrent	Questionnaires consisted of open- and closed-ended questions	44 graduates out of 50 (88%) in 1st survey 37 graduates in second survey (77%) of the 1994 cohort Stakeholder
Conneeley (2005)	Evaluate students' experiences, perceived benefits and impact on career.	UK	Occupational Therapy	Qualitative: Phenomenology	Focus group	Six students: 4 OT and 2 PT [total programme cohort]

Constantine and Carpenter (2012)	Explore practitioners' development	UK	Physiotherapy	Qualitative: Phenomenology	Semi-structured phone interview	7 out of 35 invited alumni Total population is not stated – graduates from other programmes have been included
Cragg and Andrusyszyn (2004) Cragg and Andrusyszyn (2005)	Identify perceived changes at personal, practice, and attitudinal levels	Canada	Nursing	Qualitative: descriptive	Semi-structured Face-to-face or telephone interviews	22 graduates who completed programs from 2000 – 2003 Total population: not stated
Drennan (2008)	Evaluate career and academic development	Ireland	Nursing	Quantitative: descriptive	Cross-sectional postal survey	220 out of 322 approached graduated between 2000-2005 (RR=68%)
Drennan (2010)	Measure critical thinking ability	Ireland	Nursing	Quantitative: cross sectional analytic	Watson–Glaser Critical Thinking Appraisal tool administered to two groups	Two cohorts: 83 of 110 students (75%) commencing Master's in Nursing programmes. & 140 of 222 students (63%) who had a Master's degree in Nursing between 2003-2007
Drennan (2012)	Evaluate graduates' ability to change practice	Ireland	Nursing	Quantitative: cross-sectional survey	Retrospective pre-test design	140 of 222 students (63%) who had a M degree in Nursing
Gerstel et al. (2013)	Evaluate graduates' competencies and career development	International	Public Health	Quantitative:	Online survey	177 of 327 invited alumni (RR=54%)

Green et al. (2008)	Identify the influence on career development	UK	Physiotherapy	Quantitative: descriptive Qualitative: descriptive	Postal survey & Focus group	Graduates from the MSc MSK PT programmes from 1994 to 2005 48 of 77 (RR: 62.3%)
Perry et al. (2011)	Explore impact on professional and personal development	UK	Physiotherapy	Qualitative: atheoretical pragmatic utilised within an interpretivist paradigm	Focus group	Seven graduates out of 11 agreed to take part. Pooled form respondent of Green et al. (2008)
Le et al. (2007)	Explore the relevance and impact on work	Vietnam	Public Health	Quantitative: descriptive Qualitative: descriptive	Postal survey Interviews	148 graduates out of the total of 187 (RR:79.1)
LeCount (2004)	Describe programme, inception, implementation, and outcomes.	USA	Nursing Geriatrics	Quantitative: descriptive	Postal survey	16 of 20 contacted (RR=80%) / Total population: 30 graduates
Murray et al. (2001)	Analyse graduates' satisfaction and explore the perceived impact.	USA	Interdisciplinary	Quantitative: descriptive	Postal questionnaire	53 of 85 graduates contacted / (RR=62%) Total population: 96 graduates between 1982-1998 / 29 of 37 contacted employers (RR=78%)
Nicolson et al. (2005)	Identify educational and working experiences	UK	Nursing	Mixed Methods: Sequential	Focus group that informed the Postal questionnaire & Semi-structured telephone interviews	Five cohorts of graduates Programme team nursing and medical staff at one NICU 37 questionnaires RR=71.2%

Pelletier et al. (1994)	Investigate effects on practice and career	Australia	Nursing	Quantitative: descriptive	Postal questionnaire	40 of 55 from 1991 cohort. RR=72% Total population: not clear
Pelletier et al. (2003)	Investigate the impact on patient care	Australia	Nursing	Quantitative: descriptive	Postal questionnaire	236 from Pelletier et al., (1998) / retention rate of 58% / Five cohorts
Pelletier et al. (2005)	Report motivators and barriers to career change	Australia	Nursing	Quantitative: Longitudinal descriptive and co-relational	Postal questionnaire	151 of 236 in Pelletier et al., (2003)
Petty et al. (2011a) Petty et al. (2011b)	Describe impact clinical practice Develop an explanatory theory of the learning transition	UK	Physiotherapy	Qualitative: grounded theory. theory-seeking case study	Semi-structured interviews	11 alumni agreed of 35 purposefully selected
Spence (2004a) Spence (2004b)	Evaluate the clinical impact	New Zealand	Nursing	Qualitative: descriptive	Loose-structured interviews	12 PG clinically focused programme 8 co-worker and/or employer
Spencer (2006)	Examine impact on professional practice	UK	Nursing midwives and health visitors	Qualitative: Phenomenology	Semi-structured interviews	12 qualified nurses, midwives and health visitors since its inception in 1998
Stark (2006)	Investigate differences in role choices, role flexibility, and practice settings	USA	Nursing	Quantitative: cross-sectional, comparative study	Postal survey: self-report Role Choices, Role Flexibility, and Practice Settings Survey (CFPS)	406 of 1,086 potential (RR = 37.4%) Final completed questionnaires: 285 Power analysis: 165 required

Stathopoulos and Harrison (2003)	Explore impact on professional practice	UK	Physiotherapy	Qualitative: Phenomenology	Focus group	5 of 7 graduates agreed to participate. Working in clinical setting
Tsimtsiou et al. (2010)	Assess benefits on professional and career development	UK	General Practice	Mixed	Postal questionnaire that include free writing	Graduates from 1997 until 2008 50 of 66 (RR=76%)
Whyte et al. (2000)	Evaluate the professional relevance and the personal and career growth	UK	Nursing	Quantitative: descriptive	A self-administered questionnaire	Graduates from 1991-1994 109 of 190 posted questionnaire (RR: 57%)
Wildman et al. (1999)	Evaluate the effect on clinical practice.	UK	Nursing	Mixed	Postal questionnaire	The first seven cohorts of the programme (n:169) (RR= 66.8% (113))
Zahran, (2013)	Explore motivational factors and explore perceived impact on practice	Jordan	Nursing	Qualitative: Ethnography	Semi-structured interviews	44 ML qualified nurses nurse educationalists clinical nurse supervisors
Zwanikken et al. (2014)	Examine the influence on performance at the workplace, and professional contribution to society	International	Public Health	Quantitative: descriptive	Self-administered questionnaire	n = 445 RR= 37.5%

2.3.2. Assessment of methodological quality and weight of evidence

The methodological quality of included studies and systematic reviews, evaluated by using MAAT and AMSTAR respectively, ranged from low to medium (Tables 2.4 and 2.5). The weight of synthesised evidence ranged from low to moderate evidence across pedagogy, outcomes and impact. This was mainly due to low/medium quality of evidence, and the inappropriate and limited relevance of studies. The details of WoE are shown in Tables 2.4 and 2.5.

Whilst Logic Model terminologies were clearly defined and used in one study (Zwanikken et al., 2014), an inconsistent and interchangeable use was identified across other studies. For examples, the term ‘impact’ was used in most studies to describe the programme outcomes. While Stark (2006) described ‘outcomes’ as a change of the practitioners’ scope of practice, Constantine and Carpenter (2012), who evaluated students’ experience of a musculoskeletal physiotherapy programme, used output, outcome and impact interchangeably. Also, Pelletier et al. (1994), who set out to evaluate the outcomes of a nursing programme, reported only the immediate outputs of the programme. The use of Logic Model definitions in this review ensured that data were extracted consistently on the bases of these definitions, and not on the bases of what the included studies reported.

The authors of two systematic reviews (Cotterill-Walker, 2012, Zwanikken et al., 2013) included studies in which postgraduate certificate programmes, pre-registration entry-level Master or combined M-Level/PhD programmes were evaluated (e.g. Hardwick and Jordan, 2002; Stellman et al., 2008; Stacey et al., 2010). Gijbels et al. (2010) did not evaluate the scientific quality of the included studies. Moreover, while Zwanikken et al. (2013) set out to synthesise evidence from post-Bologna Declaration programmes

(Karran and Löfgren, 2010), they included 13 out of 33 studies in which programmes were developed and implemented before the Bologna Declaration in 1999, e.g. Baron et al. (2006). Therefore, the overall literature synthesis of these reviews has limited usefulness to this review.

Table 2.4. Scores of Mixed Methods Appraisal Tool (MMAT) and Weight of Evidence (WoE)

Reference	MMAT Score	WoE A: Methodological quality	WoE B: Appropriateness of study for answering the review question	WoE C: Relevance of the study focus to the review	Overall WoE
Calvert and Britten (1999) Calvert and Britten (1998)	25%	Low	Low	Medium	Low
Baron et al. (2006)	25%	Low	Low	Low	Low
Barnhill et al. (2012)	25%	Low	Low	Low	Low
Bearn and Chadwick (2010)	25%	Low	Low	Low	Low
Chaboyer and Retsas (1996)	25%	Low	Low	Low	Low
Conneeley (2005)	50%	Medium	Low	Low	Low
Constantine and Carpenter (2012)	25%	Low	Low	Medium	Low
Cragg and Andrusyszyn (2004) Cragg and Andrusyszyn (2005)	50%	Medium	Low	Medium	Medium
Drennan (2008)	75%	High	Low	Low	Medium
Drennan (2010)	50%	Medium	Low	High	Medium
Drennan (2012)	25%	Low	Low	Low	Low
Green et al. (2008)	25%	Low	Low	Low	Low
Gerstel et al. (2013)	25%	Low	Low	Low	Low
Le et al. (2007)	50%	Medium	Low	Low	Low
LeCount (2004)	25%	Low	Low	Low	Low
Murray et al. (2001)	50%	Medium	Low	Low	Low
Nicolson et al. (2005)	50%	Medium	Low	Low	Low
Pelletier et al. (1994)	25%	Low	Low	Low	Low
Pelletier et al. (2003)	50%	Medium	Low	Medium	Medium
Pelletier et al. (2005)	25%	Low	High	Low	Medium
Perry et al. (2011)	50%	Medium	Low	Medium	Medium
Petty et al. (2011a) Petty et al. (2011b)	75%	High	Low	Medium	Medium
Spence (2004a)	50%	Medium	Low	Medium	Medium

Spence (2004b)					
Spencer (2006)	25%	Low	Low	Low	Low
Stark (2006)	50%	Medium	Low	Low	Low
Stathopoulos and Harrison (2003)	25%	Low	Low	Low	Low
Tsimtsiou et al., (2010)	75%	High	Low	Low	Medium
Whyte et al. (2000)	25%	Low	Low	Low	Low
Wildman et al. (1999)	25%	Low	Low	Medium	Low
Zahran (2013)	25%	Low	Low	Low	Low
Zwanikken et al. (2014)	25%	Low	Low	Medium	Low

Table 2.5. Scores of AMSTAR (Appendix 2.4) and Weight of Evidence (WoE) of the three systematic reviews

Reference	AMSTAR Score	WoE A: Methodological quality	WoE B: Appropriateness of study for answering the review question	WoE C: Relevance of the study focus to the review	Overall WoE
Cotterill-Walker (2012)	2	Low	Low	Low	Low
Gijbels et al. (2010)	7	Medium	Low	Low	Low
Zwanikken et al. (2013)	5	Medium	Low	Low	Low

2.3.3. Methodology and Methods

Methodology and design ranged from qualitative (n=15) to quantitative (n=14) and combined qualitative and quantitative methods of data collection (n=6). The methods used in these studies are summarised in Table 2.6. Most of the quantitative studies were descriptive, with only two cross-sectional analytical studies (Stark, 2006, Drennan, 2010) that compared M-level student cohorts with other cohorts. In three studies, large-scale alumni surveys were used to study career pathways in nursing (Drennan, 2008), physiotherapy (Green et al., 2008), and public health (Gerstel et al., 2013). While all studies were classified as retrospective programme evaluation (Appendix 2.5), the exact time of approaching graduates was unclear in 18 studies. Moreover, the total number of graduates or cohorts enrolled in the programme was reported in few studies (e.g. Conneeley, 2005, LeCount, 2004), which limited the understanding of the extent of programme outcomes and impacts. Finally, only one researcher (Drennan, 2010) used a validated assessment tool to evaluate the differences in critical thinking of two nurse cohorts.

Table 2.6. Methods used in evaluating M-level Education

Qualitative (n=15)	Semi-structured interviews (6)
	Graduates free writing (2)
	Focus group (3)
	Graduates, Managers, Educators, and Colleague's interviews (3)
	Focus groups and semi-structured interviews (1)
Quantitative (n=14)	Graduates Survey (10)
	Cross sectional analytic (2)
	Graduates, Managers, and Educators Surveys (2)
Combined data collection (n=6)	Graduates open- and closed-ended questionnaire (3)
	Graduates open- and closed-ended questionnaire, and stakeholders' interviews (1)
	Graduates survey and focus group (1)
	Graduates survey, interviews and focus group (1)

2.3.4. Programme outputs

Programme outputs are the direct products of programme activities which facilitate achieving programme outcomes (Kellogg, 2004), and includes students' reactions to programme activities (Leithwood and Levin, 2005). These outputs were documented in a few studies (N=10), that are reported in Appendix 2.6.

Firstly, **successful collaborative work**. While successful formation and support of learning groups, including small class size and promoting diversity of opinions, drove learning engagement in some cohorts (Calvert and Britten, 1998, 1999, Constantine and Carpenter, 2012), limited peers' attendance created a sense of frustration which affected group dynamics (Baron et al., 2006).

Secondly, **relevance of programme activities**. Ensuring the relevance of programme activities to students' clinical practice cultivated greater satisfaction and engagement which invariably led to achievement of programme outcomes (Chaboyer and Retsas, 1996, Bearn and Chadwick, 2010, Constantine and Carpenter, 2012).

Thirdly, achieving learning outcomes was found to be contingent on the students' **positive reactions to the learning contradictions** that characterise M-level education (Stathopoulos and Harrison, 2003, Conneeley, 2005, Constantine and Carpenter, 2012, Nicolson et al., 2005, Perry et al., 2011, Petty et al., 2011b). Graduates of these programmes suggested that achieving programme outcomes was associated with questioning the effectiveness of their previous practice, which lead to a process of reconstruction of their knowledge and skills. This process was described as 'shrugging off the old' and 'assuming the new' (Nicolson et al., 2005, p.733).

In summary, these outputs highlight the importance of learners' attitudes in driving transformative changes.

2.3.5. Programme outcomes

The outcomes of programmes were reported in 22 studies (Appendix 2.7). Outcomes were conceptualised as the specific changes in graduates' behaviour, knowledge, skills, status and level of functioning (Kellogg, 2004).

2.3.5.1 *High level critical thinking skills and/or analysis*

The advancement of critical thinking skills was identified across all healthcare disciplines. Significant differences in critical thinking ability between graduates and freshmen of six nursing programmes in Ireland were identified using the Watson–Glaser Critical Thinking Appraisal tool (Drennan, 2010). The remaining evidence of advancement in critical thinking resulted from qualitative research (Appendix 2.7). Graduates demonstrated a transformation from non-critical, routine and therapist-centred practice to a more critical and patient-centred one (Petty et al., 2011b). Participating in this level of education advanced graduates' ability to critically discuss research evidence (Calvert and Britten, 1999, Whyte et al., 2000, Constantine and Carpenter, 2012), which enabled them to justify their own practices (Spencer, 2006, Petty et al., 2011a). However, the perception of advancement in critical thinking skills was not always associated with tangible impact on patient care such as length of hospital stay (Barnhill et al., 2012). Moreover, some students questioned their ability to continue at this level of high criticality upon returning to the workplace environment (Conneeley, 2005), although the reasons for this were not examined.

2.3.5.2 *High level clinical reasoning skills*

Drawing on data from telephone interviews, Constantine and Carpenter (2012) determined that one musculoskeletal physiotherapy programme enhanced graduates' clinical reasoning skills during both the assessment and treatment phases of patient

management. In a different programme, this was associated with open mindedness in selecting alternative management options (Petty et al., 2011a). Likewise, graduates who had received nursing education became attentive to details, able to interpret patient data and articulate diagnostic and treatment decisions (Spence, 2004b). While there was limited exploration of how programme pedagogy supported change, it could be potentially attributed to the theoretical aspect of the curriculum (LeCount, 2004, Green et al., 2008). For examples, because of a module or a content that is related to ethical issues, graduates of several programmes demonstrated an advanced understanding of ethical reasoning (Wildman et al., 1999, Pelletier et al., 2003, Tsimtsiou et al., 2010). Also, a cohort of physiotherapy graduates suggested that the limited psychosocial content adversely affected the ability to manage patients with complex psychosocial issues (Petty et al., 2011a).

2.3.5.3 *Confidence and motivation to practice*

Increased confidence and motivation in clinical practice was described by graduates of several programmes (Appendix 2.7). In particular, changes involved increased credibility in the eyes of others (Stathopoulos and Harrison, 2003); increased willingness to engage in critical debates (Calvert and Britten, 1999); enhanced ability to conduct and publish scholarly research (Whyte et al., 2000); and enhanced capabilities to meet the requirements of extended scope practice, clinical specialist and consultant roles (Green et al., 2008, Perry et al., 2011). The evidence suggests that confidence improved as a result of the specific professional knowledge provided during programmes (Chaboyer and Retsas, 1996, Petty et al., 2011a). The perceived sense of self-efficacy (Ball, 2009) enabled practitioners to advocate practice and policy changes and to support professional learning of junior practitioners (Pelletier et al., 2003, Stathopoulos and Harrison, 2003, Perry et al., 2011).

2.3.5.4 *Enhanced career progression*

Whilst poorly described in most studies, career progression is described in the literature as either being promoted, have increased payment and a change of job description or specialisation (Wolstenholme et al., 2012). In one study, 84% of nursing graduates agreed or strongly agreed that the programme had enhanced career progression (Barnhill et al., 2012). For some graduates, career changes occurred either during or upon completion of the programme, indicating a high demand for M-level qualified practitioners (Chaboyer and Retsas, 1996, Conneeley, 2005, Green et al., 2008). What is less clear, however, is the impact of career progression on direct patient care since graduates from some programmes assumed management, research and education duties (Whyte et al., 2000, Green et al., 2008).

2.3.5.5 *Becoming a lifelong learner*

M-level education was found to support engagement in a lifelong learning process (Whyte et al., 2000, Conneeley, 2005, Spencer, 2006, Constantine and Carpenter, 2012). It provided graduates with the tools to “learn how to learn” (Conneeley, 2005, p.108) although details of tools and processes were not described. In another study, graduates were able to learn from their practices through processes of reflection (Petty et al., 2011a), which is thought to be a core component of M-level education. Therefore, becoming a lifelong learner was not limited to locating sources of knowledge, but also extended to synthesising practice-based knowledge, which was associated with patient-centred practice, ongoing introspection and self-critique (Wildman et al., 1999, Drennan, 2010).

2.3.5.6 *Advanced communication skills*

Graduates of public health programmes reported a 78% increase in communication competencies (Zwanikken et al., 2014). Multiple areas of advancement were identified in

nursing cohorts including: oral communication, written communication, working and coping with team conflicts, understanding team members' feelings, listening to others, and communicating with colleagues (Drennan, 2012). Advancement in communication with patients was reported in three studies (Calvert and Britten, 1998, Pelletier et al., 2003, Tsimtsiou et al., 2010). While two of these studies (Calvert and Britten, 1998, Tsimtsiou et al., 2010) identified it as the least developed outcome, with no reasons given to explain this.

2.3.5.7 *Enhanced sense of autonomy*

Whilst an increase in graduates' autonomy was reported in multiple studies (e.g. Pelletier et al., 2003, Constantine and Carpenter, 2012), the authors did to evaluate what this meant or entailed. In one study, seventy-five percent of nursing graduates (n=236) reported an increase in their ability to assume work roles independently (Pelletier et al., 2003). The authors attributed this to an enhanced level of self-confidence. Graduates perception of autonomy was associated with working in a healthcare system that supported autonomous practice (Pelletier et al., 2003, Nicolson et al., 2005).

In summary, although multiple outcomes are claimed, evaluation studies offered few details that link programme outcomes to its pedagogy and the wider clinical context.

2.3.6. Programme impact

The variability between the time of graduation and the time of approaching participants limits judgment of actual programme impact. Whilst the term 'impact' suggests long-term changes in communities of practice and organisation, it was clearly stated in only one study as the researcher approached participants 7-10 years after the programme (Pelletier et al., 2005). Impact was self-reported in most studies (Appendix 2.8), with only

two studies that consulted stakeholders such as managers and workplace colleagues (Barnhill et al., 2012, Zahran, 2013). These are explored next.

2.3.6.1 *Management of complexities*

M-level education enhanced graduates' ability to understand healthcare systems (Cragg and Andrusyszyn, 2004, Drennan, 2012), to demonstrate flexibility in management decisions (Stark, 2006, Petty et al., 2011a) and to establish creative practice (Spence, 2004a). Graduates were able to manage complex patient presentation (Nicolson et al., 2005), particularly in terms of appreciating other perspectives, thinking analytically, defining problems and resolving conflicts (Drennan, 2012).

2.3.6.2 *Assuming research, leadership and management positions*

Graduates' leadership and management skills were enhanced in terms of being in a position to drive changes in practice and service delivery (Drennan, 2012, Zwanikken et al., 2014). Graduates of public health programmes were able to evaluate service delivery and recommend development needs (Zwanikken et al., 2014). However, it was not clear whether these changes were at local level, i.e. at the graduates' workplaces, regional or at national level.

2.3.6.3 *Assuming teaching roles*

Engagement in collegial teaching duties, supporting peer learning and involvement in university education was reported in multiple evaluations (Appendix 2.8). Involvement in teaching activities was not only an opportunity for graduates to give back to society (Spencer, 2006), but also for them to engage in a lifelong learning process (Pelletier et al., 2003, Drennan, 2010, Petty et al., 2011a, Constantine and Carpenter, 2012).

2.3.6.4 *Increased retention rate of healthcare practitioners*

In one study, graduates expressed a tendency to remain in clinical practice because of increased motivation and confidence (Baron et al., 2006). This was evident in the cases of practitioners with more experience because of the fresh perspectives and insights offered by M-level education (Tsimtsiou et al., 2010), which led some graduates to express their desires to implement knowledge and skills within the clinical context (Stathopoulos and Harrison, 2003). Practitioner retention in clinical practice was associated with the presence of a comprehensive National Health Service (NHS) scope of practice that acknowledges and rewards graduates (Green et al., 2008) as highlighted in section 2.3.8.

2.3.6.5 *Patient care*

No study examined the impact of M-level education in terms of tangible change in direct patient care such as duration of recovery. However, it was implicitly demonstrated earlier that indirect improvement of the quality of patient care is plausible through advancement in knowledge, cognitive and clinical reasoning skills (Petty et al., 2011b), particularly in terms of embracing patient-centred practice (Wildman et al., 1999, Tsimtsiou et al., 2010). Nonetheless, managers or colleagues of nursing programme graduates did not perceive any change in direct patient care (Barnhill et al., 2012; Zahran, 2013). In one study, this was attributed to workplace restrictions or practice policies that do not differentiate between M-level graduates and less qualified practitioners (Zahran, 2013).

2.3.7. Programme pedagogy

Three studies reported the programmes' structure and modules (i.e. units), with no further exploration of the programme's pedagogies (Wildman et al., 1999, Constantine and Carpenter, 2012, Gerstel et al., 2013). The pedagogies of nine programme evaluations

were communicated (Appendix 2.9). In general, the programmes were informed by social constructivism, adult learning and reflective learning theories, with an overall structure that promoted a learner-centred approach. These are examined next.

The role of theoretical content: practitioners in a few studies explicitly referred to the role of the programmes' theoretical component as a source of advancing practice (see Appendix 2.9). They believed that the specialist knowledge they received positively influenced their professional development, particularly where the theoretical aspect of education was not covered in undergraduate education (Chaboyer and Retsas, 1996, Wildman et al., 1999, Nicolson et al., 2005, Petty et al., 2011b), leading to a belief that incorporating, or lack of, propositional knowledge in M-level education can directly impact the overall advancement of graduate's skills.

Social participation and knowledge co-construction: across physiotherapy, nursing, general practice and public health programmes, social learning supported peer-peer communication and co-construction of knowledge and experiences (see Appendix 2.9), especially when done in small groups (Baron et al., 2006). The collaborative and problem-solving environments were valued by the graduates when compared to pre-master's rote-learning educational experiences (Whyte et al., 2000, Stathopoulos and Harrison, 2003). Social learning was thought to promote integrating the shared knowledge and experiences in clinical practice, and to adopt a biopsychosocial model of practice (Cragg and Andrusyszyn, 2004).

Environment for reflection: a few researchers found that reflection on experience helped the most in advancing clinical reasoning skills (Chaboyer and Retsas, 1996, Conneeley, 2005, Baron et al., 2006, Petty et al., 2011b), especially when graduates documented processes of reflection (Calvert and Britten, 1998). However, no study reported the processes of reflection experienced by graduates. In contrast, learning

transition occurred when educators facilitated students' critical reflection and provided feedback on performance (Petty et al., 2011b).

Learner-centred approach: graduates believed that adopting a learner-centred pedagogy contributed to positive programme outcomes (Whyte et al., 2000, Baron et al., 2006, Drennan, 2010). The learner-centred pedagogy included setting out learning and development needs (Baron et al., 2006); flexibility of the programme delivery (Whyte et al., 2000); analysing progress throughout the programme (Baron et al., 2006); and encouraging graduates to speak their minds during interactive discussions (Drennan, 2010).

Drawing on adult learning theory: A few studies indicated that programmes drew on principles of adult learning theory (Murray et al., 2001, Cragg and Andrusyszyn, 2004, Baron et al., 2006). Promoting self-directed learning was the most prominent feature, in terms of graduates assuming responsibility for personal and professional development needs (Stathopoulos and Harrison, 2003).

In summary, while researchers reported programme pedagogies in a few studies, there is a need to comprehensively discuss how such pedagogies influenced change.

2.3.8. Learning context

Practitioners'-related context: graduates' motivation for enrolling in M-level education was reported as a driver for learning engagement in multiple studies. Motivators included the perception of practice inadequacy, advancement of manual skills, keeping abreast of knowledge; attaining senior or specialist roles; improving salary scale; increasing clinical skills; improving patient care; having a critical attitude; enhancing research skills; and becoming an autonomous practitioner (Pelletier et al., 2005, Spencer, 2006, Green et al., 2008, Perry et al., 2011, Constantine and Carpenter, 2012). Moreover,

some graduates were motivated to engage in M-level education to be able to support junior colleagues and undergraduate students during their clinical placement (Spencer, 2006). This self-perceived image of their role drove them to change their attitudes and to become lifelong learners (Zahran, 2013).

During the programme, stress and anxiety, management of time and meeting the demands of assignments have all been described as barriers to successful engagement in M-level education (Conneeley, 2000, Perry et al., 2011, Petty et al., 2011b). Positive changes were less likely to occur when graduates avoided group discussions and collaborative peer learning (Petty et al., 2011b). Moreover, integrating knowledge and skill were contingent on the psychological preparedness for advanced level of practice (Nicolson et al., 2005).

University-related context: graduates' acceptance of scrutinising their practice was associated with a supportive learning environment that offered constructive feedback (Petty et al., 2011b). These learner-centred environments were augmented by having approachable educators who offered personalised feedback and support (Whyte et al., 2000, Drennan, 2010). However, the nature and frequency of feedback was not examined. Moreover, consistent with the principles of adult learning (Knowles et al., 2014), promoting authenticity and relevance to the learners' clinical environment was seen as important to achieving positive change (Bearn and Chadwick, 2010). However, there were limited details regarding what constitutes an authentic learning environment.

Work-related context: graduates of a few programmes suggested that workplace structure could limit the full integration of knowledge and skills (Stathopoulos and Harrison, 2003, Nicolson et al., 2005, Spencer, 2006, Green et al., 2008). Whilst some graduates moved towards senior positions or extended their scope of practice, others expressed a lack of enhancement because of pay and reward systems (Green et al., 2008). A few graduates described a lack of time, a large caseload, an uncooperative employer's

attitude, a lack of autonomous practice and a ‘poor vision’ of the NHS in accommodating their skills as barriers for continued learning (Nicolson et al., 2005, Green et al., 2008, Perry et al., 2011). Having less clear job descriptions or career prospects were also documented as barriers to integration, which brought graduates into conflict with managers and colleagues (Zahran, 2013).

In summary, multiple factors at the level of the individual learner, the programme of study and workplace environment were identified as potential facilitators or barriers of professional learning and achieving positive programme outcomes and impact. However, there is a need to explore how these factors interact to drive effective learning.

2.3.9. Modelling for learners’ transformation

The links between programme activities and outcomes were explored in three studies (Cragg and Andrusyszyn, 2004, Perry et al., 2011, Petty et al., 2011a). Perry’s et al.’s (2011) ‘knowledge acquisition’ model consisted of five phases that explain learners’ transformation from changing expectations and deconstructing knowledge, through reconstructing knowledge and ending up with actualisation of changes in practice sometime after graduation. While this model did not capture the context of this transformation, Petty’s et al.’s (2011a) ‘learning transition model’, identified the role of the learners’ biographies and expectations in mediating changes. On the other hand, Cragg and Andrassy’s (2004) evaluation of a nursing programme demonstrated an ‘evolutionary’ type of learner transformation in terms of adding new knowledge to what graduates already knew from their undergraduate programmes.

2.4. Discussion

In the previous section, multiple areas of programme outputs, areas and impact were drawn from low-medium quality studies. Programme pedagogy and key didactic feature

were drawn from eight low quality studies out of nine. Drennan (2010) was the only researcher to use a validated assessment tool to evaluate differences in critical thinking of two nurse cohorts. While six studies (Chaboyer and Retsas, 1996, Green et al., 2008, Le et al., 2007, Nicolson et al., 2005, Tsimtsiou et al., 2010, Wildman et al., 1999) used combined qualitative and quantitative methods of data collection, the value of this design was not clear, nor did it appear to impact the overall study conclusion. It was not clear if qualitative data were used to interpret quantitative surveys; or if qualitative data facilitated the design of postal questionnaire (Teddlie and Tashakkori, 2009). Analysis of programme documents was not attempted in any of the studies, hence losing a rich source of data related to programme structure and delivery (Creswell and Plano-Clark, 2011). Moreover, while qualitative-based research identified programme outcomes and impact inductively, some themes lacked theoretical saturation because of underreporting of causes, conditions, context, contingencies, consequences, and covariances (Glaser, 1978) that would modulate changes. Nonetheless, while most studies drew on graduates' accounts, five programme evaluations (Chaboyer and Retsas, 1996, Murray et al., 2001, Spence, 2004, Barnhill et al., 2012, Zahran, 2013) drew on stakeholder data i.e. educators, managers and colleagues, adding more credibility to findings.

The synthesis of the review findings into a completed programme theory Logic Model is illustrated in Figure 2.2. This synthesis of M-level programme theory across several healthcare professions offers a pathway that represents how programme philosophy, pedagogical activities and context led to its outputs, outcomes and impact. The inclusion of programme activities and context by some studies facilitated the collective synthesis of this model. However, because of the low to moderate quality of synthesised evidence, the model needs to be interpreted and used carefully and potentially needs further testing to seek its representation across various healthcare M-level programmes. Nonetheless,

the synthesised data can offer a comprehensive lens to evaluate M-level education. Yet, the isolation of the reported outcomes and impact to M-level education is difficult because of drawing on retrospective studies.

The synthesised evidence offers few details that link the outcomes and impact to programmes' pedagogies, learners' biographies and the wider context. A longitudinal study could have comprehensively captured programme's pedagogy and the learning context that drove changes (Hodkinson et al., 2008). For example, it could have facilitated capturing the frequency, type and duration of programme activities as well as making informed judgments about whether the evaluated programmes delivered learning activities as planned or not. Also, utilising longitudinal studies could have offered comprehensive understanding of learners' biography and learning dispositions (Hodkinson et al., 2008), particularly in terms of understanding about how learners' biography, pre-programme clinical experience, in-service training and peer learning might contribute to outcomes and impact (Huber, 2011). Moreover, it could have provided an account for how spatial (place-related) and temporal (time-related) dimensions of M-level education can influence learners' dispositions and identity development (Bloomer and Hodkinson, 2000, Hall, 2013).

There is an evidence, however, that learners' reactions to programme activities determined the extent of transformation. For example, whilst engagement in critical reflection drove transformative changes in practice (e.g. Spence, 2004b), such scrutiny to one's practice generated reactions that ranged from being defensive of their experience to being receptive to new knowledge. This gap between students' learning dispositions and the intended outcomes of M-level education can be a source of conflict that potentially interrupts the learning process. The evidence suggests that acceptance of such

scrutiny of one’s practice is associated with a supportive learner-centred environment that offers constructive feedback (Petty et al., 2011a).



Figure 2.2: M-level education Logic Model synthesised from systematic review of literature. Whilst it is presented from left to right, the pathway does not imply causality

Whilst the value of this learner-centred approach was not further examined in reviewed studies, flexible pedagogy was found elsewhere to promote learners’ autonomy (Nissilä, 2005, Harrison, 2012, Trede and Smith, 2012, Hughes et al., 2015) as learners engage in a transactional relationship with their peers and educators. Also, the safe learner-centred environments have the potential to alleviate learners’ anxieties that impact learning engagement (Glover et al., 2008, Fisher-Yoshida et al., 2009) and therefore, achieving successful learning outcomes.

Learners’ motivation was identified as ‘catalyst for personal growth’ (Whyte et al., 2000, p.1078). However, the review offers little evidence on how the extrinsic motivation at the learning site contributed to personal and professional development. Understanding those

motivators would better inform M-level educators in designing effective learning environments that can cultivate learning engagement and even augment motivation (Rao et al., 2014). For Ryan and Deci (2000), this involves understanding how the interaction between psychological and sociological aspects of motivation modify learners' actions.

In accordance with Hager and Hodkinson (2009), who emphasised the role of workplace structure in supporting practitioners' learning, the review identified that learners' motivation to maintain an advanced level of practice was dependent on workplace environment (Stathopoulos and Harrison, 2003, Nicolson et al., 2005, Green et al., 2008). Graduates from several programmes expressed a sense of frustration because M-level advanced skills were not welcome within the healthcare system (Stathopoulos and Harrison, 2003, Spencer, 2006, Green et al., 2008, Perry et al., 2011, Zahran, 2013). This potentially limits the full integration of knowledge and skills in practice and brings graduates into conflict with managers and colleagues.

For example, drawing on the experience of nursing, occupational therapy and physiotherapy clinical educators, Gerrish et al. (2000) likened graduates of nursing programmes to mavericks who did not fit comfortably into workplace cultures. They further suggested that learners' empowerment and awakening led to conflict with managers and colleagues (Gerrish et al., 2000). On the other hand, physiotherapist working in the NHS are encouraged to work towards M-level qualification (National Health Service, 2005). In the context of musculoskeletal physiotherapy, Haywood et al. (2013) identified the positive role that physiotherapy professional bodies and employers play in supporting practitioners' professional learning when compared with other healthcare practitioners who manage musculoskeletal conditions.

Finally, modelling learners' transition was described in three medium quality studies. Perry's et al.'s (2011) and Petty's et al.'s (2011a) models drew on the physiotherapy

population and are consistent with Mezirow's (1994) stages of adult learners' 'revolutionary' transition where learner's professional identity is transformed (Figure 2.3). In contrast, Cragg and Andrassy's (2004) model drew on the nursing population and indicated an 'evolutionary' nature of transition, where learners develop their existing professional identity. This potentially explains why graduates from several nursing programmes highlighted the positive impact of their programme's theoretical content (Chaboyer and Retsas, 1996, Nicolson et al., 2005). Therefore, it appears that learners' transition is discipline-specific and probably influenced by workplace context. This interpretation remains debatable in the absence of comprehensive examination of learners' biographies.

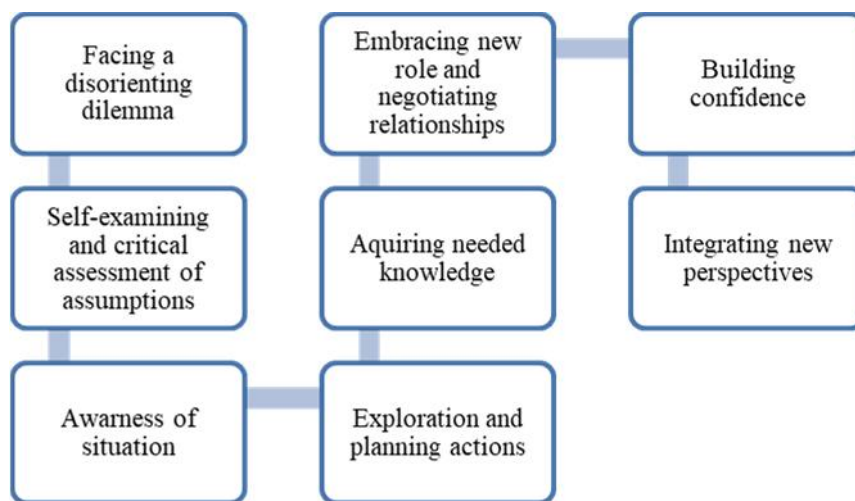


Figure 2.3: Stages of adult learners' transformation. Adapted from Mezirow (1994, p. 224)

2.5. Strengths of the review

This review fulfilled the methodological quality criteria of evaluating and conducting systematic reviews AMSTAR (Shea et al., 2007). In contrast to the retrieved systematic reviews, this review adopted a universally-accepted Logic Model terminology of 'output', 'outcome' and 'impact' consistently (Rotem et al., 2010). Whilst this might be critiqued as oversimplifying complex relationships, it offered a unified lens through which

inconsistent and interchangeable use of terminologies was avoided. The synthesised M-level programme Logic Model can be used as a theoretical framework to underpin further research. In particular, formulating questions that comprehensively capture the programme pedagogy and context.

2.6. Limitations of the review

The synthesised evidence is affected by the inclusion of low-medium quality studies. The objective of these studies varied, and at times were not aligned with the review main focus. Two articles could not be retrieved due to limited access. Studies that evaluated ‘residency’ and ‘fellowship programmes’ were not included. These programmes can be equivalent to M-level education, yet they are not based in higher education settings. One example is Rodeghero et al. (2015), who in a retrospective study of patients’ commercial outcomes database determined that practitioners who had participated in specialist musculoskeletal physiotherapy fellowship programmes have statistically better patient outcomes compared to those with residency or no postgraduate training.

2.7. Chapter Summary

This chapter reported the finding of a systematic review of studies that evaluated M-level education in healthcare professions. These findings are summarised in two points:

-) In the absence of high quality research, much is claimed about the outcomes and impact of M-level education. The synthesised evidence was derived from retrospective studies in which a single method of data collection was used, thus, the generalisability and transferability of findings is problematic.
-) Whilst some programmes drew on contemporary learning theories such as participatory learning, there was underreporting of the cultural dimension of learning. The link between programme pedagogy and reported outcomes and

impact was not clear. Researchers need to offer a comprehensive discussion of the programme pedagogy and context that influence change. A longitudinal empirical study that examines learners' dispositions prior, during and after engagement in M-level education may offer new insights.

The next chapter is a review of the clinical reasoning literature to contextualise the focus of this study. It examines key concepts and assessment methods pertained to our contemporary understanding of clinical reasoning, which is then used to guide data collection.

Chapter Three: Review of Clinical Reasoning Literature

In this chapter key literature linked to the contemporary understanding of clinical reasoning skills is reviewed to offer theoretical underpinning for this study. The chapter is comprised of: (1) a review of the importance of clinical reasoning skills in musculoskeletal physiotherapy; (2) a review of professional expertise in clinical reasoning skills; (3) a review of methods of assessing clinical reasoning skills; and (4) a review of types and sources of practice knowledge that underpin clinical reasoning. Thus, the aim of this chapter is to examine key concepts pertained to contemporary understanding of clinical reasoning skills to better inform data collection and analysis.

3.1. Clinical reasoning in musculoskeletal physiotherapy practice

For more than four decades, researchers within medicine attempted to understand the processes and actions that practitioners use to solve clinical problems (Elstein et al., 1990, Norman, 2005). The overall aim was to offer explanatory or predictive models (i.e. theories) that better inform how to teach and develop expert levels of clinical reasoning (Miller, 1990, Round, 1999). Being a core component of autonomous practice in medicine, researchers predominately examined processes of diagnostic reasoning (Bordage et al., 1990, Coderre et al., 2003, Goss et al., 2011), producing a theoretical understanding of diagnostic clinical reasoning from a behavioural (Rimoldi, 1988) and cognitive (Patel and Groen, 1986, Elstein et al., 1990, Schmidt et al., 1990) perspectives (see section 3.2). This research formed the bases for researching clinical reasoning in healthcare professions (Tanner et al., 1987, Rogers and Masagatani, 1982, Higgs, 1992, Hendriks et al., 2000).

In the context of physiotherapy, as a response to the advancement of the scope of practice and professional autonomy (Department of Health, 2000), early models of clinical reasoning in physiotherapy were equally influenced by the research in medicine. Much of this research drew on processes of diagnostic clinical reasoning used in medicine to foster the development of clinical reasoning skills of physiotherapy practitioners (Higgs, 1992, Hendriks et al., 2000). In so doing, the biomedical model of diagnostic reasoning, which focuses on establishing a pathoanatomic diagnosis of the cause of pain and disability was adopted (Jones et al., 2008). This form of reasoning is described as a practitioner-centred process underpinned by three main domains, namely, practitioner's knowledge, cognitive and metacognitive skills (Edwards et al., 2004, Higgs and Jones, 2008).

From a cognitive perspective, three processes of diagnostic reasoning within musculoskeletal physiotherapy have been identified in the literature. Firstly, pattern recognition, in which diagnostic decisions are reached by recognising specific features of a clinical presentation (Ericsson and Simon, 1998, Jensen et al., 2000). Secondly, hypothetico-deductive reasoning, which involves examining patient's data through the generation of hypotheses that would then be investigated further to either support or refute it (Doody and McAteer, 2002, May et al., 2008). Thirdly, intuitive reasoning, whereby practitioners rely on intuition to guide decision making (Petty et al., 2011b, Singla et al., 2015).

On the other hand, contemporary literature views clinical reasoning as a process bounded by the contexts of the practitioner, the patient and the wider environment, and involves negotiating the assumptions, values and beliefs of both the practitioner and the patient (Higgs and Jones, 2008, Chowdhury and Bjorbækmo, 2017). As an outcome of this conceptualisation, multiple forms of clinical reasoning are identified (Table 3.1), with

most being patient-centred processes, particularly when it pertains to the management aspects of a clinical encounter.

Table 3.1: Forms of clinical reasoning. Adapted from Higgs and Jones (2008, p. 8)

Form of reasoning	Description
Interactive reasoning	Reasoning of best methods of interaction and communication with patients and understanding their vantage points and actions.
Collaborative reasoning	Processes of shared decision-making and active seeking and utilisation of patients' vantage points about problem(s) and management.
Pragmatic reasoning	Reasoning processes that are influenced by practitioners' (e.g. motivation, skills, knowledge, and culture), political (e.g. clinical autonomy), economical (e.g. resources availability) contexts.
Ethical reasoning	Reasoning pertained to moral dilemma or conflict.
Conditional reasoning	Estimation of patients' response and likely outcomes of management based on analysing patients' presentation and social contexts.
Narrative reasoning	Understanding patients' illness experience by hearing their past and present illness stories.
Multidisciplinary reasoning	Working with other healthcare team members to make decisions about the patients' condition.

Diagnostic clinical reasoning remains, however, an integral part of advanced level musculoskeletal physiotherapy practice (Smart and Doody, 2006, 2007, Sweeney and Doody, 2010, Langridge et al., 2015, Dewitte et al., 2016) and the competency assessment of practitioners enrolled in M-level musculoskeletal physiotherapy education (Rushton and Lindsay, 2010, Yeung et al., 2015a, Rushton et al., 2016). For example, Smart and Doody (2007) determined that participants' clinical reasoning was oriented toward formulating biomedical, psychosocial and mechanism-based diagnoses of pain, as well as understanding the chronicity and severity of pain. This study drew on qualitative analysis of three videotaped patient–therapist clinical cases and semi-structured interviews with seven experienced M-level musculoskeletal physiotherapy practitioners. Drawing on the same participants, Smart and Doody (2006) noted that practitioners used

four diagnostic labels to explain the underlying pain neurophysiology: nociceptive, peripheral neurogenic, central and autonomic. Although no comparison to less qualified practitioners was made, these findings illustrate the important role of diagnostic clinical reasoning in guiding management decisions of M-level qualified practitioners.

Such an important role of diagnostic clinical reasoning was also explored by Dewitte et al. (2016) who identified, drawing on the outcomes of an international Delphi study of 21 expert musculoskeletal practitioners, the suggestive indicators of the articular, myofascial, neural, central and sensorimotor control clinical patterns of patients with non-specific neck pain. These suggestive indicators were believed to guide practitioners' assessments and diagnoses of this patient cohort. Moreover, after conducting an exploratory case study to understand the construct of M-level musculoskeletal physiotherapy clinical practice, Rushton and Lindsay (2010) emphasised the status of diagnostic reasoning within a programme's structure and curriculum (Box 3.1). Further, drawing on the outcomes of mixed-methods research that utilised questionnaires and interviews with 11 examiners, Yeung et al. (2015a) listed "generating plausible and reasonable hypotheses" as one of the four main assessment criteria of global clinical reasoning competencies to be used in assessing students in IFOMPT approved programmes (Box 3.2).

Box 3.1: Constructs of clinical reasoning advancement in M-level Musculoskeletal Physiotherapy. Adapted from Rushton and Lindsay (2010).

- **Diagnostic**
 - **Identifying cues**
 - **Pattern recognition**
 - **Hypothetico-deductive**
 - **Specificity**
- **Prioritisation**
- **Integrating different sources of evidence**
- **Creativity and lateral thinking**
- **Flexibility and multitasking**

Box 3.2: Assessment criteria for global clinical reasoning competencies. Adapted from Yeung et al. (2015a, p. 309).

- **Use different forms of knowledge to support hypotheses and management plan.**
- **Explain the significance and interaction of the subjective and physical examination data collected.**
- **Generate plausible and reasonable hypotheses.**
- **Critically evaluate sources of information and the claims they make.**

In summary, this body of evidence is suggestive of the importance of diagnostic clinical reasoning for an advanced level of musculoskeletal physiotherapy practice. As M-level education is a main pathway to developing professional expertise (Shaw and DeForge, 2012, Petty, 2015), the conceptualisation of expertise in clinical reasoning within healthcare literature is examined in the next section, with a particular focus on expertise in clinical reasoning.

3.2. Understanding expertise in clinical reasoning

The focus of research into the development of expertise in physiotherapy has been on establishing the characteristics of clinical experts in an attempt to guide novice practitioners to better utilise their time and available resources (Jensen et al., 2000, Lindquist et al., 2006, Christensen et al., 2008, Petty, 2015). Accumulating evidence (Eraut 1994, Fish and Coles, 1998, Jensen et al., 2000, Titchen, 2001, Haynes et al., 2002, Rushton and Lindsay, 2010, Petty, 2015) suggests that clinical expertise is developed through:

- 1) Clinical experience of high quality to build up knowledge and skills;
- 2) Postgraduate education that promotes the critical exploration of practice knowledge;

- 3) Observing and being observed by a clinical mentor, with timely and specific feedback about development needs.

While this body of evidence does not detail the journey through which practitioners advance their expertise, Benner's (1982) seminal model of developing clinical expertise in nursing is, according to Google Scholar analytics, a highly cited model in which different levels of expertise in healthcare literature are examined. Benner (1982) proposed that the practitioner progresses through five stages of practice, namely novice, advanced beginner, competent, proficient and expert levels (Figure 3.1). Similarly, Richardson (1999) used the term 'patient mileage' to conceptualise the number of patients that a physiotherapy practitioner needs to see to gain expertise. Such a notion of advancing expertise through experience is not supported in the literature (Titchen, 2001).

These models overlook the role of postgraduate education and critical reflection on experience as important factors in developing expertise. Petty and Morley (2009) argue that developing expertise can be difficult unless practitioners change their frame of reference e.g. routinely-performed patient assessments and management. The development of cognitive skills, as an important dimension of clinical reasoning, is not possible if practitioners do not become critical and evaluative of their routinely-performed patient assessments and management (Lake and McInnes, 2012). According to Petty (2015), this does not happen unless practitioners socialise in their workplace and expose their practice to their colleagues, which therefore ensures a high quality clinical experience.

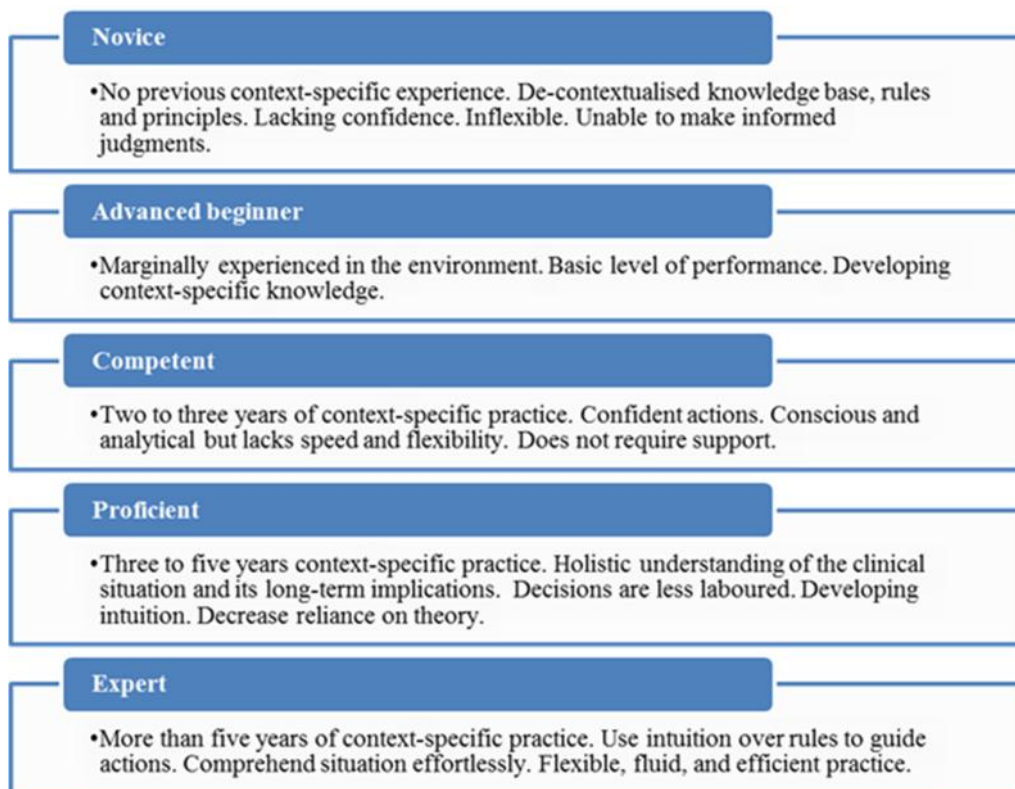


Figure 3.1. Characteristics of skills development in nursing. Adapted from Benner (1982)

In the context of understanding the development of expertise in clinical reasoning skills, early research in the medical field indicates that expert practitioners tend to ask a few properly-timed questions and make diagnostic decisions in less time than less experienced practitioners and students (Rimoldi, 1988). However, this research was conducted using quantitative data collection methods which limited comprehensive understanding of the context of clinical reasoning. This research was also located within behavioural psychology literature; thus, it did not offer an account of the cognitive processes that drive clinical reasoning, such as hypotheses generation and testing.

On the other hand, cognitive-grounded clinical reasoning empirical studies examined how practitioners organised knowledge (Schmidt et al., 1990), processed information and clinical cues (Tanner et al., 1987), and solved clinical problems (Elstein et al., 1990). Utilising this cognitive approach, multiple researchers examined the differences between

novice and expert practitioners (Patel and Groen, 1986, Ericsson and Simon, 1998, Norman and Schmidt, 2000). While this research immensely facilitated understanding the cognitive dimension of clinical reasoning, the use of research tools such as ‘think-aloud’ to understand cognitive activities might not reflect an authentic form of clinical practice. The differences between novices’ and experts’ clinical reasoning were examined with the emergence of qualitative, exploratory and ethnographic research (Laufer and Glick, 1996). The characteristics of clinical expertise in clinical reasoning were identified as: high level of cues identification, prioritising assessment, advanced level of knowledge, flexibility in thinking, knowledge synthesis and integration, and specific identification of patients’ problems (Bordage et al., 1990, Boshuizen et al., 1995, Norman, 2005). Similar empirical evidence was identified within musculoskeletal physiotherapy practice (Doody and McAteer, 2002, Black et al., 2010, Ajjawi and Higgs, 2012, Petty et al., 2011a, Constantine and Carpenter, 2012).

These studies viewed expertise as an individual cognitive attribute with little regards to the context in which clinical reasoning occurs. In particular, how the interaction with others changes processes of clinical reasoning. Evidence from occupational therapy literature suggests that the development of expertise requires positive attitudes towards the collective processes of clinical reasoning more than having specialist knowledge (Whitcombe, 2013). Similarly, Gabbay and LeMay (2011) used the concept of ‘clinical mindlines’ to suggest that expert practitioners rarely access or use research-based evidence directly. Instead, they identified that practitioners rely on collectively reinforced, internalised and tacit guidelines they named ‘mindlines’. These mindlines are socially constructed knowledge from a blend of several sources, including education, peers and tacit experience, among many others. Therefore, an advanced expert level of practice is dependent on knowledge that is contextually bounded in practice. This is in

accord with Norman et al. (2007), who note that the ability to identify clinical reasoning errors was impacted by practitioners' biographies and personally constructed illness scripts more than their de-contextualised knowledge. Thus, clinical-based pedagogy that engages practitioners in collaborative activities has the potential to facilitate mastery in clinical reasoning skills.

3.3. Assessing the advancement of clinical reasoning in educational settings

Assessing the advancement of clinical reasoning skills traditionally involved observing students' real-life actions and performance using real patient cases (Miller et al., 2001). However, such behaviour-oriented assessments did not expose the students' knowledge structure, cognitive and metacognitive processes. In response, several tools were constructed to assess practitioners' knowledge structure, e.g. the Script Concordance Test (Charlin et al., 1998); cognitive skills e.g. Diagnostic Thinking Inventory (Bordage et al., 1990); and metacognitive skills e.g. Critical Thinking Scale (Kennison, 2006). A selection of these tools is examined in Table 3.2 below. The utility of these assessment tools is debated in the literature, with evidence suggesting that no single tool is sufficient to measure the advancement of reasoning in all domains (Ilgen et al., 2012, Groves et al., 2013). For instance, the Script Concordance Test (SCT) has a poor correlation with the Objective Structured Clinical Examination (Lubarsky et al., 2011) and Clinical Reasoning Problem test (Groves et al., 2013), suggesting that each tool truly assesses different domains of clinical reasoning skills. Therefore, using more than one assessment tool would comprehensively capture changes in various domains of clinical reasoning.

Based on the data reported in Table 3.2, further evaluation of Script Concordance Test and Diagnostic Thinking Inventory is offered next because of their ability to 1) measure the advancement in of clinical reasoning skill in comparison to the experts in the field, 2) the premise of the Script Concordance Test allows comprehensive capturing of

advancement in relation to multiple clinical presentations in one exam. , and 3) the combined use of both tools would capture the advancement in the three main domains of clinical reasoning: knowledge, cognition and metacognition.

Table 3.2: Tools and Methods to measure advancement in clinical reasoning skills.

Tool	Description	Advantage	Disadvantage
Key Feature Problems (Page et al., 1995)	Assessing the number and quality of hypotheses generated in response to a written clinical scenario	Generating and evaluating multiple hypothesis	The ability to generate correct and incorrect hypotheses is not a distinctive feature of level of expertise.
Clinical Reasoning Problems (Groves et al., 2002)	Presenting a complete clinical scenario and asking test-taker to identify the two most likely diagnoses and to list the clinical features that aided formulating diagnoses	Scored against expert responses. Assesses the ability to generate and justify hypothesis	The test structure requires only two potential diagnoses per clinical presentation. Ignores diagnostic accuracy. Requires 90-120 minutes to complete
Script concordance test (Charlin et al., 1998)	Weighing the diagnostic significance of a piece of clinical information	Measuring multiple clinical presentations in short time; Responses scored against responses of panel of experts; No absolute correct response Reflect authentic ill-defined experts' clinical environment.	Require vigilant selection of a panel of expert; 10-15 experts for high stake examination. Measure only the data interpretation domain of reasoning. Does not allow hypothesis generation.
Critical Thinking Scale (Kennison, 2006)	Evaluation of reflective writing and evidence of critical thinking.	Assesses metacognitive dimension of clinical reasoning	Does not discriminate level of expertise. Examiners-led
Diagnostic Thinking Inventory (Bordage et al., 1990)	Assess students' ability to recognise and interpret clinical cues, and the flexibility of moving between different working hypotheses	Assesses multiple domains of knowledge and cognitive capacity. Highly reliable and valid in discriminating levels of expertise.	Self-reported questionnaires
Case History Assessment Tool (CHAT) (Yeung et al., 2015b)	Assessment tool based on specific musculoskeletal physiotherapy clinical reasoning framework	Directly relevant to M-level musculoskeletal physiotherapy scope of practice	Assessing performance based on one clinical case

Script Concordance Test: The SCT assesses **knowledge structure** and practitioners' ability to reason in ill-defined clinical scenarios (Charlin et al., 1998). It is based on an established theory of knowledge organisation into clinical scripts, defined as structured contextualised clinical knowledge related to various clinical presentations (Charlin et al., 2002, Lubarsky et al., 2013). The test itself simulates the data interpretation phase of hypothetico-deductive reasoning, whereby practitioners weigh the significance of a piece of clinical information (Edwards et al., 2004).

Each SCT case item introduces a brief clinical scenario followed by 3-5 hypotheses³, (Figure 3.2). For each hypothesis, an additional statement is introduced asking the respondents to rate how this statement would change their judgment on a five-point Likert scale: +2, hypothesis much more likely or certain; +1, hypothesis more likely; 0, has no effect on the initial hypothesis; -1, makes the initial hypothesis less likely; -2, makes the initial hypothesis much less likely or ruled out. The answers are then matched with the answers of a panel of experts. This scoring method reflects the differences in processing clinical information in which no absolute interpretation of a clinical scenario is present. Because it offers small-scale clinical data, SCT is argued to be suitable for clinical reasoning in ill-defined situations and thus assessing how practitioners intuitively analyse clinical data (Esteves et al., 2013). This echoes with the UK Quality Assurance Agency for Higher Education which suggests that M-level education should enable practitioners to:

Deal with complex issues both systematically and creatively, make sound judgements in the absence of complete data, and communicate their conclusions clearly to specialist and non-specialist audiences; Demonstrate self-direction and originality in tackling and solving problems (2008, p. 21).

³ SCT options could include clinical reasoning around examination procedures or treatment options.

25-year-old football player presented to you complaining of chronic antromedial ankle pain that started soon after an arthroscopic removal of medial meniscus 6 months ago.						
If you were thinking of:	And then you find:	This hypothesis become:				
		-2	-1	0	+1	+2
1. Complex regional pain syndrome	The ankle is slightly sensitive to touching					
2. Stress fracture of the calcaneus	Pain upon squeezing calcaneus firmly					
3. Autonomic driven pain	Evidence of poor circulation and skin discolouration					

Figure 3.2: An example of a SCT item

The SCT scores were found to be reliable (Cronbach range, 0.75–0.85), and valid indicator of different levels of expertise in medicine, with scores shown to increase as an outcome of participation in professional development activities (Meterissian et al., 2007, Lubarsky et al, 2011). The SCT has been used to assess the advancement in clinical reasoning in various professions, including: medicine (Lambert et al., 2009, Lubarsky et al., 2009, Humbert et al., 2011, Kania et al., 2011, Humbert and Miech, 2014), pharmacy (Boulouffe et al., 2010), osteopathy (Esteves et al., 2013) and nursing (Dawson et al., 2014). Most of this evidence is derived from cross-sectional study designs, with only Humbert and Miech (2014) who measured the advancement of clinical reasoning in a longitudinal study.

In the context of physiotherapy practice, a single SCT item might not reflect the breadth of individual clinical encounters. Also, it is rare that a single clinical cue determines the practitioners' decision-making. Nonetheless, one clinical feature can strongly influence a practitioner's reasoning of the working hypothesis (Fournier et al., 2008), especially in conditions of uncertainty (Singla et al., 2015, Langridge et al., 2015). Also, the premise of comparing respondents' scores with those of an expert is of particular relevance when the aim is to measure advancement towards expertise; that is, when the desired aim of using the test is to determine whether the respondents and the panel of experts share similar interpretations of the same clinical scenario, which signals an advancement of

clinical reasoning skills. Thus, it would be useful to use SCT to capture the advancement of knowledge structure and, in particular, the development of illness scripts in relation to prolonged engagement in professional learning.

Diagnostic Thinking Inventory: The DTI consists of 41 items that assess evidence of **knowledge structure** and **flexibility in thinking** (Figure 3.3). While evidence of knowledge structure refers to the availability of knowledge during the clinical encounter, evidence of flexibility in thinking captures the use of a variety of thinking means or processes (Bordage et al., 1990, p. 415). Contrary to novice practitioners who tend to focus on one interpretation of clinical data at each point of a clinical encounter, the evidence suggests that flexibility in the working memory characterises expert-level practice (Doody and McAteer, 2002). Because of its ability to discriminate between different levels of expertise, DTI has been used extensively in medicine to assess the advancement of clinical reasoning skills after participating in professional development activities (Round, 1999, Groves et al., 2002, Groves, 2005, Beullens et al., 2006, Rochmawati and Wiechula, 2010, Goss et al., 2011, Gehlhar et al., 2014).

A. During the course of the interview, I find that,		
Some key pieces of information seem to leap out at me	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	It is often difficult to know which items of information to latch on to
B. When I cannot make sense of the patients symptoms,		
I move on and gather new information to trigger new ideas	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	I ask the patient to define those symptoms more clearly

Figure 3.3: Examples of diagnostic thinking inventory A: Structure in memory item B: Flexibility in thinking item. Source: Bordage et al. (1990)

In the context of physiotherapy, knowledge structure and flexibility in thinking are considered valid indicators of advanced clinical reasoning within general physiotherapy (Jones, 1997) and advanced musculoskeletal physiotherapy practice (Hamzeh et al.,

2016). Whilst Jones (1997) established DTI reliability and validity within the general outpatient physiotherapist population using a 40-item version⁴, the psychometric properties of the original inventory with all 41 items was validated within musculoskeletal physiotherapy practice by Hamzeh et al. (2016) to account for the developed scope of practice. The poster of this validity and reliability study, presented at the 4th European Congress of the ER-WCPT, is included in Appendix 3.1.

In this study, a panel of 14 musculoskeletal physiotherapy experts (all MACP members, 20 years average experience, working in hospitals (n=7), private practice (n=3), NHS outpatients (n=2) and higher education and research (n=2) confirmed the DTI face and content validity in measuring the two domains of clinical reasoning (Table 3.3). The Mann-Whitney U test showed higher and statistically significant construct validity by comparing experts' scores with those of a group of undergraduate qualified practitioners. Using the intra-class correlation coefficient (ICC), Test-retest reliability was excellent, with a 95% confidence interval (p<0.05). Internal consistency as measured by Cronbach's alpha was good at 0.831, 0.739 and 0.699 for the complete version, structure in memory and thinking flexibility respectively. This makes DTI suitable to capture the advancement of clinical reasoning skills as an outcome of participation in an educational intervention.

Table 3.3: Psychometric properties of DTI in specialist musculoskeletal physiotherapy cohort. Adapted from Hamzeh et al. (2016).

Psychometric property	Test	Structure in memory	Flexibility in thinking	Complete DTI version
Construct validity	Mann-Whitney U test	32.0 (p<.001)	43.5 (p<.003)	36.5 (p<.001)
Test-retest reliability	intra-class correlation coefficient (ICC), with a 95% confidence interval	0.833	0.814	0.884
Internal consistency	Cronbach's alpha ()	0.739	0.699	0.831

⁴ One item, ordering laboratory tests, was eliminated because of being beyond the scope of physiotherapy practice at the time of study (in 1992)

To conclude, using measurement tools is arguably valuable in assessing an educational outcome such as the advancement of clinical reasoning skills and determining the extent of learning (Cohen et al., 2007, Thomas, 2016) and, therefore, maximises the credibility of research outcomes (Gillham, 2010). Whilst multiple tools are available to assess clinical reasoning, the use of the DTI together with the SCT can offer a better insight into the advancement of clinical reasoning skills and students' readiness for autonomous M-level clinical practice. Both tools are valid to discriminate levels of expertise. Used together, SCT and DTI can capture the knowledge, cognitive and metacognitive domains of clinical reasoning. In the next section the different types of practice knowledge that underpin practitioners' clinical reasoning skills are examined.

3.4. Types and sources of practice knowledge

In the previous section an advanced level of knowledge was identified as an important domain of clinical reasoning skills (Rushton and Lindsay, 2010, Petty, 2015). This section examines the types and sources of knowledge that practitioners use to underpin processes of clinical reasoning.

Types of practice knowledge: Kieseewetter et al. (2016) identified four types of knowledge necessary for clinical reasoning, namely: (1) Conceptual, related to basic discipline knowledge; (2) Strategic, related to knowledge execution; (3) Conditional, related to identifying context and interrelationships; and (4) Metacognitive, related to awareness and knowledge of cognitive tasks. While this classification of types of knowledge reflect the cognitive domain of clinical reasoning, it offers little insight into the impact of the context on clinical reasoning. In such a context, Higgs et al. (2004a) suggested that four types of knowledge should inform practitioners' clinical reasoning: (1) propositional knowledge, (2) procedural knowledge, (3) theoretical knowledge, and (4) emancipatory knowledge. Higgs and colleagues' classification of knowledge types is

examined next because of its inclusiveness of research-based and practice-based knowledge that inform practitioners' clinical reasoning. Moreover, this classification recognises how the context of patient-centred care underpins practitioner's knowledge. Thus, it has relevance to advanced levels of practice (Haynes et al., 2002, Petty, 2015).

Firstly, **propositional knowledge** is considered the basic abstract knowledge that informs practice. It consists of the codified knowledge of textbooks and guidelines used to describe and predict actions (Eraut, 2004). This type of knowledge is considered formal since it is generated through academic scholarship and research activities within university or research settings (Higgs et al., 2004a). Therefore, it is assumed that when practitioners are exposed to and assimilate more propositional knowledge, their clinical reasoning skills will be improved. However, this understanding of practitioners' learning as transferring knowledge from one setting to another does not solely explain the advancement of clinical reasoning skills.

Secondly, **procedural knowledge** consists of professional craft and experimental knowledge that define the artistic practices of a profession (Higgs et al., 2004a). It is gained through personal experience of authentic situations in which close connections to people and places exist (Reason and Heron, 1986). Because it is constructed through practice, Polanyi (1966: 2009) suggested that procedural knowledge was difficult to articulate and communicate. Nonetheless, Schön (1987) noted that engagement in reflective practice enabled practitioners to communicate this form of knowledge. Such abilities lay in an easy-to-difficult continuum (Lam, 2000, Koskinen et al., 2003), with Billett and Choy (2013) suggesting that practitioners with various levels of expertise are able to articulate and communicate procedural knowledge through work-based learning.

Thirdly, Higgs et al. (2004a) used the term **theoretical knowledge** to refer to knowledge used to explain and interpret practices. That is, how practitioners utilise research-based

evidence to understand practice and make informed decisions according to the availability of resources and patients' preferences. Fish and Coles (1998) noted that while theoretical knowledge drives practice, it is implicit and arguably hidden in the forms of beliefs, values, assumptions and motivations that drive actions. Nonetheless, Sim and Richardson (2004) noted that clinical reasoning models that rely on theoretical knowledge in processing clinical data could be flawed because they do not consider either the intuitive or collaborative domains of clinical reasoning.

Finally, **emancipatory knowledge** is generated through critical debates. It is rooted in the critical paradigm that challenges socially-constructed thinking (Higgs et al., 2004a). Such emancipatory knowledge empowers practitioners and transforms them by facilitating critical reflection on their frames of reference (Petty et al., 2011a). This is where practitioners' sets of concepts, values, assumptions and the views that underpin their thoughts and actions are challenged. The development of practitioners' emancipatory knowledge requires ongoing engagement in questioning previous types of knowledge, which requires awareness and critique of self, as well as social and cultural contexts (Cranton, 2016). In so doing, practitioners start to consider alternative or expanded frames of reference that underpin practice (Shaw and DeForge, 2012).

Sources of practice knowledge: This review of practice knowledge indicates that clinical practice is underpinned by two main sources of knowledge: **research-based** and **practice-based** knowledge. Whilst research-based knowledge is derived from sound empirical research that can be generalised to normal patterns of practice, practice-based knowledge is an experiential knowledge derived from critical reflection on practice or through peer interaction (Sim and Richardson, 2004, p.130). Moreover, while research-based knowledge can be taught and assessed, practice-based knowledge is implicit and learned through practice (Petty, 2015).

There is a debate in the literature, however, regarding practitioners' ability to translate research-based knowledge into clinical practice. While Closs and Lewin (1998) noted that little evidence existed regarding how research-based knowledge is being translated into practice, contemporary evidence suggests that context-dependant social learning facilitates the translation of research-based knowledge (Salter and Kothari, 2016), especially in clinical environments that promote creative and intuitive patient's management (Spence, 2004a, Thomson et al., 2014b, Grace et al., 2016). Mantzoukas (2008) demonstrated that when practitioners rely solely on research-based knowledge to contextualise clinical practice, they are less likely to recognise the complexity and uncertainty associated with clinical practice environments, which can significantly compromise processes of clinical reasoning skills (Higgs et al., 2004b). Therefore, developing professional expertise in programmes such as M-level education needs an equal attention to practice-based knowledge (Fish and Coles, 1998, Petty, 2015).

In spite of this evidence, some authors within musculoskeletal physiotherapy practice depict meta-analysis of systematic reviews of literature at the top of the hierarchy of evidence that informs clinical reasoning (Kent and Hartvigsen, 2015). In their chapter in *Grieve's Modern Musculoskeletal Physiotherapy*⁵ which examined models of clinical reasoning, Kent and Hartvigsen, (2015) favoured knowledge sourced from clinical guidelines and meta-analysis of systematic reviews over practice context-specific knowledge. While acknowledging the importance of research-based evidence in informing clinical reasoning, their position is a narrow-minded understanding of clinical practice because it lacks relevance to patient-centred care (Downing and Hunter, 2003, Haskins et al., 2014). Moreover, their position does not sit comfortably with the principle

⁵ Grieve's Modern Musculoskeletal Physiotherapy is a highly acclaimed textbook and internationally popular amongst musculoskeletal physiotherapists.

of clinical autonomy, i.e. practitioners' agency⁶ and the creative behaviours associated with expert-level practice (Haskins et al., 2014, Thomson et al., 2014b, Grace et al., 2016). Therefore, when evaluating the advancement of clinical reasoning skills through an educational intervention, one needs to 1) consider which types of knowledge were developed and 2) how the educational intervention contributed to advancement.

The abovementioned evidence suggest that expert-level clinical practice is a combination of several types of knowledge. It appears that variabilities of practice settings necessitate contextualising research-based knowledge. Practitioners might consider moving between alternative epistemologies to better inform their practice. That is, drawing on practice-based evidence as well as research-based evidence. In doing so, practice is validated through evidence and remains context-specific in terms of recognising patients' needs.

3.5. Chapter summary

In this chapter the literature that pertains to processes, models and the assessment of clinical reasoning skills were reviewed with a view to contextualising programme impact. The importance of diagnostic clinical reasoning within musculoskeletal physiotherapy practice was highlighted, as well as the need to draw on multiple assessment tools to comprehensively capture the advancement of clinical reasoning. Clinical reasoning is a context-dependant process underpinned by multiple sources of practice knowledge. Learning theories are examined in the next chapter to offer further theoretical understanding of practice knowledge.

⁶ In social theory, agency refers to the independent operation of individuals away from the constraints of social structure. It involves autonomous practice and social action (Biesta and Tedder, 2007).

Chapter Four: Review of Learning Theories

In the previous chapter, sources and types of knowledge that underpin clinical reasoning skills were examined. This chapter offers a theoretical understanding of practice knowledge in the context of contemporary theories of learning. In particular, an in-depth examination of learning theories associated with adults' professional learning is provided.

Multiple conceptualisations of learning theories exist to account for practitioners' learning. According to Ormrod (2012), the three traditional learner-experience oriented views of learning are 1) behavioural, 2) cognitive and 3) constructivist. On the other hand, in the more contemporary theories, learning is viewed as: 1) situated (Lave and Wenger, 1991); 2) social (John-Steiner and Mahn, 1996); 3) socio-material (Zukas and Kilminster, 2014); and 4) cultural (Hodkinson et al., 2008). These conceptualisations of learning are an outcome of researchers' assumptions and positions regarding the individual learner, the social environment and the interaction between the two. That is, the researchers' position regarding mind versus body or individual versus structure (Hodkinson et al., 2008). To conceptualise this relationship, Sfard (1998) used the acquisition and participation metaphors; Adams (2006) used the metaphor of learning as construction; and Colley et al. (2003) used the metaphor of learning as becoming.

According to Lakoff and Johnson (2003), metaphors can create a social reality that probably drives actions to fulfil the dimensions of the metaphor. For example, as the acquisition metaphor, which is examined next, assumes a transfer of knowledge from educators to learners, pedagogies based on it supports an educator-led learning environment (Sfard, 1998). Thus the use of metaphor to understand learning can be misleading if a researcher seeks an in-depth resemblance or a factual representation.

However, employing metaphors is essential and inescapable when thinking about professional learning as they provide novel insights about otherwise complex processes of interaction (Hager, 2008). That is, metaphors make aspects of the learning experience and processes of interaction more coherent and explicit. Therefore, in order to understand these processes of interaction between the individual learner and the social environment, it is reasonable to examine these learning metaphors in-depth.

4.1. Learning as acquisition

In this view of learning, the superiority of the mind over body is emphasised, due to the underlying assumption that learning is a steady increase in the contents of the mind (Hager, 2005). The argument is made for an independent relationship between the individual learner and the social environment (Hodkinson, 2005, Osberg, 2009). Educators are seen as a source of professional knowledge that learners need to acquire (Sfard, 1998). Thus, the assumption is that knowledge is an external object that can be ‘transferred’ from educators to practitioners, who then ‘transfer’ it unaltered into their practice. Accordingly, learning strategies focus on pedagogies that facilitate receiving, organising, memorising and retrieving knowledge (Ertmer and Newby, 2013). In other words, the emphasis is on what educators’ knowledge a learner is able to retrieve. However, the assumption that there is no relationship between what is learned and the context of learning clearly overlooks the socially-constructed knowledge.

Hager and Hodkinson (2009) suggest that the acquisition metaphor overlooks context-bounded learning, whereby practitioners frequently engage in social practices as part of a larger community of practice⁷. Therefore, this view overlooks the fact that learning is also contextual (Billett, 1994), and that knowledge is generated by practice (Mulcahy,

⁷ Or communities of practice, a term used to conceptualise “groups of people who share a concern, a set of problems or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis” (Wenger et al., 2002, p.4).

2012). Thus, practitioners' tacit knowledge and experience (i.e. practice-based knowledge) would not be part of the learning process, particularly in situations such as clinical reasoning and problem solving, where such knowledge underpins higher order thinking skills.

4.2. Learning as participation

In the participation metaphor, individuals learn through participation in “contextual and culturally-grounded activities” (Hager and Hodkinson, 2009, p. 626). There are multiple versions of this social dimension of learning (Reich and Hager, 2014). For example, in situated learning theory knowing is grounded in practice (Lave and Wenger, 1991), meaning that it is rooted in the active interaction of learners in a particular context (Sfard, 1998). As an outcome of participation in a learning community, Lave and Wenger (1991) noted that practitioners' level of acceptance changes, which they referred to as “legitimate peripheral participation”, which represents a movement from the periphery into full participation and experience of the community's practices. Learning is therefore an outcome of increasing social interaction between a novice and more experienced actors (Billett, 1994).

Therefore, in the participation metaphor little regard is paid to the movement of knowledge. Instead, the attainment of levels of skill accepted by a professional community is an indicator of learning. What is learned is more complex than a simple acquisition of propositional knowledge. As such, knowledge is a collective property of a community of practitioners and exists before the practitioner's engagement (Hager, 2005). Thus, in attempting to understand the learning process, one needs to consider the learning context (i.e. time and space), the mediators of learning, power relationships and context-dependant progressive development (Gherardi, 2010).

Within the physiotherapy context, communities of practice and legitimate peripheral participation theories, as situated learning theories, offered a framework for analysing physiotherapy graduates' development in the workplace environment (Black et al., 2010, Hayward et al., 2013). However, the evidence suggests that these learning theories work better within structured and stable learning communities (Eraut, 2004). Moreover, suggested that situated approaches to learning tend to marginalise learners and overlook their agency (Hodkinson et al., 2008). In other words, limiting learning to a particular context does not account for the development of practitioners' personal and professional identities or the interaction between the learners' agency and the structure of the community in which they participate. Therefore, learning as participation incorrectly implies that when learners change a learning context, they will be considered novices or beginners all over again, which contradicts the fact that university-trained practitioners who join a new workplace need to demonstrate full responsibility and accountability from the first day of work. Thus, Hager and Hodkinson (2009) argued that the background knowledge and skills of 'new-coming' practitioners are influential in shaping new learning situations. This echoes the arguments that learning is about practitioners' ability to function across multiple contexts (Elkjaer, 2004), as well as being practical and closely attached to the development of professional identity (Hammond et al., 2016).

Moreover, the notion of learning as participation is premised on the assumption of the presence of stable and organised communities of practice (Lave and Wenger, 1991). In other words, this metaphor overlooks the dynamic nature of the module-based university structure, in which students of various backgrounds engage in multiple modules. It also overlooks the competition, conflicts and divergence that is sometimes associated with clinical practice (Zukas and Kilminster, 2014).

These limitations to the participation metaphor are outcomes of a research focus on the activities of a bounded learning site (Hager and Hodkinson, 2009, Nicolini, 2011), which according to Hodkinson et al. (2004) is deceptive as it reduces professional learning to situated practices, whereas practitioners learn across various resources that are not context-specific. This highlights the need to understand professional learning when the practitioners change their contexts of learning, or when working in a dynamic environment.

4.3. Learning as construction

In the construction metaphor, learning is viewed as an ongoing process of building on existing knowledge and understanding (Adams, 2006). This view is rooted in the constructivist philosophy, according to which knowledge is nothing but an individual's construction of understanding (McRobbie and Tobin, 1997), through which learners find meanings and make sense of their subjective experiences (Ormrod, 2012). Thus, knowledge has no substantiated or real existence; and each learner constructs his or her own knowledge in light of prior experiences.

This metaphor serves as an umbrella for multiple versions of constructivist learning, with the most common ones being cognitive constructivism and social constructivism (Adams, 2006). While the focus of cognitive constructivism is on how an individual learner mentally represents his or her world (Ormrod, 2012), social constructivism involves the mediated and collaborative engagement of a group of learners' in a process of sense-making of their world (Adams, 2006, Hodkinson et al., 2007a). The premise of social constructivism suggests that when a group of learners solve problems together, they are collectively creating new knowledge that represents their socially-accepted and shared interpretations (Adams, 2006). Both versions of constructivist learning are important in understanding whether advancing expertise in clinical reasoning skills is a process of

building an illness script, i.e. a product of the mind, or whether it is a contextually situated and shared experience, as examined in Gabbay and LeMay's (2011) concept of 'clinical mindlines'.

In contrast to the acquisition metaphor, in which educators are viewed as the owners of a knowledge that can be transferred to students (Adams, 2006), in the construction metaphor, educators are viewed as facilitators of students' learning and understanding. Thus, constructivist pedagogies acknowledge that the individual learner has different ways of interpreting and organising knowledge. The principles that distinguish social constructivist learning environments are depicted in Box 4.1.

**Box 4.1: Principles that distinguish social constructivist learning environments.
Adapted from Adams (2006, p. 247)**

-) Focus on learning not performance.**
-) View learners as active co-constructors of meaning and knowledge.**
-) Educator–learner relationship is built upon the idea of guidance not instruction.**
-) Engage learners in tasks seen as ends in themselves.**
-) Assessments are active process of uncovering and acknowledging shared understanding.**

On the other hand, learning as construction shares similar features with the participation metaphor, in terms of both viewing learning as the transformation of the learner, and in offering little insight into how the individual learner influences the context of learning. Therefore, it overlooks the transactional relationship of the learning encounter (Elkjaer, 2004) and how other contexts (physical and social) can impact a students' construction and expected transformation (Hager and Hodkinson, 2009). In response, some researchers have advocated "learning as becoming", a metaphor that combines several aspects of previous metaphors, yet overcomes their limitations by offering a comprehensive account of professional learning (Colley et al., 2003, Hager and Hodkinson, 2009).

4.4. Learning as becoming

Several empirical studies have noted the difficulties associated with acquisition and participation metaphors in offering a comprehensive account of professional learning (Billett, 2003, Colley et al., 2003, Hodkinson et al., 2007b, Reich and Hager, 2014). Hodkinson et al. (2008) attributed this to the lens through which a researcher examines learning. In so doing, they suggest that researchers need to use a map-scaling system when examining the learning culture where:

The largest scale might focus on the learning of one individual. The next scale down might focus on the site where the person learns – which might be a community of practice in Wenger’s (1998) sense, but might not be. Decrease the scale again, and perhaps the whole organisation or activity system is the focus. Decrease it further, and we can look at learning in relation to wider social or economic structures and power-relations, including globalisation (pp. 32-33).

As a hybrid conceptualisation of previous metaphors, learning in the becoming metaphor is viewed as a product and a process of participation (Hodkinson et al., 2008). In particular, drawing on Dewey’s concept of embodied construction, learning is a transaction between the learner and his or her environments (Hager, 2005). Hodkinson et al. (2008) noted that:

Within any situation, an individual may learn, through the integrated processes of participation and their ongoing (re)construction of their own habitus⁸. In these processes, that which is learned can be modified as it becomes part of the person (p. 41, *footnote not in original*).

Thus, the most distinctive feature of learning as becoming is that learners are active members of the learning culture. They shape the learning environment as much as they are shaped by it (Elkjaer, 2004, Hager, 2005). Thus, professional learning is much more than building propositional knowledge, i.e. located in the mind. Instead, Hodkinson et al.

⁸ Habitus is a learning-specific conceptualisation of identity representing a set of tacit dispositions that orient learner’s actions in all aspects of life (Bourdieu, 1977/2013). This concept is examined in section 4.6.

(2008) note that learners are engaged in practical, embodied and social experiences that involve ongoing interaction with their environment. According to Colley et al. (2003), this view of learning facilitates understanding of complex questions around the impact of the learners' biographies and learning dispositions on their expectations, learning engagement and process of transformation, and becoming members of a professional community.

Therefore, viewing learning as becoming bridges the divide between the individual and social dimensions of learning. It facilitates the understanding of whether changes occur in an individual's mind, the location of learning and/or the wider social or physical environments beyond the learning location. As an outcome, university-based education needs to be considered as part of the social world instead of as a rigid structure or system. At the end of any learning encounter, practitioners will have changed dispositions that may or may not be valuable for the environment they move to. According to Elkjaer (2004), creating those connections between past and present experiences is the essence of learning.

4.5. Theory of learning culture and cultural theory of learning

As an outcome of understanding learning as becoming, Hodkinson et al. (2008) suggest that the learning culture needs to focus on driving valuable learning instead of focusing on how educators can teach better. That is, they need to foster a culture that prepare practitioners to learn from different contexts by creating connections between practitioner's past experiences, present actions, and imagined future possibilities. Utilising this lens when examining professional learning will facilitate drawing on a comprehensive set of educators' pedagogies, which include acquisition of knowledge and skills; exploring shared understandings; and engagement in individual as well as collective processes of reflection. In relation to advancing clinical reasoning skills, this

view embraces bringing intuitive, tacit and practice-based knowledge into the learning encounter, something that augments the learner's agency and their active role in the learning environment (Colley et al., 2003).

Such knowledge transition across boundaries (for example, from university to workplace environments) is facilitated through recognising the learner in relation to the context of learning (Bloomer and Hodkinson, 2000, Billett and Somerville, 2004, Billett, 2014). To explore this further, the *theory of learning culture* and *the cultural theory of learning* developed by Hodkinson et al. (2008) provide an excellent theoretical grounding to understand learning as becoming. Hodkinson et al. (2008) viewed learning culture as a practice constituted by the actions, dispositions and interpretations of the participants. They further argued that cultures are (re)produced by individuals, just as much as individuals are (re)produced by cultures (ibid, p. 34). The conjoint use of both theories without favouring either is arguably important to a comprehensive understanding of professional learning.

The primary assumption underlying the *Theory of Learning Culture* is that any single learning culture does not have clear boundaries such as those of a learning site, i.e. university or workplace settings. This represents the main difference to the participatory lens, in terms of which learning is exclusively context-bounded. Therefore, learning culture is not a synonym for learning location or site. To offer a further conceptualisation of this, Hodkinson et al. (2008) used Bourdieu's (1985) concept of "field" to suggest that the key to understanding learning is through understanding the relationships and interconnectedness between actors (e.g. students, educators, and workplace colleagues) in the field instead of focusing on establishing their properties. Yet Hodkinson et al. (2008) argued that the sole use of the theory of learning culture would cause one to fail to recognise learners' agency and transformation within the learning culture. Thus they

suggested that the *Cultural Theory of Learning* facilitates understanding of how an individual learner transforms through participation in a given culture.

The Cultural Theory of Learning positions learners within their cultures, and to acknowledge that their biographies prior to engagement have impact on the learning experience (Bloomer and Hodkinson, 2000). This is something that is frequently unnoticed in a participatory view of learning, and entails exploring the learners' agency, what drives their actions, and how they are actively engaged in constructing their learning (Biesta and Tedder, 2007). This theoretical understanding (i.e. cultural theory of learning) draws from Bourdieu's (1977/2013) concepts of "habitus"; a learning-specific conceptualisation of identity representing a set of tacit dispositions that orient learners' actions in all aspects of life. Thus, while the term *field* is used to conceptualise the objectively structured social spaces, the term *habitus* is used to conceptualise the nature of the subjective (Bourdieu's, 1977, 1985). In other words, habitus is shaped by a learner's prior interactions and lived experiences, and it is reshaped through exposure to new experiences. This indicates that multiple fields such as university-based programmes or workplace environments can interact to (re)create a learner's habitus, making the interconnections between field and habitus fluid (Bleakley, 2006).

Using these concepts positions the learner within the social structure and highlights the discursive nature of habitus (Hodkinson et al., 2008). In similitude with the impact of social structure, a learner's habitus can influence learning. According to Bloomer and Hodkinson (2000), this is about exploring common expectations and attitudes in the learning culture. In doing so, the use of Bloomer and Hodkinson's (2000) concept of 'learning careers' facilitates conceptualising ways of learners' engagement in the learning process. This concept captures the change in learners' learning dispositions over time, which comprises the temporal dimension of transformation and change:

It [learning career] is a career of events, activities and meanings, and the making and remaking of meanings through those activities and events [...] and the constant making and remaking of relationships, including relationships between position and disposition (p.590).

Therefore, to understand learning, the researcher needs to look beyond what is immediately present (Biesta, 2011, p. 203) and to consider looking for the direct and indirect impact of the learning culture on the learning encounter. According to Hodkinson et al. (2008), this is not limited to the immediate actions and interactions at the learning site, but also extends to distant actors, such as institutional, national and international policymakers.

In summary, the sociocultural theoretical lens that combines the social and cultural aspects of learning constitutes a more authentic and comprehensive way to examine professional learning. Studies in which learners' actions, dispositions, and power relations within a learning culture are explored can map out how the learning culture offers valuable learning experiences, in particular, how forces within and outside the learning site interact. Additionally, drawing on concepts such as 'learning career' and 'individual agency' facilitates understanding of how changes in learning dispositions facilitate transformation of learners over the course of an educational intervention. In terms of the evaluation of learning, one needs to explore the barriers and facilitators of professional learning within a learning culture (Biesta, 2011).

4.6. Learning culture and adult learners

In the context of adult education, adult learning theory offers an overall framework to understand practitioners' professional learning. However, this theory has been criticised for its assumptions (Merriam, 2001, Glover et al., 2008, Durning and Artino, 2011, Taylor and Hamdy, 2013), such as that adults are self-directed, whereas evidence suggests that they highly depend on educators for structure (Merriam, 2001). Also, adult learners

sometimes have an extrinsic motivation to participate in professional development activities (Glover et al., 2008). Moreover, contrary to expectation, previous experiences can constitute a barrier to learning transition if practitioners are not willing to change (Durning and Artino, 2011). Therefore, the adult learning theory does not comprehensively capture how practitioners learn.

Instead, a sociocultural approach to adult learning can offer a framework of analysis that facilitates conceptualising adult learning. Marchesani and Adams (1992) suggested that this framework involved examining (1) learners' sociocultural identities and educational experiences, (2) educators' sociocultural identities, (3) the comprehensiveness of a programme curriculum in supporting diverse sociocultural perspectives, and (4) the effectiveness of an educator's pedagogy. Examining educators' and learners' cultural identities entails identifying shared beliefs, assumptions, values, attitudes and behaviours associated with advancing clinical reasoning skills (Hodkinson et al., 2008), in particular, what practices are considered to be valuable pedagogy. According to Guy (1999), this is about identifying how educators attach meanings to their pedagogy and how they interact with learners. In other words, it is about whether educators are willing to change their pedagogy or class interactions in response to the learners' biographies. Such attitudes are the hallmark of what Prain et al. (2013) refer to as personalised learning. From this perspective, Prain et al. (2013) argue that personalised learning is an outcome of (a) students' ability to develop and assume responsibility over an extended timeframe, and the (b) educators' ability to locate and negotiate students' needs.

Evans' (2002; 2007) concept of 'bounded agency' is a useful tool to further understand this relationship. Evans (2007) notes that bounded agency is a 'socially situated agency, influenced but not determined by environments and emphasises internalised frames of reference, as well as external actions (p. 90). In line with Hodkinson et al.'s (2008)

cultural theories of learning, the concept of bounded agency is significant to understand the impact of habitus on learning engagement. According to Hodkinson et al. (2008), while there is often an unequal expression of power relations inside the learning fields, there is dynamic interaction and mutual dependency between multiple actors. Similarly, Evan's (2002; 2007) empirical evidence suggests that when open opportunities are available in a particular learning culture, learners will have a strong belief that their success relies on their active engagement. Evans (2002) also noted that through self-evaluative processes over an extended timeframe, students can alter their attitudes to meet the norms and expectations of their context, indicating that familiarity with the requirements of a learning culture can support learning (Glover et al., 2008). Thus, the interpretation of learning opportunities can influence learners' actions. Such interpretation is guided by past experiences and imagined future possibilities. Therefore, in exploring the impact of an educational intervention, one needs to examine: (1) the educator-learner power relationship, (2) the sociocultural boundaries of this relationship, (3) the programme pedagogy that facilitates an effective relationship and (4) the timeframe needed for effective outcomes.

4.7. Chapter Summery

Several theoretical perspectives relating to professional learning were examined. The use of Hodkinson et al.'s (2008) theory of learning culture and cultural theory of learning overcomes the limitations of both cognitive and situated leaning theories. It provides a comprehensive account for processes of learning in recognising the individual, social and cultural dimensions of learning. This avoids a dualist individual-social approach to learning that is evident in cognitive, participatory, and situated leaning theories. Therefore, the use of a sociocultural framework facilitates the understanding of the micro (i.e. the individual learner), meso (i.e. institutional pedagogical structure) and macro (i.e.

professional, regulatory, and workplace structure) levels of influence that modulate professional learning.

Chapter Five: Methodology and Methods

5.1. Introduction

In this chapter the methodological decisions that underpinned data collection and analysis are examined. First the research paradigm of pragmatism that informed the methodology, design and procedures will be explained, in particular how this research is situated closer to an interpretive research paradigm (Howe, 2003). Then the research longitudinal mixed-methods and case study methodologies are presented and justified. This is followed by outlining the rationale for methods of data collection and analysis; and an examination of the ethical considerations that governed the study. The relativist (non-foundational) approach used to evaluate the quality of the study is presented thereafter. The chapter concludes with a reflexive account of methodological and analytical decisions.

5.2. The Research Paradigm

As identified in chapter two, diverse ontological and epistemological positions have underpinned the evaluation of M-level education, ranging from positivist, e.g. Drennan (2010) to interpretivist, e.g. Zahran (2013) and pragmatic, e.g. Nicolson et al. (2005), research approaches. These ontological and epistemological positions guided the research process in terms of the focus of research, what data to collect, how to collect data, and how to analyse and interpret data (Denzin and Lincoln, 2011). Therefore, communicating such positions from the outset enables the research user to understand how the researcher perceived the nature of reality, being and truth (ontology); how the researcher obtains knowledge (epistemology); and processes of constructing knowledge (methodology) (Thomas, 2016).

5.2.1. The researcher's position

In order to evaluate the advancement of clinical reasoning skills and to understand the learning culture of M-level education in a single line of inquiry, I embraced a pragmatic research approach, which represents a transactional realist ontology and intersubjectivist epistemology (Howe, 2003, Hall, 2013). Such a position rejects the dualistic view of either subjective or objective existence of reality; and suggests that reality is an outcome of constant interaction between the mind and the world (Biesta, 2010). As such, actions and driven by beliefs and new meanings are constructed from careful analysis and reflection on those actions. With regards to this study, there was a need to draw on a combination of qualitative and quantitative data to address the objectives highlighted in section 1.1. While qualitative methods were used to capture the programme's learning culture, quantitative methods had a role in measuring the extent of advancement in clinical reasoning skills (Howe, 2004, Greene, 2007). In this way, I was able to address the complexity of the research question, especially in the context of the limited literature on how M-level education advances clinical reasoning skills. The following sections comprises an examination of how the concept of the research paradigm is perceived in the literature, as well as how a pragmatic research paradigm supports mixed-methods research.

5.2.2. Pragmatic Research Approach and Research Paradigms

The word 'paradigm' is conceptualised and used in several ways amongst social sciences researchers. In his seminal book "The Structure of Scientific Revolutions", Kuhn (1970) acknowledged the use of four meanings of this term, which reflects that the paradigm concept is a human construction that is susceptible to differing interpretations. For some researchers the word refers to a holistic and comprehensive view of the world and the researcher's place in it (Guba and Lincoln, 2004). This conceptualisation is an all-

encompassing view that includes the morality and values of the researcher when examining the world (Kuhn, 1970). On the other hand, a narrower definition of paradigm refers to metaphysical philosophies that underpin knowledge claims (Morgan, 2007). This involves identifying the ontology, epistemology and methodology of the research process (Table 5.1). Guba and Lincoln (2004) suggested that each researcher has a fixed worldview that guides the research process. Thus, in such cases of a deeply entrenched worldview, a paradigm shift is unlikely to occur when a researcher moves from one study into another. That is, an individual researcher is not expected to move from a positivist to interpretivist paradigm or vice versa. A summary of the key features of the four main research paradigms is shown in Table 5.1.

This traditional conceptualisation of what ‘paradigm’ means has divided researchers into either objectivists (i.e. knower and known are independent) or subjectivists (i.e. knower and known are inseparable) (Denscombe, 2008). Furthermore, this traditional conceptualisation of the term challenged the idea of mixing qualitative and quantitative data collection methods in a single study (Shaw et al., 2010), leading to the use of the *incommensurability* concept by researchers who do not accept the possibility of mixing the two types of data (Teddlie and Tashakkori, 2009).

Such dualistic ‘either-or’ research practice referred to in the above text does not recognise the increasing complexity of research projects and the nature of the questions currently being asked by research communities (Greene et al., 1989, Brannen, 2005, Gorard and Makopoulou, 2012). It is argued that the nature of the research questions, not a predetermined philosophical view, should be the sole determinant of how to design and conduct research (Morgan, 2007). Therefore, in a pragmatic research approach, the researcher acknowledges that his or her community has an influential role in determining the type of questions to be asked, and the appropriate methodologies to be used; thus,

either objective, subjective or intersubjective views about social reality can be embraced (Punch, 2014). While this implies a rejection of the metaphysical arguments regarding ontology, it does not imply rejection of positivism or interpretivism as *research approaches* (Morgan, 2014). Methods of data collection are chosen if they are likely to enable one to answer the research questions without any commitment to a philosophical system of reality (Creswell, 2009).

Therefore, instead of debating the nature of reality, a pragmatic research approach shifts the focus to a consideration of the social contexts of the research as a form of social action (Morgan, 2014). Put differently, the pragmatic maxim suggests that construction of reality is a consequence of social interaction with events and that knowledge is the outcome of reflecting on those social interactions (Garrison, 1994, p. 8). In this way, scientific inquiry, as a special form of social interaction, starts with thinking about actions to solve a problem instead of beginning with a preconceived understanding of reality.

Embracing such views in this study in the form of a pragmatic mixed-method research approach was an outcome of both the research culture in the School of Sport, Exercise and Rehabilitation at the University of Birmingham, which encourage the drawing on multiple methods of data collection, and my physiotherapy background, in which practice is characterised by movement between collecting qualitative and quantitative patient data (Edwards and Richardson, 2008, Shaw et al., 2010, van Griensven et al., 2014). In the context of this study, the research objectives necessitated considering a mixed-methods research design framework in which qualitative and quantitative data collections were utilised to measure changes in clinical reasoning skills and to understand how the programme's learning culture influenced changes.

Table 5.1: Research Paradigms. Adapted from: Doan (1997), Creswell (2009), Teddlie and Tashakkori (2009), Creswell and Plano-Clark (2011), Smith et al. (2012), and Morgan (2014).

Dimensions of comparison	Positivism	Post-positivism	Pragmatism	Interpretivism
Ontology: nature of reality, being and truth.	Naïve realism: objective existence of independent, single, tangible and fragmentable reality.	Critical realism: reality exists independent of social actors and observers. Because our understanding of the world may change this does not mean that the world itself changes.	Transactional realism: Intersubjective view where reality is constructed by the interactions of events. Both Positivism and Interpretivism views are sides of the same coin	No objective reality. It is Multiple, constructed and holistic. Necessitate fitting each reality within its context
Epistemology: how researchers obtain knowledge	Knower and known are independent The world exists and is knowable as it really is	Outsider and insider views are co-constructed to create knowledge	Knower and known are inseparable with simultaneous reliance on both believes and actions.	Knower and known are interactive, inseparable
Claims on Causation	There are real causes temporally precedent to or simultaneous with their effects	Possible but transitory and hard to identify	There are stable relationships in the social world, but causation cannot be fully established.	It is impossible to distinguish causes from effects as all entities in a state of mutual simultaneous shaping
Methodology: the process for studying	Quantitative Deductive logic Testing hypothesis Avoiding researcher's bias	Mixed method that best fits the investigation Integrating data to create representative model	Mixed method that best fits the investigation with the use of inductive, deductive, and often abductive logic	Qualitative Inductive logic meaning-making and contextualising the lived experience

Possibility of generalisation	Time- and context-free generalisation are possible	Modified time- and context-free generalisation; external validity important	Time- and context-bounded working hypothesis are emphasised; both external validity and transferability issues are important	Only time- and context-bounded working hypothesis are possible; consider naturalistic generalisability
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5.2.2.1. Characteristics of Pragmatic Research

The three main elements that characterise pragmatic research are transferability, intersubjectivity and abduction (Morgan, 2007). In terms of transferability, knowledge is viewed as anything that can potentially change the individual's physical or social functioning (Shaw et al., 2010, Creswell and Plano-Clark, 2011). As such, pragmatic research moves away from the argument of whether the outcomes of the research are context-bound or can be generalised to various contexts (Lincoln and Guba, 1985). In terms of this position, one acknowledges that drawing on multiple sources of evidence can more readily produce knowledge that would inform practice and policymaking (Smith and Caddick, 2012). In adopting this approach, it was anticipated that this study would contribute to our existing understanding of how clinical reasoning is advanced and to offer guidance for planning M-level curricula through an analysis of how the participants in M-level musculoskeletal physiotherapy education effectively advanced their skills.

Intersubjectivity draws on the differences in the shared social experiences between various communities or group of individuals (Joas, 1990). It is suggested that whilst there is a single reality in the lived world, individuals hold multiple interpretations of their experiences of this world (Morgan, 2007). As such, being the social actors, the emphasis is to capture the shared meaning amongst the study participants in an attempt to construct knowledge (i.e. an interpretation) that is intersubjectively stable and fixed (Garrison, 1994). Therefore, intersubjectivity entails that researcher's relationship to what is known is reliant on both belief and actions (Teddlie and Tashakkori, 2009). Thus it is not unusual for a pragmatic researcher to swing between frames of reference to address the research questions (Shannon-Baker, 2015), which is consistent with daily practice, in which subjective and objective actions are taken to inform decisions (Shaw et al., 2010). In the

context of this study, drawing on the concept of intersubjectivity allows capturing the shared meanings of students and educators on how M-level education influenced the advancement of clinical reasoning skills.

Whilst the positivist researcher uses deductive analysis to draw inferences from probably true premises and the interpretivist researcher uses inductive analysis to generalise from the particular, the pragmatic researcher uses an abductive logic of analysis (Fox, 2008, Shank, 2008). Abductive logic is described as a movement between deduction and induction with a particular emphasis is on capturing the meaning of events through proposing a logical best explanation for which there are grounds to believe that such explanation is part of the phenomenon (Morgan, 2007, Bryant, 2009). Although this best explanation is considered plausible, abductive logic produces creative and innovative knowledge whilst analysing data (Reichertz, 2004, Timmermans and Tavory, 2012). In this way, the researcher tries to seek new ideas through an iterative process of deductive, inductive and abductive analysis. This iterative stance constitutes the framework of constructivist grounded theory, which although often being described as an inductive method of analysis, inherently involves abductive processes that facilitate logical explanations and understanding of data (Charmaz, 2014).

5.2.2.2. Nature of Truth in Pragmatism

Pragmatism as a philosophy does not close the debate around the need to combine different methods (Moran et al., 2011). However, it has a unique stance in recognising the nature of truth obtained through pragmatic research. While Greene (2007) suggested that it is evidence that matters, it is not clear what evidence should be recognised as truth, or when the evidence is acceptable and who determines that. According to Dewey (1941/2008), truth is in constant formation as new evidence emerges. In accordance with the pragmatic intersubjective view i.e. having multiple interpretations of a single reality,

the lower case 'truth' is used since it is impossible to reach the absolute or universal 'Truth' (Hall, 2013, Hesse-Biber, 2015). That is, pragmatic researchers aim to capture the stable and fixed shared meanings of social actors at the time (Garrison, 1994). This produces knowledge that is temporal and embedded in a transactional relationship (Hall, 2013). The nature of truth is revisited and revised with the emergence of renewed understandings (Hesse-Biber, 2015). Thus, the researcher's role is to capture different understandings and to evaluate which one offers the best explanation of the studied phenomenon. It can be argued that the integration of different methods, as in mixed-methods research, has the potential to approximate the researcher to one version of the truth.

In conclusion, the pragmatic research approach provides an umbrella for combining qualitative and quantitative methods in a single inquiry. It enables capturing best interpretations of the participants' experience through iterative processes of analysis and abductive reasoning.

5.3. Research Methodology

Underpinned by a pragmatic research approach, the methodology of this study involved a longitudinal mixed-methods research bounded in a single instrumental theory-seeking case study design, with an aim to provide an understanding of a particular phenomenon related to one case when little is known about the processes within it (Bassegy, 1999, Stake, 2005). This methodology was perceived as meaningful and applicable to the studied population because it allowed a parallel examination of the advancement of clinical reasoning skills through quantitative and qualitative data collection and the examination of the learning culture that facilitates change through qualitative data collection (Creswell and Plano-Clarck, 2011, Thomas, 2016). The next two sections describe how the study's

mixed-methods and case study research methodologies framed the design and selection of data collection methods.

5.3.1. Mixed-Methods Research Methodology

Mixed-methods research is becoming increasingly popular in applied fields of science as it facilitates examining the complexity of human behaviour (Teddlie and Tashakkori, 2009; Creswell, 2012). The idea of mixing quantitative and qualitative methods is still however under critical evaluation, both within and outside the mixed-methods research community (Bryman, 2007, Freshwater, 2007, Creswell, 2011). The term itself has been defined in varying ways that sometimes lack conceptual and practical applications. For example, one of the earliest definitions was about the use of multiple methods of data collection, whether in parallel or sequence, within one single study (Greene et al., 1989). This suggests that both qualitative and quantitative data are collected, analysed and reported on separately. On the other hand, the consensus of 21 leading mixed-methods researchers suggests that it is about integrating the findings of both qualitative and quantitative data at the different stages of the research process, from conceptualisation to data collection, analysis and inferences (Johnson et al., 2007). Mixed-methods research is viewed therefore as a methodology rather than as a separate application of different methods. Moran-Ellis et al. (2006) suggested that mixing also involves drawing on different qualitative data.

The later definition of mixed methods was adopted in this study. Therefore, in spite of the interpretive focus of the study, it is still situated within a mixed-methods framework because it accounts for the principle of methodological eclecticism, whereby qualitative, quantitative or mixed methods are integrated to thoroughly investigate the phenomenon of interest (Teddlie and Tashakkori, 2011). That is, identifying where inferences drawn

from qualitative and quantitative data could converge or diverge, which triggers questions for further exploration.

The use of mixed-methods research in this study was therefore a way of gaining profound and nuanced understanding of the various dimensions of the study phenomenon rather than being a tool for validation or triangulation (Hammersley, 2008, Flick, 2009, Morgan, 2014). Different methods were anticipated to selectively reveal the micro, meso and macro levels associated with the learning culture of M-level education (Kelle, 2005). For example, it was anticipated that student interviews would facilitate a detailed understanding of how the programme worked, i.e. meso level of understanding. On the other hand, educators' interviews and programme documentations were anticipated to offer a detailed understanding of how programme activities were embedded in a wider context, i.e. macro level of understanding. Therefore, the process of integrating and synthesising various data sources was about constructing knowledge and understandings which might not have been attainable in the case of using a single method.

In conclusion, mixed-methods research is an increasingly popular yet developing field of research both at conceptual and practical levels. Integrating data sourced via different methods promotes the comprehensiveness of evidence and therefore enhances the credibility of the research (see section 5.10). The mixed-methods design of the study is described in section 5.6. In the next section, the case study research methodology, that was used to encapsulate the research objectives and mixed-methods methodology, is examined.

5.3.2. Case study research methodology

Case study research was also chosen as a research methodology because it enables researchers to examine an authentic, real-life and naturally occurring phenomenon

(Thomas, 2016), and to capture the complexity of the educational phenomenon by involving relevant stakeholders (Armour and Griffiths, 2012). In spite of being frequently linked to qualitative research, case study research can be measurement-based as well (Bennett, 2001). Thus, it is reasonable to suggest that both mixed-methods and case study research methodologies can be utilised in the same line of inquiry to strengthen research inferences (Bennett, 2001, Hancock and Algozzine, 2006).

This study is consistent with a single instrumental theory-seeking case study, as the aim is to explore the processes within the case when little is known about a phenomenon (Table 5.2). Capturing the advancement of clinical reasoning through M-level education required focusing on a single case to explore programme activities and the socio-cultural context that modulates change. In so doing, thick and comprehensive description could be achieved (Stake, 2005, Flyvbjerg, 2006).

Table 5.2: Types of case studies. Adapted from (Bassey, 1999, Stake, 2005, Yin, 2009, Thomas, 2016).

Intrinsic (Stake, 2005)	Analysing, describing, and reporting an interesting situation. Aim to capture the uniqueness of the case, not its representation of other cases
Instrumental (Stake, 2005)	Aim to provide an understanding of a particular phenomenon related to the case.
Theory seeking (Bassey, 1999) or exploratory (Yin, 2009)	Explore the processes within the case when little is known about a phenomenon
Theory testing (Bassey, 1999) or explanatory (Yin, 2009)	Seeking analysis or explanation of a particular theory.
Evaluative (Thomas, 2016)	Seeking to understand if something is working or worthwhile

On the other hand, to understand the influence of learners' biographies and dispositions on learning engagement (objective 3), students' programme experiences were utilised as nested cases, i.e. subunits of analysis (Yin, 2009, Thomas, 2016). Comparing various students' cases through a cross-case analysis was expected to identify the individual

characteristics of each nested case (Stake, 2005). The inclusion of students as nested subunits of analysis facilitated an extension of the analysis, both vertically (from the programme lead to the module leads to the students) and horizontally (across the students). Comparing and contrasting student cases provided an opportunity to investigate the antecedents and contexts that supported the advancement of reasoning skills for each. For example, it enabled the exploration of how learners' biographies modulated programme impact. Moreover, it offered opportunities to explore issues related to the students' development throughout the programme, thus examining concepts such as learning career and agency (Bloemer and Hodkinson, 2000, Biesta and Tedder, 2007).

In conclusion, the case study methodology offered a clear set of boundaries for this research. It made it possible to examine several voices and perspectives within a particular context. Although as a researcher I had no control over what was happening within the programme, the case study research made it possible to draw on a variety of resources, data and materials, which reflected the authenticity of a naturally occurring phenomenon.

5.4. The Case and Sampling Procedure

This study drew on one of nine MACP approved M-level programmes. The selection of the case was suitable in the context of the study questions since MACP and IFOMPT educational standards require recognition of the advancement of clinical reasoning skills as a core component to patient care (IFOMPT, 2008). In terms of directed learning hours, the minimum requirements for MACP approved programmes is 200 hours of theoretical learning, 150 hours of practical learning and 150 hours of mentored clinical practice. The programme examined in this study has a modular structure (Box 5.1) that allows full-time students to complete their postgraduate diploma (i.e. M-level qualification) in less than a year, and thus become eligible for MACP membership.

This made it possible to conduct a longitudinal mixed-methods design, where the researcher could be fully immersed in exploring the programme culture across its modules (Thomas, 2016). This ethnographic dimension of the research facilitated understanding of the programme philosophy; pedagogies and educational approaches; content; and methods used to advance clinical reasoning. Moreover, the selection of this case study facilitated capturing the interpretations of the students as well as those of the educators in terms of what, how and when clinical reasoning was advanced, which aided the development of the breadth and depth of the analysis (Denzin, 1970, Flick, 2009).

Box 5.1: The modular structure of the programme examined in this study

Research Methods - 20 credits

Advancing Practice through Personal and Professional Development (APPPD) (20 credits)

Advanced Musculoskeletal Physiotherapy 1: Lower Quadrant (AMP1) (20 credits)

Advanced Musculoskeletal Physiotherapy 2: Upper Quadrant (AMP2) (20 credits)

Evidence Based Clinical Practice (EBCP) (20 credits)

Optional module (20 credits)

Sampling procedure: Purposive sampling of participants who have the potential to provide learning opportunities about the research question were considered for recruitment (Armour and Griffiths, 2012, Creswell, 2012). Thus, students who started the programme were recruited as they provide valuable insights in terms of the research objectives. With the permission of the programme lead, the research objectives and expected outcomes were verbally communicated to the students during the induction week. They were also given an information pack containing a participation information sheet (Appendix 5.1) and a consent form (Appendix 5.2). Approaching and interviewing students at the start of the programme made it possible to explore their prior experiences, attitudes and expectations of M-level education, and their understanding of clinical reasoning before being influenced by the programmes' learning culture.

The programme and module leads were also purposefully invited to participate in the study (Appendix 5.3). As an outcome of iterative data analysis, theoretical sampling directed the researcher to interview other educators, as well as going back to previously interviewed educators to further explore and define the properties of the constructed categories (Yin, 2009; Charmaz, 2014).

5.5. Research design

A parallel mixed-methods research design (Teddlie and Tashakkori, 2009) was determined to be an appropriate data collection structure because it facilitated examining linked research objectives. This design made it possible to address the multi-layered dynamic interaction of individuals within a complex educational culture (Hodkinson et al., 2008). The study consisted of two distinctive longitudinal parts, with data collected over 18 months⁹ from the point of the students' enrolment (Figure 5.1). This complex design was thought to support programme evaluation by offering profound understanding of the programme's culture, pedagogy and outcomes in relation to advancing clinical reasoning skills.

Combined qualitative and quantitative data collection and analysis were used to evaluate the programme's impact in terms of advancing clinical reasoning skills. Quantitative methods were used to measure changes in clinical reasoning. However, to avoid the risk of oversimplifying a construct as complex as clinical reasoning, qualitative data collection facilitated the understanding of the dimensions of change identified in quantitative data, as well as exploring new domains of change (Hammersley, 2008, Morgan, 2014). Because of the gap in the literature, in terms of examining M-level programme culture that advanced clinical reasoning, qualitative data collection was also needed to explore

⁹ Full-time students completed all modules in 12 months. They were followed up in six months. Part-time students almost completed all modules, except their dissertation, by the end data collection timeframe at 18 months.

how and why M-level education achieved its intended outcomes (Lincoln, 2010). In particular, exploring participants' actions, dispositions and interpretations of the processes that facilitated change.

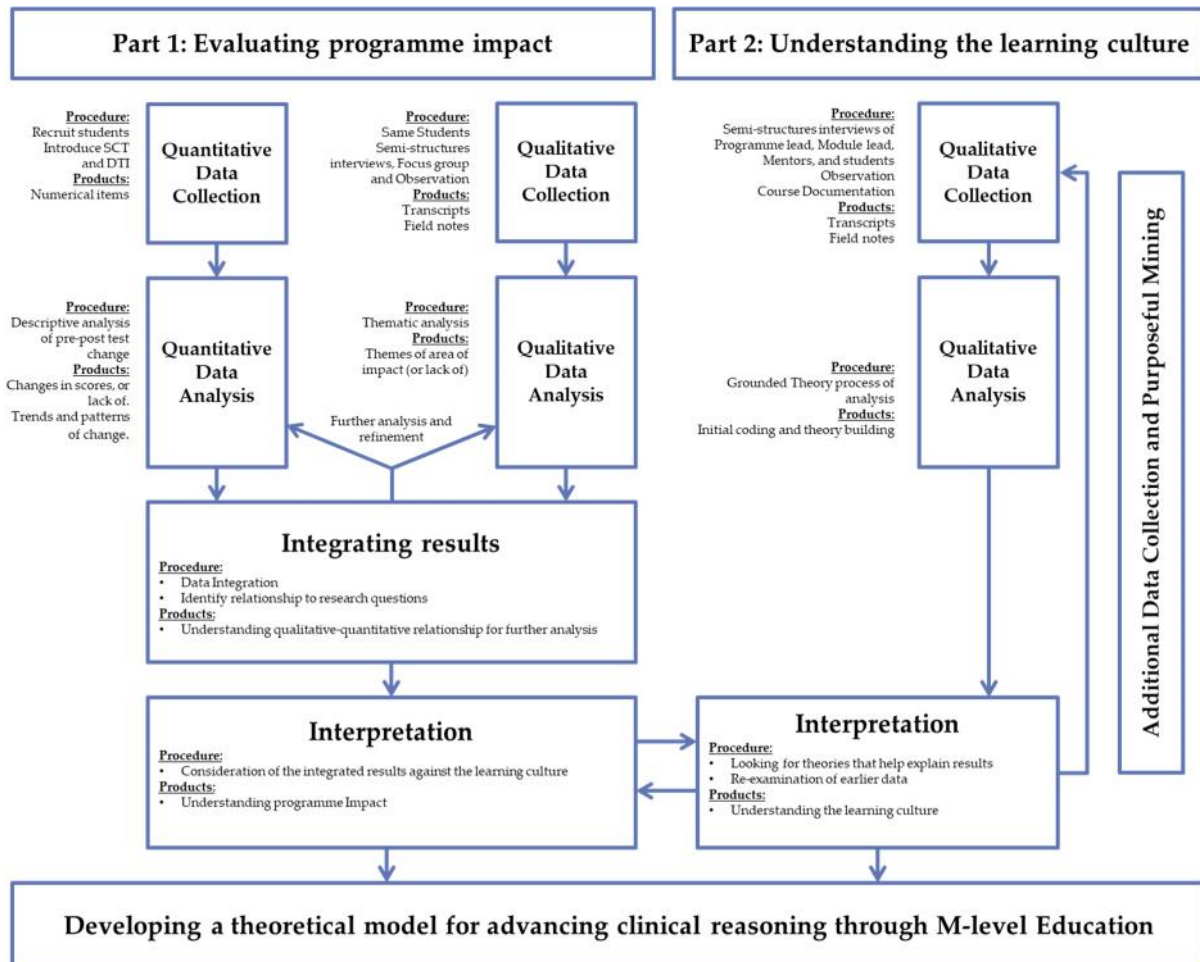


Figure 5.1: A longitudinal and parallel mixed-methods research design: part one consists of mixed data collection; and part two consists of qualitative data collection

5.6. Methods of Data Collection

Methods of data collection included quantitative measurement of clinical reasoning skills through the SCT and DTI, as well as qualitative documentary analysis, semi-structured interviews, focus groups and overt observations (Table 5.3). The research timeline, participants and data collection methods are depicted in Table 5.4 below. In communicating the selection of methods of data collection, I purposely use the first-person pronoun to convey the subjective experience throughout the research process and

highlight my role in data collection, construction and analysis. Moving between the use of third-person and first-person pronouns is encouraged in reporting mixed-methods research as it makes the researcher’s involvement in creating meaning visible to the research user (Zhou and Hall, 2016).

The synthesised Logic Model (Chapter 2) and sociocultural theories of learning (Chapter 4) initially informed data collection. In particular, with respect to how the M-level learning culture supported authenticity, self-directness, reflection, introspection, and the critical evaluation of practice, all of which were identified as drivers of change (e.g. Stathopoulos and Harrison, 2003; Bearn and Chadwick, 2010, Petty et al., 2011b). Moreover, the constructs of advancing clinical reasoning in M-level musculoskeletal physiotherapy education informed both data collection and analysis of programme impact (Box 3.1). Thereafter, the iterative process of data analysis underpinned further data collection (Charmaz, 2014).

Table 5.3: Methods of data collection for the main research objectives						
Research Aims	Programme documents	Observations	Educators Semi-structured interviews	Students Semi-structured interviews	Focus groups	SCT and DTI
Evaluating the impact on clinical reasoning skills						
Understanding the learning culture						

Table 5.4: Timeline of data collection			
	Method of data collection	Participants and context	Notes
Jul-Aug 2014 (Piloting)	Semi-structured interviews SCT and DTI	Two MSK PT PhD students	Topic guide informed by review of clinical reasoning and learning literature
Sep-Oct 2014	Semi-structured interviews	Students: 4 Full-time; 6 Part-time	Revised topic guide
	SCT and DTI	Students: 4 Full-time; 6 Part-time	First round
	Overt observations	University-based Unstructured	Research Methods; A PPPD; AMP2; and EBCP modules.
	Interrogating programme documents		All core modules
Jan-Feb 2015	Overt observations	University-based Structured	AMP2 and AMP1 modules
Mar-May 2015	Semi-structured interviews	Programme lead 4 Module leads 1 Tutors	Topic guide informed by: } Clinical reasoning and learning literature } Classroom observations } Programme documents
	Focus group	Students: 3 Full-time	
	SCT and DTI	Students: 4 Full-time	Second round
Jun-Jul 2015	Focus group	Students: 3 Full-time	
	Semi-structured interviews	Students: 1 Full-time; 2 Part-time	
	Semi-structured interviews	Programme lead Clinical mentor (n=2)	The mentor interviews were spaced by a week of analysis
	Clinical Observation	Mentored clinical placement of 2 Full-time students	
Aug-Sep 2015	Semi-structured interviews	Students: 3 Full-time	Topic guide informed by: } Data analysis } Constructed themes and categories
	SCT and DTI	Students: 2 Part-time	Second round
Mar-May 2016	Dyadic interview	Educators: 2 key Module leads	Topic guide informed by: } Data analysis } Constructed themes and categories
	Semi-structured interviews	Students: 3 Full-time 1 Part-time	
	SCT and DTI	Students: 3 Full-time 2 Part-time	Third round

The first round of data collection comprised capturing the landscape and structure of the programme. Programme documents and unstructured university observations facilitated gaining breadth of understanding of the programme's culture and pedagogy (Cohen et al., 2007, Thomas, 2016). At the same time, initial interviews with the students captured their past experiences, motivations, expectations, knowledge and understanding of clinical reasoning processes, which established a baseline for follow-up in subsequent rounds of data collection (Hodkinson et al., 2008, Huber, 2011). In the following sections I explain how the different methods of data collection were used in this study, beginning with quantitative methods of data collection and then examining the qualitative methods.

5.6.1. Quantitative data collection.

Using tests and questionnaires to evaluate educational outcomes is believed to reveal the extent of learning (Cohen et al., 2007, Creswell, 2012). While pragmatic researchers, who are rooted in transactional realism, acknowledge the ability to make causal inferences, it is not always possible to link changes in students' scores to programme activities (Teddlie and Tashakkori, 2009, Howe, 2011). In other words, using the concept of evidence as an indication of causal relationship is not adequate (Schwandt, 2009, Hall, 2013). The fact that students demonstrate changes in clinical reasoning by the end of participating in a programme could be attributed to factors such as biography, abilities, level of engagement, motivation or any other social mediators (Searle, 1995). This necessitated shifting the focus toward ensuring credibility in the research methodology which gives the researcher grounds for believing that changes in students' scores, i.e. advancement of clinical reasoning, were attributed to the programme activities (Thomas, 2016).

The quantitative data collection focused on measuring the advancement of the students' knowledge structure and flexibility of thinking being two of the domains that characterise advanced level clinical reasoning (Rushton and Lindsay, 2007, Petty, 2015). The SCT

and DTI were used in this study. Both tools were found to discriminate between various levels of expertise as examined in section 3.3. SCT and DTI were administered at three points throughout the duration of data collection: at the commencement of the programme; part way through and on completion of the M-level qualification in order to capture programme-related changes.

DTI was used in this thesis with permission from the copyright holder, which was granted on April 14, 2014. Its psychometric properties were established using a musculoskeletal physiotherapy cohort similar to this study (see Appendix 3.1). More details about DTI were provided in section 3.3.

The focus of this section, therefore, is on the process of developing and validating of SCT. The process of developing the SCT used in this study followed the published test construction guidelines (Fournier et al., 2008, Lubarsky et al., 2013). An adaptation of the original test structure was made to include students' perceptions of limited knowledge (Figure 5.4), thus enabling assessment of Miller's (1990) "knowledge" and "know how" constructs of clinical knowledge. Two M-level musculoskeletal physiotherapists (qualified from the USA and Australia, with over 10 years of experience) built a pool of 71 case vignettes, with three questions nested in each case. The 71 cases were then examined by the programme lead to identify their fit within the scope of advanced level musculoskeletal physiotherapy practice. This included checking for language and structure issues to make it accessible for the students. Feedback from the programme lead led to focusing more on the biopsychosocial model of practice and ensuring an equal representation of all regions of the body.

The modified test included 50 cases that were consistent with the programme philosophy and current clinical practice in terms of covering the five categories of clinical reasoning within advanced-level musculoskeletal physiotherapy, namely, biomedical, psychosocial

and mechanism-based diagnosis, as well as understanding chronicity and severity of pain (Smart and Doody, 2007). These 50 cases were then sent to four experts¹⁰ (All MACP members working in clinical settings, with more than 10 years of post-qualification experience). Each expert was asked to comment on the quality of the test by checking each case vignette and to then score its quality based on Fournier’s (2008) 12-point checklist grid (Figure 5.2). They were also requested to complete a questionnaire about the suitability of the test for M-level musculoskeletal physiotherapy students (Figure 5.3). Two of those experts responded at this stage, which is consistent with the recommendations of test development (Fournier et al., 2008). Both experts answered ‘yes’ to each of the quality items. One expert’s comment was: “*It is a very good tool, well designed and challenging*”. The second expert thought that the idea of the test was hard to fit into a physiotherapy practice model, yet the expert felt that the cases were ill-defined, as intended, and covered a broad spectrum of clinical situations with potential bias towards musculoskeletal sports injuries.

Script Concordance Test item quality grid*			
Scenario	Describes a challenging situation, even for experts	yes	no
	Describes an appropriate situation for examinees tested	yes	no
	The scenario is necessary in order to understand the question and to set the context	yes	no
	The clinical presentation is typical	yes	no
	The scenario is correctly written	yes	no
Questions	Questions are developed following a key-feature approach	yes	no
	In the experts' opinion, the options are relevant	yes	no
	The same option is not found in two consecutive questions	yes	no
	The new information (2 nd column) makes it possible to test the link between the new information and the option (1 st column) in the described context	yes	no
	Likert scale anchors are clearly defined and unambiguous yes no	yes	no
	Questions are developed to spread the answers equally over all the values of the Likert scale	yes	no
	Questions are developed to provide balance between low and high variability	yes	no
Total score (out of 12):			

* Used against each case scenario (and nested question).

Figure 5.2: Fournier’s 12 points checklist grid. Adapted from Fournier (2008)

¹⁰ The test construction guidelines suggest sending the test to more than two clinicians at the stage of validation to ensure the required minimum response of two.

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. I feel that the script concordance test is a useful addition to assessing manipulative physiotherapy practice.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. I think this test covered a wide range of cases seen in clinical practice.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. I think the cases presented were authentic reflecting cases seen in clinical practice.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. I think the cases presented reflected the uncertainty that characterise clinical practice.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. I think the cases reflect the objective of an advanced musculoskeletal physiotherapy programme	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. I think the cases are well written and clear	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. I think that the test has NO cases that can be considered as culturally, ethnically, or racially offensive.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 5.3: Expert's questionnaire for the utility of SCT for M-Level musculoskeletal physiotherapy

The next stage of test development involved generating the test scoring key. In line with test development guidelines, the number of cases was reduced from 50 to 35 cases that generated variability in answers at both ends of the Likert scale (Bland et al., 2005). A document was emailed through the programme lead to 17 clinical experts affiliated to the programme. They were requested to take the test individually, in exactly the same conditions as intended for the students. Six experts (all MACP members working in clinical settings, with more than 10 years of post-qualification experience) returned the completed test, meeting the minimum number of panel numbers (Boulouffe et al., 2010). The test triggered variability in response amongst the experts (i.e. they did not agree on a single option per test item) which is consistent with test development recommendations. An example of this is shown in Figure 5.5. Items that showed polarity in responses, i.e.

when experts' responses were split on either side of the scale, were removed. The test items were checked again to ensure equal representation of all body regions.

The optimised final version, with a total of 27 cases (81 questions), was used for data collection. Participating students were given an explanation of the test purpose and use (Appendix 5.5). A short questionnaire was used to elicit the students' experience of the test, and whether they felt it captured the advancement of clinical reasoning (Figure 5.6) at each point of data collection.

I. 25-year-old office worker presented to you with insidious onset of bilateral inferior heel pain that is aggravated by prolonged standing.							
If you were thinking of:	And then you find:	This hypothesis become:					I have limited knowledge
		-2	-1	0	+1	+2	
1. Planter fasciitis	Pain on passive dorsiflexion of 1 st MTP joint	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Tarsal tunnel syndrome	Pain may be felt at the toes as well	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Psychosocial yellow flags	Patient sought pain relief from different health care professionals without good outcome	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 5.4: An example of an adapted SCT item given to participants

I. 25-year-old office worker presented to you with insidious onset of bilateral inferior heel pain that is aggravated by prolonged standing.							
If you were thinking of:	And then you find:	This hypothesis become:					I have limited knowledge
		-2	-1	0	+1	+2	
4. Planter fasciitis	Pain on passive dorsiflexion of 1 st MTP joint		4/4= 1	2/4= 0.5			
5. Tarsal tunnel syndrome	Pain may be felt at the toes as well			2/3= 0.67	3/3= 1	1/3= 0.33	
6. Psychosocial yellow flags	Patient sought pain relief from different health care professionals without good outcome			2/3= 0.67	3/3= 1	1/3= 0.33	

Figure 5.5: An example of SCT item scores based on six experts' responses

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. I feel that the script concordance test is a useful addition to assessing physiotherapy practice.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. I was satisfied with this type of exam.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. I think this test covered a wide range of cases seen in clinical practice.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. I think the cases presented were authentic reflecting cases seen in clinical practice.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. I think the cases presented reflected the uncertainty that characterise clinical practice.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. I think script concordance test is a useful way of assessing clinical reasoning skills.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. I think the use of panel of experts rather than one correct answer makes script concordance test more closely related to clinical practice.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. I would have preferred another method to assess my clinical reasoning skills.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. I think script concordance test can reflect my advanced clinical reasoning skills	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. I think the programme should adopt the script concordance test for future students.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 5.6: Student questionnaire for the utility of SCT for M-level in musculoskeletal physiotherapy. Adapted from Esteves et al. (2013) and Lubarsky et al. (2013)

5.6.2. Qualitative data collection

5.6.2.1. Programme documents

The aim of interrogating programme documents was to capture the culture of the programme that facilitated the advancement of clinical reasoning skills. Programme documents are considered a rich source of data related to the programme's structure and delivery (Hancock and Algozzine, 2006), and in particular, outlines the programme philosophy in its own language and words (Creswell, 2012). Thus documents are a transparent illustration of the programme's learning culture. In the context of this study, there was a specific focus on interrogating documents related to the programme pedagogies. In so doing, module guides, timetables and the study guides for individual

sessions were purposefully sampled as it provided a description of the context in which these programme pedagogies were conducted (Bowen, 2009).

While using programme documents contributed to the overall understanding of the programme's learning culture, there are concerns in the literature that this method of data collection alone might not reflect the implementation of its contents, or the lack of sufficient detail (Bowen, 2009, Silverman, 2011), thus raising the need to draw on other methods of data collection such as direct observations or interviews. In this context, planning and engaging in class observations and interviews would not have been comprehensive without consulting programme documents.

Early document analysis, through open coding and focused coding, aided the development of the topic guide for the interview with students and educators (Charmaz, 2014). For example, one of the aims of the specialised modules (AMP2) was to analyse students' prior experience in musculoskeletal physiotherapy. This was included in the form of questioning educators about the value of this introspective analysis of one's experiences and its relevance for clinical practice (Appendix 5.6). Moreover, the time and locations of observations were informed by documentary analysis of module guides.

5.6.2.2. *Student semi-structured interviews*

As this research is embedded in a social context, I followed a constructivist approach to interviewing in terms of co-constructing knowledge with the study participants (Cohen et al., 2007). In terms of this constructivist approach to interviews, the connections between the researcher and participants is recognised (Hiller and Diluzio, 2004) and the research interview is conceptualised as a social encounter that shares many daily life features (Kitwood, 1977, p. 167). Such transactional co-constructions of data take account of the researcher's identity and the theoretical framework underpinning the research process

(Charmaz, 2014), demonstrated by my choice of questions and the focus of the interviews followed by an interpretive meaning-making process of what the participants were describing throughout the interviews.

It is therefore argued that data went through a “chain of transformation” (Murphy and Dingwall, 2003, p. 54) that started with the researcher’s selection of questions and then continued with the participants’ choices of what to share about their experiences. As this conception of interviews reflects an interactive and dynamic process, I constantly went back to the participants for more profound theoretical understanding across repeated interviews. In other words, interviewing participants was not only about identifying new categories, but also offering a rich description of constructed ones (Corbin and Strauss, 2014). Through an iterative process of data analysis, questions were refined in subsequent interviews, thus, clarifying and elaborating on the interpretations constructed in an earlier interaction.

In accordance with this conception of interviews, semi-structured interviews were selected because they constituted a compromise between the flexibility of unstructured interviews and the predetermined questions of structured interviews (Hancock and Algozzine, 2006). The participants were allowed to express themselves freely and openly, yet within the research aims and in reply to open-ended questions. For example, I used questions such as “How do you think your professional identity influenced changes?” The flexibility of semi-structured interviews yielded diversity in responses, which is acceptable in the constructivist approach to interviews (Hammersley, 2008).

Informal conversations were used as another form of interview to address emergent topics (Hancock and Algozzine, 2006). This sort of interaction promoted the relevance of the questions asked. For example, prior to classes, students were asked about the content of certain lectures and how they were perceived as relevant to advancing clinical reasoning

skills. These questions were derived from field observations or analysis of previous interviews. Although they were less structured, they enabled rigour from initial analysis and data interpretations (Smith and Caddick, 2012). On the other hand, students' demographic data and descriptions of events were collected through informational types of interviews (Cohen et al., 2007).

The topic guide (Appendix 5.7) was informed by the review of clinical reasoning literature (Chapter 3) and sociocultural learning theory (Chapter 4). In the initial interviews, I focused on eliciting students' learning and professional biographies, their perception of the programme promotion, the expected relevance and usefulness of programme activities, and exploring financial, moral, social issues that might impact learning engagement. In subsequent interviews I focused on perceived changes in clinical reasoning in terms of changed understanding, behaviour, performance and knowledge integration. Probing questions were used to elicit descriptions of change, thus ensuring the richness of interviews (Cohen et al., 2007). Interviews conducted at the beginning of the programme also focused on students' previous educational and professional backgrounds, attitudes to learning, expectations, goals and motivation to pursue M-level education. Understanding such learners' biographies and learning dispositions aimed at evaluating their readiness to engage in programme activities, change perspectives, and integrate changes into practice (Huber, 2011). Follow-up interviews included students' interpretations of the learning activities and pedagogy that advanced clinical reasoning and its relevance to practice.

All the initial interviews were conducted face-to-face in a private room within the programme premises after participants had signed an informed consent form. Skype and telephonic interviews were conducted thereafter with five students to overcome geographical boundaries (Weller, 2015). The sessions were audio-taped and transcribed

verbatim. An excerpt from the initial interview with the full-time student Ethan (pseudonym) is provided in figure 5.7.

Researcher: *What kind of learning do you use to inform your practice?*

Ethan: *Obviously as soon you start working, you rely on your undergrad study since this is what you know. The [place] I work in have in-service training, I funded courses myself, [there were] courses funded by the places that I worked for, watching other people, spending time with senior physios –more experienced people- asking them questions why they do things in certain ways... I am just looking to share information with the people that I worked with; above and below...*

Researcher: *What do you mean by that?*

Ethan: *As I've developed, [...] there might be a course that I do, taping for example, where people in my clinic kind of interested in if they have not gotten so much experience. that's where I am slightly more experienced when I come back, I feel that back to my colleagues who might not have done K-taping before... so I am teaching them, which gives me something new to work on and looking at my teaching style, and learning from other people and how they teach me.*

Researcher: *With this kind of interaction, I am interested in knowing how it helped your thinking, cognition, your approach to patients. Did it change your approach to patients? Did you have another way when dealing with patient?*

Ethan: *Yes, of course. New course, new learning, interactions that you have open your mind to a new way of thinking; a new way of process; a new application of specific technique. I don't think it always changes your practice because sometimes you think actually, I don't like that, it doesn't work for me. Because [of my physical character], it is easy for me to manipulate big guys; whereas I work with women and they really struggle ... something that does not work for the same person. I think, again, it is reflecting on that and see if it helps or it does not.*

Figure 5.7: An excerpt from an initial interview with Ethan (pseudonym) demonstrates an exploration of participants' meaning

5.6.2.3. *Educators' semi-structured interviews*

The programme (n=1) and module (n=4) leaders participated in semi-structured interviews that were informed by analysis of the programme documents, sociocultural learning theories and programme evaluation literature (Hodkinson et al., 2007, Huber, 2011, Reich and Hager, 2014). The focus of these interviews was on understanding the learning culture of the programme in terms of its philosophy; what aspects are centrally planned, i.e. by the university or external organisations; how it addresses students' and professional practice needs; the background of the educators and how the teaching team is formed; the timing and delivery of the programme modules, planning sessions and class

interactions; and methods used for teaching. An example of the topic guide with a module lead is provided in Appendix 5.6. Similarly to the student interviews, a constructivist approach was adopted for the educator interviews.

A second round of data collection involved theoretical sampling in which participants are selected to refine and develop theoretical understanding (Charmaz, 2014). It included sampling of the programme lead, a programme tutor, and a clinical mentor. Moreover, one dyadic interview, defined as interactive conversations with two participants in response to open-ended questions (Morgan et al., 2013, p. 1276), was conducted with two module leaders to facilitate an interaction in which the properties of constructed categories were refined and tested.

5.6.2.4. Focus groups

Focus groups were utilised to elicit information on the collective group perspective and shared experiences (Morgan, 1996, Barbour, 2010). In these focus groups the emphasis was on triggering interaction between the participants themselves to glean the common group impression (Cohen et al., 2007). It was expected that sharing a particular experience by one participant would trigger another's thoughts about similar experiences (Mertens, 2010). Thus I assumed an active role in creating a topic for discussion, as evident in Appendix 5.8. The participants were left to elaborate on each other's views and extend the understanding of the programme's influence on clinical reasoning.

Upon completing three modules, part-time and full-time students were recruited separately to participate in the focus groups to ensure the cohesion between group members, and thus refine the discussion and expose the uniqueness of the group experience (Cohen et al., 2007). This approach of homogeneous sampling of participants who shared similar characteristic was thought to yield a successful focus group interaction

(Creswell, 2012). Bloor et al. (2001, p. 4) attributes this to the *normative understandings* generated through group interaction (italic in original). Figures 5.8 and 5.9 demonstrate sections of this group interaction.

Researcher: *Do you feel that the programme has changed anything in your clinical reasoning skills?*

Charlie: *Yes. The next question!*

Researcher: *In terms of?*

Charlie: *For example, I am doing like two days a week of work, and there are sometimes I found myself in old habits ... I'll be doing PA on some one's neck and I'm starting like: Why I am doing it in this position? You idiot!*

Ethan: *yeah*

Charlie: *And then it is like: Sir, can you get into this position? and I start kind of doing AP ... kind of doing different assessment ... different.... just made me go; I've got some awful habits there that I still need to change.*

Ethan: *I think it is a bit of a process. So, I echo that but ... because I was still working [at a place] as well, and you do what you always did because that's what you know, and then you start asking yourself like what Charlie said then: why I am doing it like that ... But you might not act on it ... presuming what time or the comfort zone and the knowledge ... then you start playing around it a little bit. So, you ask yourself why, then you do something about it ... and now instead of asking yourself why I am doing something wrong, you just don't do something wrong ... You do it how you think you should do it ... so it is a bit I think it is more of slow progression. I don't know, would you agree?*

Figure 5.8: A section of focus group one: students' interaction regarding clinical reasoning changes

Researcher: *You already highlighted the role of the lecturer. Is there anything else other than their availability that you might consider?*

Danielle: *They pretty much know everything you asked them ... but they won't tell you straight away*

Charlie: *It feels like they know everything.*

Danielle: *Yeah*

Charlie: *[named tutor] and [named tutor] at least*

Danielle: *So yeah, I think I mean*

Charlie: *[...]*

Ethan: *Their knowledge base is huge and even if they don't know the answer they'll have ...*

Charlie: *A reason*

Ethan: *Yea they can reason an answer. And again, I think the biggest thing I learn to embrace it ... it is like ... So, I've written in my proposal for my dissertation and I don't think [named tutor] answered a single question I've asked her. She just asked me... okay well: go and read this, go and read that. So, it is just pointing, which is the best type of learning... They put you in the right direction... their availability... their promotion of our learning I think have been huge*

Charlie: *I do wonder if I ever will get any near to that level though or sustain that kind of learning [...]*

Figure 5.9: A section of focus group one: students' interaction regarding the educator's role

A second focus group was arranged prior to mentored clinical placement. The timing of this focus group was pragmatic to enable evaluating students' progression and to accommodate their availability at the programme site. The topic guide was informed by the initial analysis of the first focus group and the need to define terms or refine analysis. For example, there was a need for in-depth exploration of concepts such as awareness, challenging, internalisation and personalisation, which had been raised in the first focus group (Figure 5.10). This ensured high quality and rigorous data co-construction and interpretation.

Researcher: *There was the element of advancing knowledge, however, I need to explore that. You have described breadth of knowledge and depth of knowledge. How do you differentiate between both knowledges?*

Danielle: *Probably breadth: knowing a wide variety. Whereas depth knowing a lot about that particular thing, you know.*

Researcher: *Can you give me an example of what you mean by that?*

Charlie: *Take ACL injury that you might know an awful lot about, the anatomy, and the mechanism of injury; but when they came to Rehab may be the breadth of knowledge was a little bit less. So, you know an awful a lot about anatomy but not so much about how to improve something. For example, I don't know.*

Researcher: *Is this breadth or depth?*

Charlie: *You might know an awful lot about depth of the anatomy of something, but breadth of knowledge, you wouldn't know how to rehab, not quite so much, perhaps.*

Ethan: *Or maybe from just the flipside. So, you might know how to assess and manage a hamstring, so your breadth of knowledge is pretty good. But your depth is in terms of "functional muscle patterning" during a running mechanism. It is that depth of knowledge that might not be there.*

Figure 5.10: A section of focus group two: demonstrating an example of exploring the properties of a definition

5.6.2.5. *Observations*

Rounds of direct overt observation contributed to an in-depth understanding of the programme culture. It facilitated capturing and understanding the programme activities and the context of learning as it occurred (Murphy & Dingwall, 2003). Early unstructured overt observations were informed by the programme's documents and were used to capture the programme's landscape, to develop a rapport with the participants and to

generate questions that guided further interviews (Cohen et al., 2007). An observation schedule was then used to structure data collection (Appendix 5.9). This schedule was informed by the literature pertaining to constructivist learning environments and adult learning theory. For example, because adult learning theory suggests that adults are assumed to be self-directed (Knowles et al., 2014), I actively sought evidence of taking responsibility for learning, such as engagement in the planned self-directed studies.

Consistent with the inductive-deductive nature of the research, the decision to observe the students' mentored practice was made at a later point, since both the students and educators consistently regarded it as the point at which most of learning occurred (Figure 5.11). An observation schedule of the mentored clinical placement was drawn up to capture the clinical-based learning culture, as well as consideration of clinical reasoning processes (Appendix 5.10). These observations were informed by Rushton and Lindsay's (2010) constructs of M-level musculoskeletal clinical practice (Box 3.1).

So I think clinical placements at uni were probably the most ... the steepest learning curve because you suddenly realise how little you know when you got a real patient in front of you but when you think you understand the theory [...] so I think doing the placements and then probably the feedback from tutors on the placements developed my clinical reasoning skills more so than the university based learning ...

Figure 5.11: Section of initial interview with Victoria, pseudonym of a part-time student, highlighting the role of clinical-based pedagogy during undergraduate programmes

The number of students in observed sessions varied considerably, from 20 to 30 in modules such as the research methods module to only two students in the mentored clinical practice. Whilst observing the behaviours and interactions of students who had agreed to participate, whole-class interaction was also captured. In doing so, my identity as a researcher was communicated to the other students who were not part of this study. That is, prior to any scheduled observation, permission to observe was sought from the session facilitator and all the students in the class.

5.7. Pilot Study

The SCT, DTI and students' interview topic guide were piloted using two musculoskeletal physiotherapy PhD students. Minor wording changes were needed to clarify the SCT instructions. The feedback that was provided on the interview process and clarity of questions led to a modification of the structure of the topic guide in a way that facilitated a smooth transition between questions. Some questions were grouped together. For example, questions related to students' prior learning experiences and professional biographies were grouped to be asked together instead of being scattered throughout the interview. Also, there was a need to consider alternative probing questions, to start with open non-directive questions and to ask students to define the terms they used. While transcribing these interviews, I had a sense that I had not given students enough time to answer questions before moving on to the next one. Therefore, I was consequently mindful of giving the participants the time they needed before interrupting them with another question.

5.8. Data Analysis

5.8.1. Analysis of Advancement in Clinical Reasoning Skills

The SCT and DTI responses were scored manually. Because the number of participating students was not sufficiently large ($n=6$)¹¹, descriptive analysis of change was conducted. The means and percent of change of the SCT and DTI scores at the three points of data collection (Table 6.1) were computed. These data were then coded and synthesised with the qualitative data pertaining to programme outcomes (Mertens, 2010). This approach was valuable in terms of providing evidence of advancement in clinical reasoning skills

¹¹ Statistical analysis using the non-parametric Friedman test of differences among repeated measures was originally planned. Because the number of participants was below seven, the P-value would be an imperfect approximation of the sampling distribution of the Chi-square (Lowry, 2013).

that can be integrated with qualitative data. “Following a thread” type of analysis was used to facilitate integrating data from various sources to account for changes in clinical reasoning skills (Moran-Ellis et al., 2006) whereby the key initially identified dimensions of a theme are followed further across all data sources.

5.8.2. Qualitative Data Analysis of the Learning Culture

Data analysis was performed according to the process of the constructivist grounded theory approach as described by Charmaz (2014). Unlike other forms of qualitative methods of analysis, grounded theory is prescriptive, with a set of procedures and techniques specifically devised to guide data collection and analysis. Although being criticised as “procedural machinery” (Thomas and James, 2006, p 791), grounded theory analysis was appealing to a researcher like me who moves from quantitative to qualitative research. The choice of constructivist grounded theory over a traditional one was an outcome of perceiving its strength in capturing how participants make sense of their experiences (Charmaz, 2014). Traditional grounded theory is rooted in a post-positivist paradigm, in which the researcher assumes an objective stance and therefore needs to be an unbiased observer looking for theory to ‘emerge’ or be ‘discovered’ from the participants’ data (Glaser and Strauss, 1967, Watling and Lingard, 2012). On the other hand, in terms of the subjective stance of constructivist grounded theory, the transactional relationship between the researcher and study participants is recognised (Charmaz, 2014), thus acknowledging their influence on the research process. Moreover, this transactional relationship entails a mutually-negotiated and shared analytical understanding of data (Shannon-Baker, 2015).

While theoretical blindness is advocated in terms of the traditional grounded theory approach when approaching data analysis (Glaser and Strauss, 1967), I approached data analysis with a pre-existing sociocultural theoretical framework (Charmaz, 2014).

Therefore, the research was consistent with the nature of everyday practice, in which existing knowledge and a theoretical framework guide one's understanding of the world (Nagel and Burns, 2015). As such, theory is expanded, revised, or sometimes abandoned through a continuous process of reflexivity (Meston and Ng, 2012). This conceptualisation suggests openness to the various interpretive frameworks that potentially explain the studied phenomenon (Walsham, 1995, Charmaz, 2014). In this study, the sociocultural theoretical framework and prior knowledge directed my methodological choices (e.g. what questions to ask) and understanding of the collected data (e.g. how responses are filtered and analysed). For example, open codes such as "being self-directed" and "relevant" were interpreted in the light of adult learning literature.

At a procedural level, the first stage of constructivist grounded theory data analysis involved open coding, a common feature of different versions of grounded theory (Glaser and Strauss, 1967, Charmaz, 2014). A line-by-line open coding that started soon after data transcription¹², with the codes remaining close to what the participants said without theoretical leaps (Charmaz, 2014). The focus of open coding was on identifying the participants' actions, interactions, reasons, consequences, relationships and context in an attempt to answer questions such as what happened, how it happened, by whom, why it happened, etc. (Corbin and Strauss, 2014). This was followed by a focused coding process in which open codes were grouped together to identify categories. Significant or frequent

¹² Transcripts were not returned to the study participants. Whilst it is suggested that a one-hour interview would take 6-8 hours to transcribe, it took me three working days to transcribe one interview. Afterwards, I checked the accuracy of each transcript 2 to 3 times to make sure it had no linguistic mistakes. I came to the conclusion that sending a completed transcript to the participants two weeks after an interview would be inappropriate, considering their engagement in a rather demanding programme. I thought that overburdening participants would lead to the risk of them dropping out of the study. In spite of this potential limitation, the integrity of data analysis was assured by co-constructing the analysis and interpretations with the participants at various points throughout the study. Individual students' experiences were also documented in case vignettes (chapter six), which were sent to each student via email so that they could reflect on and comment on whether these interpretations comprehensively captured their experience, on which all the students replied with affirmations.

open codes that made analytical sense were used to categorise data. This stage of focused coding facilitated examining data on a more conceptual level. With more data collection, the initial codes were revisited and renamed. Maintaining this flexibility in coding enabled responsiveness to data and the development of a coherent theoretical understanding (Watling and Lingard, 2012). During these coding processes, movement between data and constructed categories facilitated refining categories and concepts (Glaser and Strauss, 1967, Charmaz, 2014). Tables 5.5 and 5.6 are examples of open coding and focused coding of the same data excerpt taken from an educator's interview.

The constructed categories were further explored in subsequent interviews and field observations. This is where the relationships between categories were specified, and made coherent and comprehensible (Charmaz, 2014). Theoretical sampling or sampling of concepts elevated the level of abstraction of the focused codes. I then went back to participants who had been interviewed already to define the properties of the constructed categories (Corbin and Strauss, 2014). For example, the theme "being relevant" constructed from the programme and module lead interviews was explored in further interviews with students to glean the boundaries of this category and then to describe the activities that they perceived were relevant to them.

During the process of coding and early data analysis, I engaged in memo writing to capture my thoughts regarding data, the participants and directions for data collection and to crystallise the concepts (Charmaz, 2014). This active engagement facilitated going through inductive-deductive and abductive processes of data analysis. Examples of early and then detailed memo-writing are provided in Figures 5.12 and 5.13.

Excerpt from a module lead (Educator 3) Interview	Open Coding
<p><i>I think the important thing in terms of the possible benefits for advanced MP students, and probably after that, is the association of the module in term of the attribute of learning educationally and its relationship thereafter. I think the aspect that I know interests you, which is clinical reasoning, is another aspect. But what I say is, in terms of the advanced MP students, what the module is actually most interested in at its basis in two things; self-analysis and self-evaluation in terms of the predetermined self-assessed needs for learning; and secondly, there are some wider aspects of the module itself in terms of thinking about the value of learning for our advanced MP students which is about professional values, professional responsibilities, it is about leadership, it is about management, it is around professional identity; within professional identity: skills acquisition and expertise. Because they are generic properties of the module itself, they will have specific application for the registered health care professionals. So, what it does, is looking for students to self-assess, self-evaluate, and make some kind of judgement around their level of clinical... their level of knowledge and skills, their current level of practical application, the scope of their practice, and the responsibility and the accountability of their practice; because all of those things are particularly attendant on delivering an effective, high quality and safe service for their patients.</i></p>	<p><i>Understanding professional values</i></p> <p><i>Being a responsible professional; Preparing for leadership and management; Recognising own professional identity; Examining key professional terms</i></p> <p><i>Providing models of expertise to consider</i></p> <p><i>Providing applicable knowledge</i></p> <p><i>Judging the level of clinical experience</i></p> <p><i>Judging the level of knowledge</i></p> <p><i>Recognising model of practice</i></p> <p><i>Pushing for effective practice</i></p>

Table 5.5. Example of open coding

Excerpt from a module lead interview	Focused Coding
<p><i>I think the important thing in terms of the possible benefits for advanced MP students and probably after that is the association of the module in term of the attribute of learning educationally and its relationship thereafter. I think the aspect that I know interests you, which is clinical reasoning, is another aspect. But what I say is, in terms of the advanced MP students, what the module is actually most interested in at its basis in two things; self-analysis and self-evaluation in terms of the predetermined self-assessed needs for learning; and secondly, there are some wider aspects of the module itself in terms of thinking about the value of learning for our advanced MP students which is about professional values, professional responsibilities, it is about leadership, it is about management, it is around professional identity; within professional identity: skills acquisition and expertise. Because they are generic properties of the module itself, they will have specific application for the registered health care professionals. So, what it does, is looking for students to self-assess, self-evaluate, and make some kind of judgement around their level of clinical... their level of knowledge and skills, their current level of practical application, the scope of their practice, and the responsibility and the accountability of their practice; because all of those things are particularly attendant on delivering an effective, high quality and safe service for their patients.</i></p>	<p><i>Establishing baseline levels</i></p> <p><i>Examining key professional terms</i></p>

Table 5.6. Example of focused coding

Judging the level of clinical experience

I think with this he refers to students recognising their abilities of what they are capable to do and what experience they are bringing to the programme and how the programme would facilitate advancement

Figure 5.12. A memo written at early stage of data collection

Learning from errors

The students are continuously learning from their own errors. This is evident in the different activities that request them to reflect on past experience. This extends to the real cases provided during the AMP1/2 modules in which there are elements of knowledge construction; A) from peer interaction, and being aware of these errors, and B) using the constructed knowledge to guide future assessment and planning during the module. So, it is kind of interacting with self. Promoting the concepts of self-evaluation cause the students to have an interactive self which could be used to reflect back on any experience that s/he have during the programme.

So, what is evident is that students always construct knowledge, even when thinking of past errors. I think with this type of learning the students are somehow encouraged to have a go and in way allowed to make mistakes, so they can learn from it. They are not being defamed or put into corners or embarrassed in front of their peers. It is evident that as soon as the students embrace this and recognise this, and participate, learning would occur, and they can move forward. Otherwise they will not change anything (even for reflectors). The other interesting dimension is that I guess as soon as they recognise this and embrace that they are allowed to be wrong in this protected environment, they will go through this process faster.

Figure 5.13. A memo written at a later stage of data collection

Consistent with this abductive logic of grounded theory, a process of purposeful mining of quotes, incidents and expressions of the original participants' transcripts and observations was used to build a comprehensive model of how the programme's learning culture advanced clinical reasoning skills (Watling and Lingard, 2012, Bryant, 2017). In so doing, data were re-coded and theoretically sampled for concepts to offer the most "plausible theoretical interpretation of the observed data" (Charmaz, 2014, p. 200).

5.9. Ethical Considerations

The study was approved by the Ethical Review Committee at the University of Birmingham on 22/07/2014. Reference number: ERN_14-0747. Thereafter, it adhered to the institutional research governance laid out by the University of Birmingham, outlined in the application for ethical review form (Appendix 1.2). Approaching study participants

and data collection started only after ethical clearance had been received. Permission to approach students and programme educators was granted by the programme leader. Permission to observe the mentored clinical placement was also sought and granted. In accordance with recommendations found in the literature regarding conducting case studies, the programme activities were not disturbed by the research process, especially when conducting observation (Creswell, 2012). Consent was obtained from all the participants. The students and educators were briefed about the purpose, procedures and expected outcomes of the study. To maintain confidentiality, the students were assured that their data would not be communicated to the programme educators. They were also assured that their participation would not impact on their educational experience. They had the right to withdraw from the research at any time before completion of data analysis (October 2015). All the participants' data were handled and stored securely in a locked cabinet and on a password-protected computer.

A coding scheme was utilised to preserve the anonymity of the participants. Any identifying information was removed from the interview transcripts. While Saunders et al. (2014) suggest that complete anonymity is difficult to achieve, they further argue that the researcher has to mitigate against the promise of concealing participants' identities and the possibility of being identified by others who are familiar with the research setting; or being able to identify themselves and their colleagues. Ensuring the anonymity of the participants was important in this study because it was a single case study with few participants. Additionally, anonymising identities was particularly important because the participants not only shared their own personal experiences, but also information about other participants (both students and educators) who either participated or did not participate in this study. Thus, purposeful misleading information was inserted, such as the gender identities of some of the students (Saunders et al., 2014). Moreover, because

this was one of the few MACP approved programmes, the educator's identities and responsibilities in the programme were concealed in an attempt to make it difficult to trace data extracts to an individual educator by any external readers who might search for my affiliation at the time of the study and deduce the location of this case study. Even with such anonymising approach, the richness of data obtained from this case study research was well-maintained and reported. In disseminating my findings at the IFOMPT 2016 conference, I adhered to these ethical principles and I intend to continue to do so in any forthcoming dissemination.

5.10. Participants and Collected Data

Ten out of a cohort of 18 students agreed to participate in the first round of data collection; all four full-time and six part-time students. Thereafter, four of the part-time students were not able to continue. Consistent with the research ethical principles, no explanations were sought, but some of those students cited a busy personal and professional life. Their data were therefore removed from the analysis.

The data reported in the finding chapters is premised on the accounts of seven programme educators, including the programme lead, four module leads, a module tutor and a clinical mentor. All are qualified physiotherapist with an extensive expertise in teaching and researching musculoskeletal physiotherapy, sports medicine, clinical reasoning, professional development, and evidence based clinical practice. The data also draws on the accounts and data of six students who participated in all data collection phases: two part-time students (pseudonyms: Abbie and Victoria) and four full-time students (pseudonyms: Charlie, Danielle, Ethan and Simon). At time of recruitment, their age ranged between 23 and 34. They were qualified as physiotherapist in the UK, except for Simon. Their post-qualification experience in musculoskeletal physiotherapy ranged from 2-10 years. At the commencement of the programme, those students were working

in the UK at NHS (n=1), private practice (n=4) and military (n=1) settings. All of the students, except Danielle, maintained some form of clinical practice throughout the programme. Towards the end of the programme, four students moved into an alternative workplace. For Ethan and Danielle, this was planned before the programme. Simon moved to a different workplace culture. Charlie had an additional part-time job and then started his own private practice. Abbie and Victoria remained in the same workplace. Abbie became the head of her physiotherapy unit. Victoria was put in charge of planning in-service training at her practice.

Data sources included 10 individuals and one dyadic semi-structured interview with educators; 16 individual semi-structured interviews with full- and part-time students; two focus groups with three full-time students; programme documents; and a total of 108 hours of overt structured and non-structured observations conducted across classes, self-directed studies, informal student conversations on campus, and the mentored clinical practice of two students.

All students completed SCT and DTI at three phases of data collection, except for Simon who did not respond to the phase three. The full-time students completed all their modules in 12 months. They were followed up six months after completing M-level requirements. By the end of this data collection timeframe (i.e. 18 months), the two part-time students had completed all their modules, but not their dissertations.

5.11. Quality criteria

Two parallel approaches were cited in the literature to evaluate the quality of the quantitative and qualitative research (Guba and Lincoln, 1989, Thomas, 2016). While post-positivist researchers aim to establish internal validity, external validity, reliability and objectivity, interpretive researchers aim to communicate the credibility,

transferability, dependability and conformability of the research (Table 5.7). On the other hand, mixed-methods researchers attempt to reconcile those approaches by suggesting different quality judging criteria that offer a different language to the numerous terms used within post-positivist and interpretivist traditions. These include the legitimization model (Onwuegbuzie and Johnson, 2006); the validation framework (Dellinger and Leech, 2007); and the integrative framework (Teddlie and Tashakkori, 2009).

Table 5.7. Judging qualitative research quality. Adapted from Guba and Lincoln (1985).

Criteria	Description	Methods of achieving criteria
Credibility (Qualitative term for internal validity)	The researcher's interpretation of data corresponds the participant's constructed realities.	Prolonged engagement; persistent observation; Triangulation; Peer debriefing; Negative case analysis; Member checks.
Transferability (Qualitative term for external validity)	Making inferences that are transferrable beyond the context of research.	Thick description of contextual information. Reader judges what aspects are transferable.
Dependability (Qualitative term for reliability)	Obtaining consistency and stability of data under different conditions.	Communication of research process, decisions and changes made throughout the research.
Conformability (Qualitative term for objectivity)	Avoiding bias toward preferred inferences and ensuring that inferences are grounded in data itself.	Critical friend; Reflexive journal; Audit trail.

Although being underpinned by contrasting theoretical assumptions, these qualitative, quantitative and mixed-methods quality criteria share what Smith et al. (2014) referred to as a 'criteriological approach' to judging quality, which imposes pre-determined criteria on evaluating research value. That is, research quality can be evaluated only by applying a set of fixed external criteria (Hammersley, 2008). This criteriological approach decontextualises the research process as it assumes that various research methods across qualitative, quantitative and mixed methodologies can be treated equally when it comes to evaluating quality (Gorard, 2002). Whilst each method has its own assumptions and

procedures, judging quality against universal criteria would be problematic because of the tendency towards identifying a single truth or explanation, which contradicts the pragmatic research principle of a continuously forming truth (Dewey 1941/2008, Burke, 2016). In response to the limitations of Guba and Lincoln's (1985) quality criteria, Tracy (2010) suggested eight universal criteria that need to be considered to evaluate the quality of research. However, this can be equally criticised as forcing external predetermined criteria.

Therefore, several authors have argued for more flexible and contextually-bounded applications of quality criteria (Smith and Hodkinson, 2008, Smith and Caddick, 2012, Gergen, 2014, Burke, 2016). In other words, they argued for a relativist approach that is tailored to suit the specific research aims and chosen methodology, acknowledging that what is thought to be good or bad quality is subject to constant reinterpretation. Smith and Hodkinson (2008) therefore viewed quality criteria as a way to assess knowledge claims without necessarily associating it with any of the research paradigms. Therefore, judging research quality is embedded in the researcher as well as the research user's background and experience. In this context the researcher's role is to offer a reflexive stance and nuanced understanding of how the research quality can be evaluated. Such a position acknowledges the inherent properties that characterise each study type (Burke, 2016). The researcher can apply multiple quality-ensuring criteria at different stages of the research.

In line with this thinking, a relativist (non-foundational) approach to judging quality guided this study. The following criteria, adapted from Smith and Caddick (2012), were selected to demonstrate how I ensured credibility in data collection and analysis:

-) Offering comprehensive evidence supported by high quality data collection and interpretations.

-) Ensuring coherent analysis that draws a meaningful picture.
-) Capturing the totality of the participants' experience.
-) Seeking the participants' reflection on data interpretation in terms of its fairness, believability and appropriateness.
-) Resonating with what is already known and/or experienced.
-) Ensuring transparent reporting.
-) Offering a substantive contribution to the existing understanding.
-) Impacting the research user in terms of generating new questions, engaging in new research and promoting actions.

Multiple aspects of these quality criteria were communicated in many sections throughout this chapter. For example, capturing the totality of the participants' experience was done through constructing students' vignettes. A separate findings chapter (Chapter eight) aims to provide research users with detailed accounts that thoroughly capture students experience throughout the programme. Moreover, the chosen case study and sampling strategy appropriately considers the research objectives. Utilising mixed data collection methods constituted a rigorous and coherent process of data collection. Quality was obtained by paying attention to best practices in data collection and analysis, and drawing conclusions that were grounded in the data (Guba and Lincoln, 1989, Shadish et al., 2002). Mixed-methods research can potentially add credibility when a single method has higher credibility in the eyes of the research users, i.e. policymakers (Johnson and Onwuegbuzie, 2004)¹³.

¹³ The argument laid out here is that some research users might consider, for example, direct observation more advantageous than interviews, and therefore accept the research outcomes. However, I need to affirm that my position around utilising mixed method was about comprehensive capturing of different dimensions

Focusing on a single case and using a grounded theory analytical process facilitated a coherent, multi-layered and cyclical process of data collection and analysis (Watling and Lingard, 2012). Each cycle provided the opportunity to answer more questions constructed from the previous one. The prolonged engagement with the case study for over 18 months ensured capturing the participants' perspectives and the programme context. Throughout the research, rapport was built with the participants through repeated observations, interviews and focus groups, offering opportunities to conduct data co-construction, as well as to be reflexive about the culture, behaviours and experience of the participants (Creswell, 2012, Charmaz, 2014). Giving the participants an opportunity to discontinue participation resulted in a cohort of participants who were genuinely willing to share their experiences (Shenton, 2004). The theoretical sampling of some educators aimed to ensure in-depth understanding of the properties of the constructed categories (Bazeley, 2013).

Moreover, access to participants and observations was gained after providing a strong rationale regarding the appropriateness of data collection method. This was particularly relevant when it was assumed that the researcher's presence could 'interrupt' the students' learning experiences. In such events, access was negotiated with 'gatekeepers' (Devers and Frankel, 2000). For example, in order not to disturb student-mentor and student-student interactions during mentored clinical placement, clinical observation was limited to two days which were beneficial in terms of added richness to data collection and analysis.

Furthermore, my developed interest in the topic was an outcome of being a graduate of a similar programme. Although in a different country, it was under the umbrella of

of the studied phenomenon in order to synthesis robust conclusions. It was never intended to be used as a method of ensuring internal validity or a triangulation strategy as some researchers might use it for.

IFOMPT; thus, I was exposed to a learning culture in which advancing clinical reasoning skills was a core competency. In a way I could be considered an insider who had an understanding of how the programme works (Creswel, 2012). To avoid bias toward preferred interpretations, multiple strategies were used, which included frequent debriefing sessions with supervisors, to account for methodological decisions and crystallising my thoughts on the direction of data analysis. Such data analysis was underpinned by their regular and critical reviews of constructed interpretations. In light of their research and educational experience, these debriefings added credibility and rigour to the process of building the model of convergence and synergy (Chapter 6). The analysis and interpretations of the participants' experiences were anonymously communicated to three PhD colleagues on multiple occasions, which gave them an opportunity to comment on or challenge those interpretations, thus limiting unwarranted conceptual leaps (Corbin and Strauss, 2014).

In the absence of exemplary mixed-methods studies that are similar to this study, the design of the study is novel. Utilising SCT and DTI is novel within this population of M-level musculoskeletal students in terms of measuring the advancement in clinical reasoning skills. Qualitative data were then used to provide richness and a deeper examination of how changes occurred. This mixed-methods design offers a theoretical framework that would potentially inform other studies that seek to evaluate the impact of professional development activities.

Whilst developing SCT to measure advancement in clinical reasoning was valuable for this case study, ensuring the quality and utility of the test was not without challenges. In constructing the test, I followed the published test development guidelines. An M-level qualified physiotherapist and I constructed more vignettes than administered, which took relatively a long period of time. A careful effort was put to ensure that the added statement

in each test item reflected what is commonly referred to as a “forceful feature” that relates the clinical script to the hypothesis (Fournier et al., 2008). This ensured that students would still be thinking of the same clinical script related to a diagnosis instead of thinking of new diagnosis, something that could cloud their judgment (Kreiter, 2012).

Finding a panel of experts who are ready to review the clinical relevance of the questions and to score the final version of the test was challenging. Only 6 out of 17 MACP practitioners who received the final version of the test responded. Although this low number have effectively been used in the literature (Boulouffe et al., 2010), the recommended guideline for panellists ranges between 10-15 for high stake exams.

To ensure transparency, I offered a detailed methodological description. Data collection tools, the rationale and the process of analysis have been clearly documented (Houghton et al., 2013). All inferences are grounded in data collected from the participants. This is thought to enable the research users to trace the researcher’s decisions and to scrutinise the integrity of the research inferences.

5.12. Reflexivity

Reflexivity involves mindful introspection of how the researcher’s actions are impacted by engagement in the research, as well as with other individuals such as the research participants, supervisors or colleagues (Shenton, 2004, Ryan, 2005). In other words, it is not only about reflecting on one’s experience, but also how that experience was collectively shaped by the environment of the research. Thus, reflexivity is an attempt to understand what shaped the researcher’s actions and how he or she reconsidered, renegotiated and planned for future actions (Lewis, 2003). Such a reflexive stance would not be possible if one simply withdrew from one’s subjective experience and reflected on it. Instead it requires engagement with others to raise awareness of what is being reflected

upon and why alternative action needs to be taken, leading to an “interpersonally negotiated processes of interpretations” (Winter, 2005, p14). To address these issues of reflexivity, a journal was kept at different stages of the research to help document thoughts, problems and possible biases that arose throughout the research process (Creswell, 2009).

As noted in the previous section, transparent communication of the research processes through a reflexive account enables research users to evaluate the credibility of the outcomes. Part of this reflexive account was communicated in the preamble, where I examined the influence of my biography, my supervisors and the physiotherapy research community on determining the research focus and processes, thus highlighting the transformation of my ontological and epistemological assumptions (Piantanida et al, 2004). As a novice researcher I needed to develop my research skills. At an early stage of the study, my attendance at a mixed-methods research module, along with evidence from the evaluation literature, shaped my decision to conduct a concurrent mixed-methods research design, on the assumption that the research process was about measuring programme outcomes. However, with the development of the research objectives and identifying gaps in the literature, there was a need to explore the learning culture of the programme, which required drawing on qualitative data collection. Although this massively skewed the research towards interpretive qualitative research, the study remained within a mixed-methods framework because it conformed to the principle of methodological eclecticism (Teddlie and Tashakkori, 2011), thus enabling the selection of methods that thoroughly investigate the phenomenon of interest.

Whilst the transformation of my identity as a researcher was evident, going through the research processes was not without challenges. Research in a mixed-methods field sometimes necessitates using opposing interpretations of terminologies and methods of

analysis (Cosgrove and Jonas, 2016). For example, the term ‘triangulation’ has been conceptualised in multiple ways in the literature (see Hammersley, 2008). My position around utilising mixed methods was about comprehensive capturing of different dimensions of the studied phenomenon in order to synthesise robust conclusions. It was never intended to be used as a method of ensuring internal validity or a triangulation strategy as some researchers might use it. This use of mixed-methods was in congruency with the overall constructivist analytical framework of the study in which the existence of multiple realities is acknowledged (see section 5.3.1).

Similarly, I used Guba and Lincoln’s (1985) concept of “member checking” quite a lot in the initial stages of planning the methodology. However, by adopting an intersubjective stance, I came to the understanding that member checking was much less concerned with verifying my interpretation and more to do with co-construction of understandings. This changed my rationale for the need to go back to the study participants. Instead of looking for one universal truth, my rationale has transformed into checking the depth of my interpretation in terms of comprehensive capturing of the participants experience (Charmaz, 2014).

As a developing qualitative researcher, the initial coding of data was challenging. In spite of using NVivo to code the transcribed data, the coding was inconsistent and yielded over 800 codes for the first three student interviews. I used several terms to code similar concepts. I attributed the reason to the length of time (2-4 weeks) I had spent before coding the next interview and having trouble with my short-term memory. Thereafter, once I developed theoretical sensitivity (through reviewing the literature), I started to use a coding frame that facilitated consistent coding and revisiting of all previously coded data, as well as facilitating constant comparison. Going through this process was

strenuous, but I believe it enabled me to look at the data with fresh eyes each time I examined the transcripts.

Assuming a reflexive position entailed being open to and acknowledging the presence of multiple theoretical interpretations (Pillow, 2003). For example, achieving theoretical abstraction was not without difficulties. At the early stages of analysis, I could not go beyond focused coding and constructing categories. Convergence into the programme culture was the fifth constructed category after promoting reflection, authenticity, motivation and developing identity. However, with further examination of data, and developing an understanding from the literature and supervisory team's advice, I realised that convergence was much more than a personal process related to the students' transformation, but a theoretical concept that could capture what was going on in the learning culture, and how programme outcomes were achieved.

In terms of data collection, the students' limited availability throughout the programme challenged scheduling focus groups. Three full-time students (out of four) participated in the two focus groups. Only two part-time students continued to participate in the study. Although Morgan et al. (2013) sensibly argued for dyadic interviews, a miniature focus group of two individuals, I made the decision to conduct individual interviews to (1) account for difficulties in finding a time that was suitable for both students¹⁴, (2) my feeling that dyadic interviews would not yield superior outcomes, and (3) I would have a better opportunity to see whether my interpretations represented their individual experience.

¹⁴ As I anticipated the time pressures prevented four part-time students from continuing the study. At the time of planning the focus groups with part-time students, university-based teaching blocks consisted of two full days per month. I was not successful in receiving a reply. To avoid dropping out, I thought that individual interview over Skype or by telephone with them would offer a more flexible option. Two students accepted this proposal; one apologised because of personal issues, and I received no reply from the rest.

Whilst the use of focus groups might be criticised because they potentially recruit dominating participants who could overshadow others (Cohen et al., 2007), this was not the case in this study because of the small number of participants in the two focus groups. Nonetheless, even with three participants, transcribing the focus group interaction was difficult because of overlapping voices (Creswell, 2012). During transcriptions, I was able to discriminate participants' voices, but sometimes I could not understand what they were saying because of background noise. However, having the opportunity to go back to the participants individually to verify the integrity of my interpretations minimised this effect. Moreover, being of a non-English speaking background, it was difficult for me at certain points to manage group interactions. In spite of this, the two focus groups provided an opportunity for me to understand the students' perceptions and development at several points throughout the programme.

Since I could be considered an insider, having attended a similar musculoskeletal physiotherapy programme, initial observations included participatory observations in which I participated in some programme activities (Cohen et al., 2007). This was then changed to non-participatory observation, in which I had minimal contact with the study participants. This change of the observational roles has been described as advantageous to ensure good quality data collection (Creswell, 2012). While participant observations were effective in terms of developing rapport with the participants and engaging in the actual experience of the students, non-participant observations offered a chance to document observations as they occurred in the setting. The adaptation of the observational role permitted subjective as well as objective involvement with the case study.

In conclusion, in accord with Mills et al. (2006), this reflexive approach to research enabled me to reflect on my actions and interactions with others and to consciously

examine my methodological and analytical decisions throughout the various stages of the research.

5.13. Summary

The methodological decisions that underpinned data collection and analysis were examined in this chapter. Adopting a pragmatic approach reflected my belief in focusing on methods instead of predetermined conceptions about social reality. A mixed-methods research framework was adopted to capture the programme learning culture by drawing on a single theory-seeking case study. The study was limited to one MACP approved programme, which facilitated deep exploration of what works within the programme by talking to a variety of educators and students. The chapter concluded with an examination of how the research quality was evaluated and a critical exploration was provided of how I influenced and was influenced by the research process. Chapters six, seven, eight and nine comprise reports of the findings derived through the various methods of data collection.

Chapter Six: Introduction to Findings

The study set out to examine how the learning culture of an MACP approved musculoskeletal physiotherapy programme facilitates the advancement of clinical reasoning skills. A longitudinal mixed-methods single theory-seeking case study design (Thomas, 2016) was used. Qualitative and quantitative data were collected over a period of 18-months which enabled examining the advancement of clinical reasoning skills and exploring the processes that facilitated change.

As highlighted in section 5.10 these findings draw on data sourced from multiple educators and students semi-structured interviews, two focus groups with three full-time students; analysis of programme documents; overt structured and non-structured observations, and three rounds of administering SCT and DTI. In presenting findings, data extracts that clearly illustrate themes, interpretations inferences or context are provided (Rubel and Villalba, 2009). The source of the participant's extract is provided after each one in brackets that contain the participant's pseudonym and the context of researcher-participant interaction. To maintain the promise of concealing identity i.e. ethical considerations, extracts sourced from educators' data were kept anonymous.

These findings are organised in a logical, linear and chronological order that guide the reader on the journey of developing a theoretical understanding of learning culture of M-level musculoskeletal physiotherapy. In **this chapter**, the interpretive model “*A culture of convergence and synergy*” (Figure 6.1) is introduced to offer a visual representation that guides the understanding of the results reported in subsequent finding chapters. This model explains the multi-layered and complexity of interaction in the learning culture through which clinical reasoning skills are advanced. In **chapter seven**, the programmes'

pedagogical activities and context that supported professional learning and the advancement of clinical reasoning skills are reported. In **chapter eight**, a cross-case analysis that draws on the biographies, changes in learning dispositions and the experiences of the six students is furnished to offer a more profound and illustrative analysis. In **Chapter nine** the interpretive model of “A culture of convergence and synergy” is examined in detail.

This model was derived from data through an iterative process of deductive, inductive and abductive analyses to provide the best explanation (Bryant, 2009) of how clinical reasoning skills were advanced. An inductive analysis was used to build data from the ground up in order to understand the programme’s processes (Chapter 7). Then, to make sense of this analysis, the sociocultural theoretical lens was used deductively. In an abductive stance, the model of a culture of convergence and synergy offered a plausible theoretical explanation that captures how and why different levels of impact interacted to mediate advancement in clinical reasoning.

This process is consistent with Charmaz (2014) who encouraged researchers to re-examination of data in the event of mental leaps. A process of purposeful mining of quotes, incidents and expressions of the original participants’ transcripts and observations was used to build this model (Watling and Lingard, 2012, Bryant, 2017). Data were re-coded and theoretically sampled for concepts, which is consistent with the abductive logic of grounded theory, in which researchers “form and test hypothesis for each explanation until arriving at the most plausible theoretical interpretation of the observed data” (Charmaz, 2014, p. 200). The culture of convergence and synergy was seen an important model because it highlights the nature of interactions across various dimensions at the micro, meso and macro levels of influence.

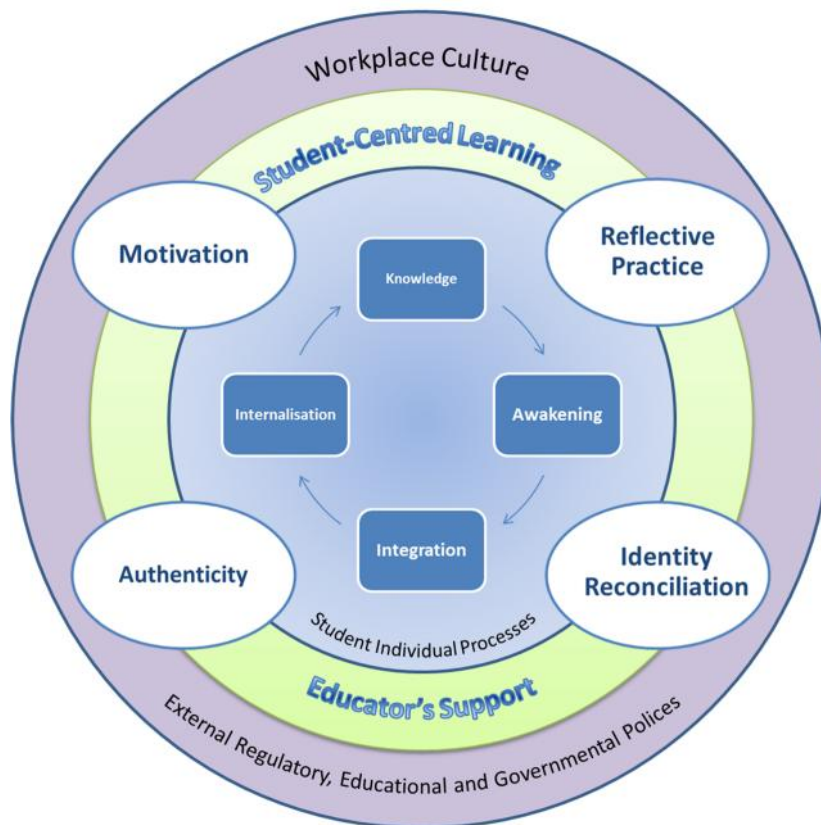


Figure 6.1: Advancing clinical reasoning through a culture of convergence and synergy

The model demonstrates that a convergence of students' biographies, programme pedagogies and professional regulatory policies and workplace structures at M-level is important for successful programme outcomes. While this model builds on Hodkinson et al.'s (2007b) description of programmes operating under the umbrella of English Further Education, it particularly emphasises the interconnected and convergent relationship across multiple levels of influence, hence, the avoidance of presenting professional learning as a linear process. Thus, the model resonates with the theory of learning culture in terms of identifying that professional learning goes beyond situated and participatory practices (Hodkinson et al., 2008). The model also has connections to adult learning theory. Whilst it is suggested that adult learners are self-motivated for learning (Knowles et al., 2014), the model demonstrates that in addition to this intrinsic motivation there is a need for an extrinsic one. This resonates with self-determination theory and what Ryan

and Deci (2000) suggested that psychological and sociological aspects of motivation are at interplay. The model also corresponds with reflective learning theory (Schön, 1987) with an emphasis on the social dimension of learning. This has implications in terms of planning pedagogies that drive coherency of educational message through recognising the individual, social, and cultural dimensions of learning.

The terms ‘convergence’ and ‘synergy’ specifically refer to the congruency and alignment of learners’ biographies and learning dispositions (micro level of influence), the programme practices (meso level of influence), professional regulatory policies and workplace culture (macro level of influence). For students to engage successfully in M-level education, coherency of educational message across these three levels of influence is needed. The use of the terms ‘convergence’ and ‘synergy’ does not mean that students’ learning dispositions were always congruent with the programme or external regulatory requirements. The findings suggest students who reconcile their habitus to the identity of the programme would be more likely to perceive the relevance of the programme structure and begin to internalise M-level knowledge and skills. Therefore, the model suggests that the presence of synergy and convergence in the learning culture is associated with achieving positive outcomes. In contrast to a culture that drives divergence and conflicts, a culture of synergy and convergence is more likely to drive changes in clinical reasoning skills.

Changes in Clinical Reasoning Skills:

The programme’s culture of convergence and synergy led to the successful advancement of clinical reasoning skills. The evidence from the qualitative and quantitative data indicated that this culture led advancement in multiple domains related to clinical reasoning skills. The data suggest that the advancement was gradual and progressive at each phase of data collection. From the beginning of the programme to the point of

completing all the modules, data indicated an increase of 28.8% and 13% of SCT and DTI structure in memory scores respectively (Table 6.1). The individual student's scores are presented in Figures 6.2-5. In Figure 6.2, the data from all students, but Simon, demonstrate a steady increase in the total SCT scores through the three phases¹⁵ of data collection. This concurs with the increase in the DTI structure in memory scores between the start and the end of data collection (Figure 6.5). while the mean scores of DTI flexibility in thinking slightly dropped during the programme, scores of individual students demonstrate variable tendencies (Figure 6.4).

Table 6.1: SCT and DTI Mean Scores at three phases throughout the programme. Standard Deviation in brackets				
	Point 1(n=6)	Point 2(n=6)	Point 3(n=5)	Change% P3-P1
SCT	53.68 (6.44)	62.34 (10.16)	69.16 (8.84)	28.8%
DTI-total Score	176.00 (9.82)	177.60 (4.22)	192.60 (14.19)	9.4%
DTI-Structure in Memory	83.00 (4.58)	87.00 (4.12)	93.80 (8.98)	13 %
DTI- Flexibility in Thinking	93.00 (7.14)	91.00 (4.95)	98.80 (6.53)	6.2%

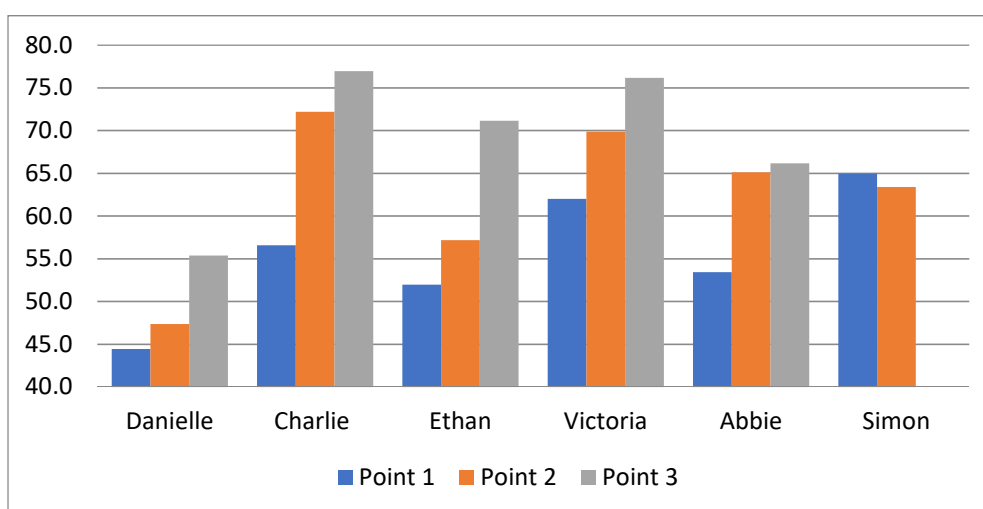


Figure 6.2: Individual student's scores: SCT

¹⁵ The timeline of these three points varied between full- and part-time students, and is depicted in Table 5.4

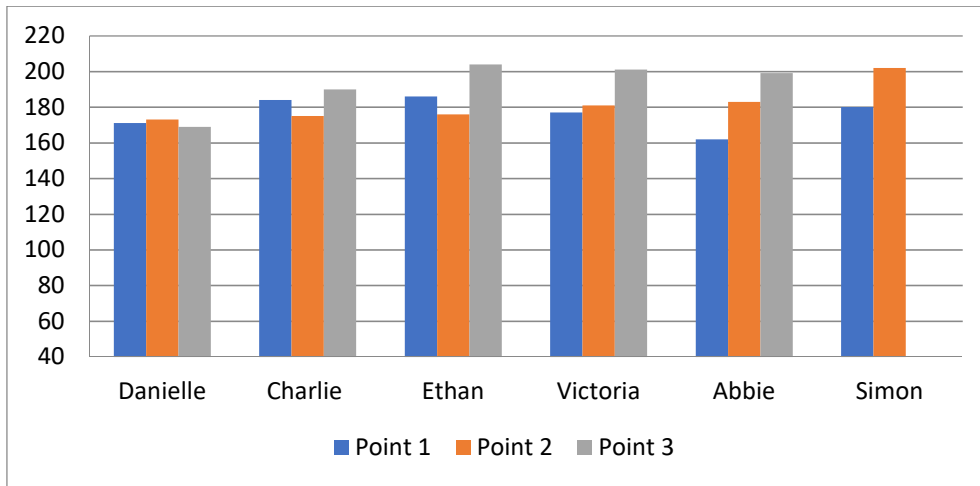


Figure 6.3: Individual student's scores: DTI total scores

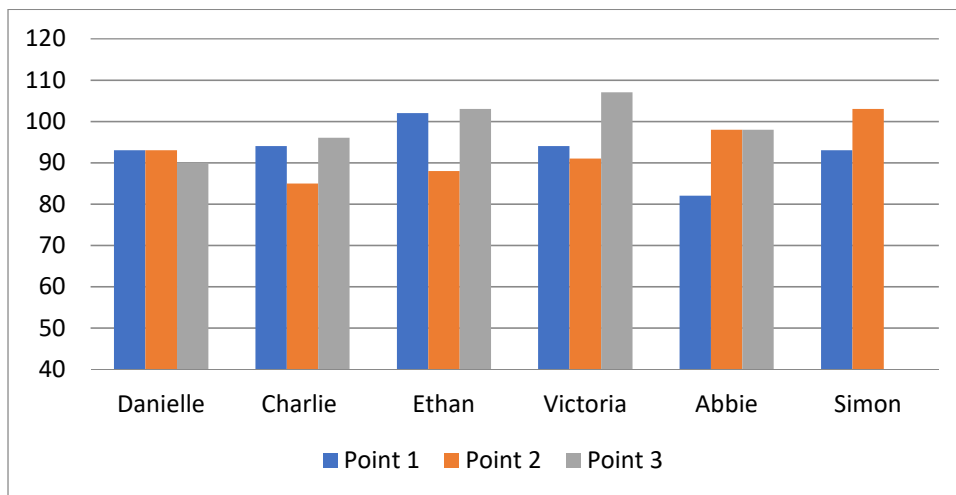


Figure 6.4: Individual student's scores: DTI flexibility in thinking scores

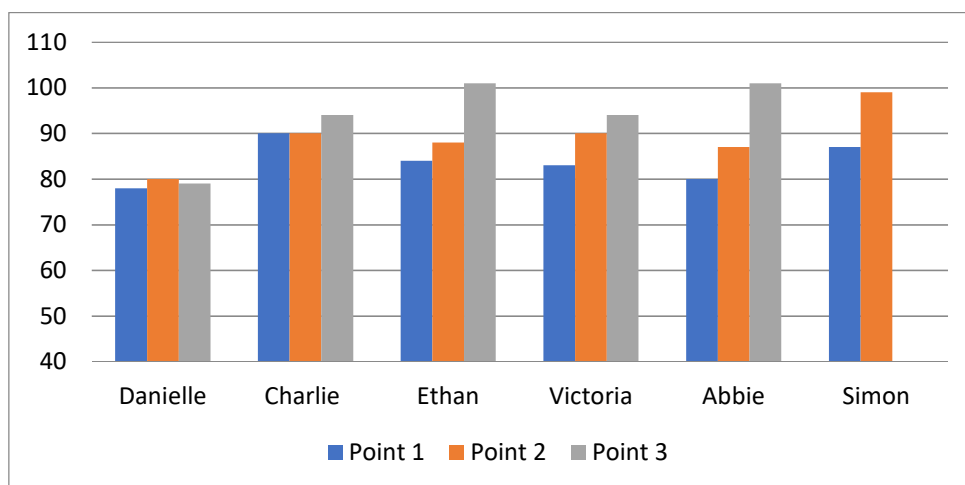


Figure 6.5: Individual student's scores: DTI structure in memory scores

Similarly, the students reported the following positive outcomes:

- 1) **Having a sense of self-efficacy**, *“I am confident that I am right, that I am able to add a real value. I am able to clinically reason decisions in my own mind which support the decisions that I made with the group. I am able to challenge the things that the group might suggest, and I am confident in doing that. I wouldn’t have been as so when I started the programme.” (Ethan, Interview2)*
- 2) **Becoming self-evaluative and reflective**, *“The master [programme] has provided me with the tools and skills to actually become aware of my mistakes and the ways that I can make them better” (Danielle, Interview2)*
- 3) **Prioritising assessment and management**, *“I am consciously thinking a lot more about should I really start off all the standing stuff, or should I start with what I feel definitely needs to be tested: my shoulds, my coulds, as opposed to just testing everything” (Abbie, Interview2)*
- 4) **Advanced knowledge base**, *“I started using things like ‘hats’¹⁶ I never used before; like anxiety and depression. I am just like: I think there is something going on here, would you mind telling me more about it?” (Charlie, Focus Group1)*
- 5) **Advanced communication skills**, *“They made me listen to the things the patient is saying that I wasn’t putting an interest in. I wasn’t really listening because I didn’t think that they may have been important” (Simon, Interview3)*
- 6) **Managing complexities**, *“I consider far more hypotheses now than I would have before. Just thinking about the knees now, I could think of so many potential different diagnoses and ways to test them.” (Danielle, Interview2)*
- 7) **Personalising management**, *“You got to spend much more time and effort in your subjective assessment, to try and really understand what is going on with the patient; because every patient is different. And really trying to tailor the specific treatment or advice or education or whatever you’ve chosen to do to fit that patient.” (Victoria, Interview3)*

The following chapter demonstrates how the programme drove these changes.

¹⁶ Frames of reference

Chapter Seven: Programme structure and pedagogy

7.1. Introduction

The data reported in this chapter addresses two of the research objectives, in terms of 1) examining how an MACP approved musculoskeletal physiotherapy programme advances clinical reasoning skills, and 2) the potential of the programme in enhancing the professional learning of participants. Programme pedagogies that supported professional learning and the advancement of clinical reasoning skills are reported in detail. Thus the chapter addresses the concerns raised in the literature regarding how professional development activities achieve planned outcomes (e.g. Rogers, 2008, MacLeod, 2016).

Four conceptual categories that reflect the shared beliefs and experiences of the programme lead, educators, students and the researcher's observations were inductively constructed (Figure 7.1). Discrepancies between the participants' perspectives were explored whenever they occurred. Consistent with Charmaz's (2014) suggestions, the title of each of these categories offers an understanding that best reflects and effectively describes data within it. Moreover, using the gerund form of verbs for naming subcategories is meant to preserve the programme processes and participants' actions throughout the duration of the study. The definition of subcategories is summarised in Table 7.1.

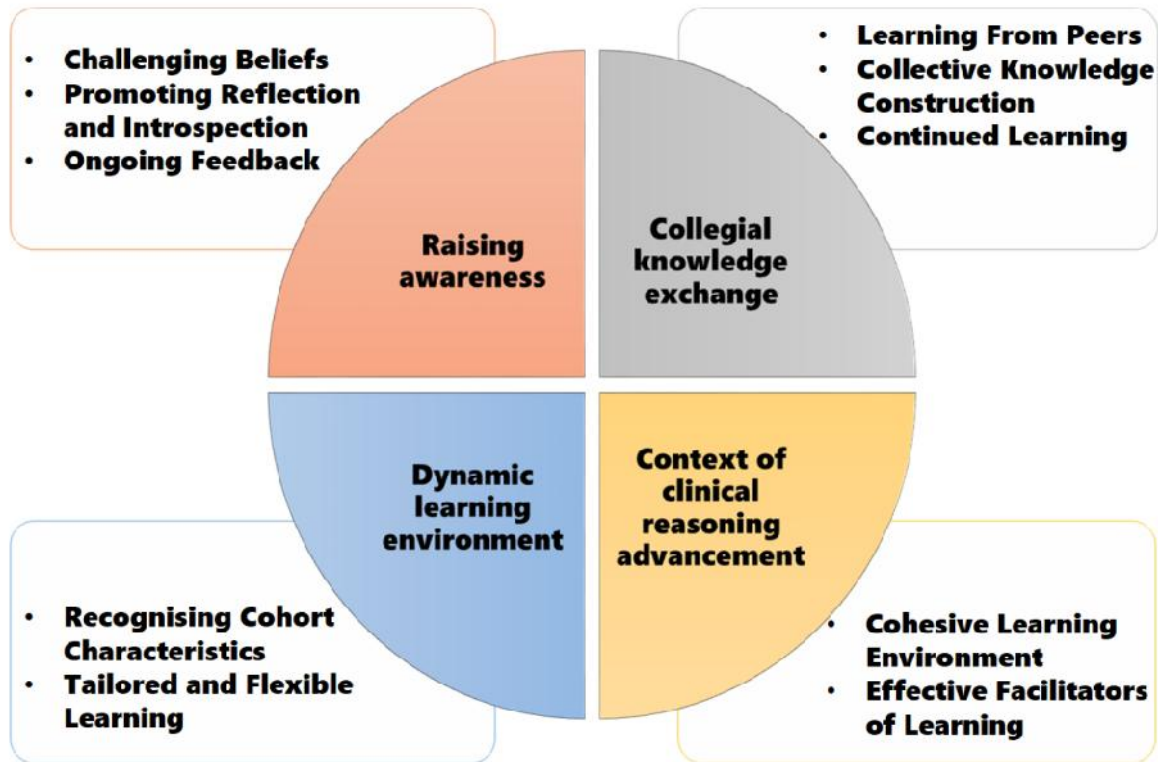


Figure 7.1. Depiction of the programme pedagogy that support change

Table 7.1: Processes and mechanism of change - description of the sub-category

Core Categories	Subcategories	Description
Raising awareness	Promoting critical thinking and challenging beliefs	Process of knowledge deconstruction and evoked students' critical thinking and reconsideration of their model of practice (i.e. frame of reference).
	Promoting reflection and introspection	Examining prior experiences in the context of M-level knowledge and skills.
	Ongoing feedback	An ongoing process of raising awareness through comprehensive, regulatory and relational feedback.
Collegial knowledge exchange	Learning from peers	Promoting peer learning and sharing experiences and skills with colleagues and a process of passing on programme experience from one cohort to another.
	Collective knowledge construction	Making sense of the new knowledge and skills in pairs, small groups, and whole class discussion and debates.
	Continued learning	Continuous process of learning engagement through self-interaction in self-directed studies, informal university discussions, and moving the conversation to workplace settings.
Dynamic learning environment	Recognising cohort characteristics	Adapting the learning environment to meet the cohort's biography, background knowledge and size.
	Tailored and flexible learning environment	A personalised learning culture that meets students at their level and negotiates their learning needs.
Context of clinical reasoning advancement	Cohesive learning environment	The cohesion across and within programme modules supports learning transition through graded exposure.
	Effective facilitators of learning	Educator's preparation, attitudes and behaviours that support synergistic interaction with adult learners at an advanced level of criticality.

7.2. Category 1: Raising awareness

The category ‘raising awareness’ describes processes through which students were exposed to a new level of knowledge, thinking and model of practice that supported the advancement of their clinical reasoning skills. These processes started early and continued throughout the lifespan of the programme. Students became aware of the level at which they needed to work and therefore altered the way they approached their practice. As an outcome of raising awareness, the students began to reconcile and develop personal and professional identities. Within this conceptual category, three subcategories are encapsulated, namely:

Promoting critical thinking and challenging beliefs

Promoting reflection and introspection

Ongoing feedback

The definition and characteristics of these subcategories are considered in detail in the following sections.

7.2.1. Promoting critical thinking and challenging beliefs

The evidence suggests that multiple activities in the programme challenged the students’ beliefs regarding patient care and management. This was particularly evident during in-class discussions and assessments of patients. The students were encouraged to consider an alternative frame of reference or to generate more hypotheses. In other words, the students become aware of either new knowledge or the presence of errors in their clinical reasoning processes, as demonstrated in the following data extracts.

The educator challenged the widely-known impingement theory, which is based on the biomechanical model. The educator grounded the claims in research evidence. The educator admitted that this current evidence goes against his/her previous practice and teaching. The students were then asked to discuss in groups the presentation of 4 shoulder pathologies. [...]. After 10 minutes of students’ social and interactive discussions, the educator highlighted specific areas that the students did not consider in classifying patient presentations. (Researcher’s observation, 6 January 2015)

Because the problem with those errors [in clinical reasoning skills] is that students don't see them as errors until we challenge them to think about it. In some of the tasks that I give them, students don't do the task well; and that is intentional. Then, what we would do is talk through what they could have improved in the way they did that. For example, the symptom chart I said earlier on; they will start off, and I will give them five minutes to generate hypotheses and then I'll go around the groups to 'say how many hypotheses have you got'? It might be 2-3 and I say alright you should all be above ten [hypotheses] by now, so take another five minutes to get above ten hypotheses. (Educator)

Promoting critical thinking and challenging beliefs moved the students out of their comfort zones. Nonetheless, both the students and educators perceived it to be positive because of bringing awareness of advanced levels of clinical reasoning skills and enabling the development of students' frame of reference. Some examples are: 1) promoting clinical reasoning within the biopsychosocial framework; 2) promoting thinking within a patient-centred care framework; and 3) moving students away from technical rationality to considering professional artistic practices such as creative practice and embracing uncertainties. The following extracts highlight these points.

They need to be able to justify it from an evidence-based perspective and to critically justify selection of the management approach within a biopsychosocial framework. (Educator)

What the patient expresses has to be factored in, because ultimately if the patient does not buy into our view of their problems, the chances of us being successful getting concordance and being able to assess the changes. I think it possibly becomes limited. (Educator)

Now, you just think: well, if that's a 30% psychogenic, then I can actually address psychogenic in my treatment and justify it; rather than see it as 'there is no need to worry about that'; or 'that is not my arena'. (Danielle, Focus Group1)

When we worked together, [other students] started doing these assessments which were not from the book. [These assessments] were a little bit modified. Also, they created some specific exercises that may be patient specific and pathology specific. This helped me to be more creative in that sense. (Simon, Interview3)

One of the tools that facilitated the transition into these frames of reference was the continuous challenge of the students' thoughts and asking why they were thinking the way they did.

They do what they do in practice, but then someone is watching them and says: why did you do that; what information did that give you; and how did you use that information? So, that is the challenge that you need to get deeper into the different components. (Educator)

It's like what [educator] said. Explain why you do it, and try to consider everything in a lot more detail before going straight away and saying it's the ankle or it's this. You have to look at it in the wider context. (Abbie, Interview2)

Moreover, as an indication of awareness of the advanced level of skills, the students were encouraged to challenge their educators as well. This created an emancipatory learning environment.

If they challenge me, they will also challenge themselves, and they can challenge each other. And if they keep asking why, then they will go away and find out. (Educator)

We challenge everything. This week, we have been together [in an optional module]. I'd loved if you've watched us on a film [and see] how we were in the first week compared to how we are now. Because we just sat there and we were just like: 'But why? That's rubbish; that can't be true.' We do it to each other. We do it to [named educators] now. I think it shows that we are just a lot more critical in everything that we know. (Ethan, Focus Group2)

In summary, the findings suggest that longitudinal engagement in critical thinking and challenging beliefs extend and redefine students' working paradigm i.e. frame of reference, thus developing the students' personal and professional identities. These critical discussions advance students' higher order thinking skills, which enables the analysis of patients' presentations from various perspectives of clinical reasoning.

7.2.2. Promoting reflection and introspection

In seeking to develop the students' personal and professional identities, the programme supported examining their experiences in the context of M-level advanced knowledge and

skills. This pedagogy included: students' self-assessments such as SWOT¹⁷ analysis; educator-led interactive discussions, writing reflective journals, summative assessment in the forms of a viva voce examination and seminar presentation. To bring about awareness, these activities started early and continued throughout the programme.

The philosophy all the way through is to get [students] to think about what they do know, what they don't know, and how they are going to improve their knowledge. (Educator)

In the following extract, Ethan describes how the programme made him aware of the limited knowledge he had.

After being qualified for [a number of] years, you are quite confident in your ability; but I think on reflection, some of that is probably misplaced. If I look at what I know now and what I knew then, I thought that I knew quite a lot then, and in fact I knew absolutely nothing. And now, I know a lot more, but in the grand scheme you know even less because there is always more to know. (Ethan, Interview2)

The students' reflection on previously managed cases facilitated a critical exploration of the theory that underpinned their clinical reasoning. The summative assessment in the form of seminar presentations of case histories is a good example.

Initially, you get taught the different clinical reasoning methods and the models. But in the whole way through, they [educators] were bringing it back to that type of clinical reasoning. And I think the best example of that was the presentations that you sat in. There was a big emphasis on being able to demonstrate the clinical reasoning that you use and support all things, reflect on why you'd better use a different method... (Danielle, Interview2)

They got 30 minutes to present a case. They can choose any [...] case they've seen previously or someone they've seen alongside the programme. [...] They need to highlight something within the case that they want to get the group to discuss and explore. That's a way of getting the depth of analysis. There are two key things that we are looking for in the presentation of the case. One is the clinical reasoning processes and their evaluation of that. So, it is not that we are looking for the perfect case. I often say to them: it is easier to present a case that you managed very badly and then analyse it. So then start to bring in the theory and bring in the depth of analysis. And the other thing we are looking for is their use of evidence. So, the clinical reasoning theory to support the case, but also the

¹⁷ Strengths, Weaknesses, Opportunities and Threats.

evidence of effectiveness, for example, for interventions to support the case. (Educator)

Therefore, reflection facilitated raising awareness through analysing errors in clinical reasoning, as well as thinking of strategies to avoid these errors in practice.

It is looking for students to self-assess, self-evaluate and make some kind of judgment around their level of knowledge and skills, their current level of practical application, the scope of their practice. And these include looking at their own disposition to learning, their own preferences in terms of learning and the particular context in which they are working. (Educator)

Danielle clearly demonstrated a reflection on her history taking. She included new insights that she'd learnt from educators, like considering the Plantaris muscle as a source of pain. Danielle included and communicated some information about it. She made reference to errors in clinical reasoning that included limited consideration of patient lifestyle and individualising management. Therefore, she was in a position to self-critique and accept feedback on her practice. (Researcher Observation, 8 September 2015)

Being embedded in social practices within the programme, the students were in a position to reflect and think in response to interactive discussions with educators and peers. This indicates a social dimension of reflection.

Because one of the difficulties with clinical reasoning [is that] it is something that any clinician would say they can do. But it is trying to identify [that] there is a lot within the clinical reasoning process; is there any room for improvement? And that is the bit that needs a bit of probing to try and identify what those issues are. (Educator)

At this very early point in the programme, the educator advised the students to evaluate their practice. The educator directed them towards considering changes to their patient evaluation techniques. For example, how they use the Visual Analog Scale (VAS) for Pain. Also, encouraging them to consider triangulating different sources of information to help in establishing the severity of patient symptoms. For example: work, sleep, VAS and medication. (Researcher Observation, 24 September 2014)

Also, programme documents such as the module's marking grid (Appendix 7.1) were communicated with students which facilitated the process of reflection. The following is an extract from an educator's correspondence, encouraging students to use the marking grid to assess themselves and their peers.

The marking grid I am using for the mini seminars is attached. You may wish to use this for your own self-evaluation or peer assessment. (Educator, Canvas correspondence)

In summary, reflection and introspection facilitate comprehensive recognition and understanding of clinical reasoning errors and knowledge gaps.

7.2.3. Ongoing feedback

Ongoing feedback raised the students' awareness of their level of clinical reasoning skills.

The main source of this feedback was the formative and summative assessments embedded in the programme.

It is feedback on what they have done. And [we] also give them constructive feedback around how they can develop further. (Educator)

The programme's learning culture supported relational feedback. In other words, the feedback was not a unidirectional transmission of knowledge. For example, during the mentored clinical practice, students were given weekly feedback and a negotiated action plan that enabled them to overcome gaps in their knowledge and errors in their clinical reasoning skills. In the following extract, a clinical educator describes the content of feedback given to a student in the first week of the mentored practice.

This is a record of feedback for week two: [the student needs] to reduce [the] assumptions and to go into more details, to question more, to reflect in action, to follow pathways to negate or prove hypotheses, [to have] knowledge of systemic diseases, [and to] identify percentage of genics¹⁸. So, these [are the] goals for the next week. (Educator)

As students became aware of the importance of this feedback, their defensive attitudes decreased. Therefore, feedback contributed to their awakening and integration of knowledge and skills in practice. The following extracts provide evidence of how

¹⁸ An abbreviation used by the students and educators to describe the body tissue that produces or cause the patient's pain, for example using 'myogenic' to refer to a muscular origin of pain.

accepting feedback initiated the students' professional learning and advancement within the programme.

People are no more defensive now. Whereas in the first [patient assessments], I was a little bit defensive and a bit cautious ... People will not say anything that make them look stupid; whereas now, everyone just chats. I think it is a form of thinking: "why not"; and then you see where it goes. (Charlie, Focus Group1)

You grow a thick skin quickly. You don't take it hard. You don't get put down by it. You look at it as constructive criticism, rather than being upset with the feedback. You think: right, these are the areas that they [educators and peers] have seen that I need to work on. I am going to go away over the next couple of evenings and [I will] make sure I target those areas. Whether when I am talking to another classmate or reading some research or whether going back to the lecture notes, or ask other tutors. You improve on your errors or weaknesses. (Danielle, Interview3)

Also, as an outcome of perceiving the importance and relevance of feedback in advancing knowledge and skills, the students actively sought it from educators and peers, and integrated it into their practice.

If there is something I don't understand from a patient or there is a complex case, I am like: right, these bits work; but that bit, I just don't know what's going on here. I try to inform myself or ask my peers. (Victoria, Interview2)

The following is an observation of peer feedback during an informal interaction between two students preparing for a module viva voce.

Danielle was reflecting on an old case she managed before the programme. Ethan started asking her questions about why certain things were done, and how the programme would change management plans now. Ethan also advised Danielle to include thoughts around 'yellow and black flags' and the weight of genics in her reflection. (Researcher Observation, 05 March 2015)

Moreover, the educators' feedback served a regulatory purpose that augmented self-assessment and self-evaluative activities. For example, the preparation for clinical mentorship involved the development of a learning contract in which students documented their intended learning outcomes. If those intended learning outcomes did

not match the requirements of M-level education, the educators would negotiate it with students.

The guiding role of the mentors starts before the placement. They look at the learning contracts and say [to some students]: Well, actually, you are not being critical enough. (Educator)

Their [students'] appreciation of the learning contract at the start isn't always as much as we would like it to be. So, it is seen as the process. But, actually, they need to use the information from [an educator's] module to inform the scope of their learning contract. We give them feedback to make sure that the learning contract does allow them to achieve what they want to achieve through the placement. They can develop the learning contract. They can change it if need be through the placement. (Educator)

In summary, the findings in this section indicate that educators' and peers' feedback raises awareness of the clinical reasoning levels of students. Feedback gives students targets to achieve through the programme and therefore it keeps students motivated and engaged in the learning process.

7.2.4. Summary of category 1: Raising awareness

The findings in this category convey that raising students' awareness is critical in advancing clinical reasoning skills. They highlight that students' acceptance and motivation to engage in these processes facilitates a learning transition. In other words, students' awakening and convergence into the culture of M-level education facilitates effective learning transition and advancement of clinical reasoning skills. The following is a summary of these findings:

-) Ongoing feedback, reflection, and challenging students' frame of practice facilitate awareness of errors in clinical reasoning skills.
-) Students' engagement with the culture of feedback is an outcome of perceived importance and relevance in advancing knowledge and skills.

-) Developing or altering frames of reference facilitates the development of students' personal and professional identities.
-) Reflective practices need to incorporate critical thinking within a new frame of professional knowledge.
-) There is a social dimension of reflection. Educators and peers facilitate reflection within the new frame of reference which refines and directs students' thoughts.

7.3. Category 2: Collegial knowledge exchange

The category 'collegial knowledge exchange' constitutes a conceptualisation of the social and interactive nature of the programme's environment. It relates to the processes through which students share knowledge and externalise tacit knowledge as part of the programme. It suggests that collegial knowledge exchange is a critical component of advancing clinical reasoning skills, not only in terms of offering insights into peers' experiences but also in facilitating knowledge transition, integration and a comprehensive understanding of patients' presentations. Therefore, it is interconnected with the category of raising awareness. This category encapsulates three main subcategories, namely:

- Learning from peers
- Collective knowledge construction
- Continued learning

The definition and characteristics of these subcategories are considered in detail in the following sections.

7.3.1. Learning from peers

In this section, peer learning refers to sharing knowledge and experiences with colleagues. It also describes the process of passing on programme experience from one cohort to

another. Peer learning was particularly evident during in-class interactive discussions, the self-directed studies and the mentored clinical practice. There was a recognition that students had a wealth of clinical experience to share. For instance, in-class observations consistently yielded evidence that after introducing a certain musculoskeletal disorder, an educator would ask the students to discuss how they would manage it in their workplace settings.

Students are exposed to a range of educational strategies ... obviously lectures that look at advancing knowledge ... but also the critical discussion and social interaction ... we anticipate that students will learn probably 40-50% through their engagement with their peer group or with the other students. (Educator)

As a result, sharing these experiences facilitated knowledge transition and integration into practice. At procedural level, the programme facilitated the students' collaborative learning and enabled them to externalise their tacit knowledge and experiences in a horizontal form of knowledge sharing.

If it was not an interactive session we would not get to the details of what people would do in different circumstances, how they might do it differently, and how they might vary things for different patients. (Educator)

The fact that they are hearing it from a fellow student is actually a strong motivator for someone else to go and perhaps try it themselves in their own practice. (Educator)

This interaction provided students with an opportunity to bridge any gaps in their knowledge, which was particularly evident as they came from different clinical backgrounds and healthcare settings.

I think it is generally useful. I have seen my colleagues, we discussed things in classes. I do things differently. Their experience helps me to look at things in a different way. So that was a positive thing about the programme. Sometimes I felt the gap was a lot. Sometimes I felt the gap less. (Simon, Interview3)

I think even with the four of us [the full-time students]; if you got a specific question like [a named tissue] question, you go and ask Simon because in our little group he knows that. You are just aware of peoples' strengths and you kind of bounce on that a little bit as well. (Ethan, Focus Group1)

Additionally, as an outcome of the modular structure of the programme, which enabled full- and part-time students from different cohorts to register on one module, new students tended to learn and observe what the “old-timers” were doing (Farnsworth et al., 2016). Old-timers were students who had completed earlier modules; therefore, they were more familiar with the programme culture. Their contribution was evident during in-class patient assessments and the self-directed studies.

When we were doing the “manips” for the lower quadrant in our first year, the full-timers had obviously done their “manips” for the upper quadrant already. So, they were showing us some techniques for the thoracic spine when we were doing the lower quadrant in our extra time. So, there was knowledge sharing that wasn’t facilitated by the teachers or the lecturers. (Victoria, Interview3)

Also, Ethan pointed out that the old-timer students supported his knowledge regarding sources of pain during in-class patient assessments.

Ethan: The first time we did it, I didn’t really have a clue what they were talking about. The neurogenic and myogenic bits and pieces. It just wasn’t the language that I was familiar with [...] we just asked questions; we would ask, ‘okay what does that mean?’ It was absolutely fine.

Researcher: Asking the lecturers or the part-time students?

Ethan: The first thing I would ask people around me [Danielle and Charlie], then I would ask other people on the course. If none of us really knew the answer, then I would ask [named educators]. (Ethan, Interview2)

Because of demonstrating an early convergence into the programme culture (case vignette 8.5), Victoria was nonetheless in a position (i.e. power) to participate in the first patient assessment. Therefore she did not rely on this form of vertical transmission of knowledge.

Victoria: No one was that keen to do them [in-class patient assessments]. It didn’t really bother me to volunteer. I found them useful. So, I volunteered for them. Every time we did one, I think I did something.

Researcher: Why did you find them useful?

Victoria: Because they were the things that were pitched to us by the tutors as the most similar thing to what the placement is going to be like. So, I thought it is probably an important kind of situation to be part of; and trying to get my brain into the right gear in order to be able to do that on my own, or with one colleague. (Victoria, Interview3)

In summary, peer learning is a powerful tool for professional development. It enables learning engagement, externalising tacit knowledge, and informed integration of knowledge into students' workplaces. Both horizontal (from one student to another) and vertical (from old-timers to new-comers) knowledge transmission contributes to professional learning.

7.3.2. Collective knowledge construction

This subcategory relates to a collaborative and collective process of making sense of the new knowledge and skills in pairs, small groups, whole class discussions and debates. The programme supported a cooperative learning model (Johnson et al., 2014). Throughout the duration of the programme, the researcher's observations demonstrated that educators created groups of 2-4 students to engage in collaborative problem solving and critical discussion. This was always followed by a facilitated class discussion. These activities ensured a depth of understanding and advancement of knowledge.

We move the students around to make sure they are interacting with different student groups. (Educator)

You learn a lot from a lecture; but you learn equally a lot from talking about the lecture with other people. (Danielle, Focus Group2)

I always found that it's much richer to draw on diversity of experience: people from different disciplines, backgrounds [...] sometimes, it feels more helpful to have diversity in the student body so that discussions can be developed within students' responses. (Educator)

The collective sensemaking was facilitated by various interactive activities. A clear illustration is the patient assessment sessions, in which the students engaged in processes

of taking patients' histories, coordinating, planning and performing the physical examination.

One of the students would take the history, one of the students would then guide the planning stage, and one of the students would then do the physical examination. And we've got the patient there for a period of 3 hours. So, we got the ability to make it an interactive educational experience. (Educator)

I think it [patient assessment] was an interesting experience to go through, because you would be looking at everybody's different ideas about the same set of information. We are all there for the subjective [examination]; we are seeing what everyone else is talking through, what everyone's [suggested] pathology, where their weighing(s) are going to sit, and then to have the assessment objectively, and then for the lecturer, whoever was with us, to then probe it a little bit more. They [lecturer] would be like: why would you think that, what information leads you down that route? (Victoria, Interview3)

Similar points were raised by Charlie, Danielle and Ethan in the first focus group.

Charlie: I think it would probably take 25 minutes for the subjective assessment. So, one person does it, and then other people start chipping in with other questions so it will extend it a little bit, and then they call out, and then they go out, and then the planning part. We all sat there, I think we had up to an hour and it is just the planning phase...

Danielle: You could talk and debate for an extra half an hour....

Ethan: Because you just think more laterally

Danielle: You could probably sit there all day and talk about one patient and you can make it interesting ... there is so much you can go into...

Charlie: A lot of what I said in there, and then the actual assessment part: kind of the [end]. You're doing something and then will be: well, this is what I found and that we have a plan. People might start to say actually we should shift this around a little bit and change it. So, you are getting a conversation there. Then you finish and there is big discussion.

As an outcome, students were able to extend this culture of collaborative reasoning and collective sensemaking to management of patients in their workplace.

We are looking at more collaborative ways of working that involve much more shared decision making which involves interaction between patient or client and therapist. So, you're mutually coming to some sort of decision about what would be appropriate or best for that particular person. (Educator)

I try giving my patients more space to tell me what they want from the treatment and what [is] the activity that's causing them pain? So, that's something I never asked before; but actually, I found that patients are really happy about it. (Simon, Interview2)

In summary, through collective knowledge construction and sensemaking, the students start to consider a line of thought that is different from before and therefore develop a comprehensive understanding of patient presentations, as well as methods of assessment and management.

7.3.3. Continued learning

This subcategory relates to a continuous process of learning engagement through self-directed studies, informal university discussions and workplace learning. The programme structure enabled students to share knowledge beyond the point of educator-student contact. Some of this learning was purposefully planned through self-directed studies. Appendix 7.2 is a part of a module guide that constitutes documentary evidence of embedding self-directed studies in the programme structure. The programme dedicated specific morning or afternoon hours for self-directed studies that students could utilise for preparation or reviewing their practice. The following extracts demonstrate how self-directed study time was important for advancing students' knowledge.

In this self-directed practice session, there are only five students, including the four full-time students. Students are practising assessment techniques of groin-related pain. They attempted to use anteroposterior mobilisation of the lumbar spine. They helped each other to visualise the area and explain what they were looking for. (Researcher Observation, 18th May 2015)

Within the module, there are obviously learning outcomes. As a module lead, it is for me to look at what needs to be included. The included elements will range from ensuring that they develop or have the opportunity to develop knowledge through some of their self-directed activities and being aware of current evidence. (Educator)

I think the self-directed study is good if we got lots of technique that we want to practice. I do think it has its place. I think it is needed [...] We don't use it every session. I think we are using it three quarters of the time. (Abbie, Interview2)

On the other hand, issues such as commuting to university and booking a room for practice hindered university-based self-directed practice.

We [part-time students] have jobs, we have lives, and God knows what else is going on. And we also go through the programme a lot slower in time. So, we have the time. If you want to ask, we can wait for a month, or we just look it up ourselves. I can't speak on behalf of everyone, but this is what I do. (Abbie, Interview2)

It's a little bit hard because I am doing it [the programme] full time, and most of the people do it part-time. They just come here for the lectures. Sometimes we [the four full-time students] were finding opportunities to meet with each other; but it is difficult to find a moment where we are all here. And also find a place, I would say, because we are booking the room like two weeks in advance. (Simon, Interview2)

Moreover, although observations identified a fair amount of interaction using the university-based virtual learning platform (Canvas), the students preferred other platforms that were more social, dynamic and offered informal access to peers.

Ethan: For the viva, we set up a Dropbox between the three of us to just chuck stuff in ... we often email each other ... oh guys I've just read this today, have a little look. And [we have] the WhatsApp group obviously.

Researcher: Why are you using a WhatsApp group for these discussions not the Canvas?

Danielle: If you did it on canvas you'd probably take a week to get a reply, whereas with WhatsApp you get it in 5-30 seconds.

Ethan: I sent an email to the [students in 2 modules] the other day to try to collate some videos and pictures that people took. I heard nothing back. Whereas I sent out a WhatsApp [message] and I got a reply straightaway. It is more accessible. On canvas, you have to log in and take time. It is just not an appropriate format. Canvas is alright but for chatting, it is not relevant.

Charlie: I use canvas for emails to [educators] and getting lectures.

Researcher: Do you feel it is helping in your journey? These informal settings?

Charlie: Yeah, definitely.

Ethan: Just to embrace that you don't know it. Before yesterday, before today even, people were writing things that make me think: 'Oh God I don't know that!

And then someone in the group said: 'I don't know what you are talking about, guys'; you just feel [whew!] it is not just me.

Charlie: I suppose that is part of it. It is that you are reassured that you are not the only one that's confused or doesn't know something. (Focus Group1)

Moreover, since the students were not separated from their workplaces, they were able to continue their learning activities in their workplace settings. Creating collaborative and interactive learning with workplace colleagues facilitated communicating and carrying over the activities they were engaged in during in class. This was particularly relevant for part-time students.

The full-timers will get together [in self-directed studies]. The part-timers invariably won't, but their interaction is then back in their departments. (Educator)

I hope once a week, I would pick a patient, anyone, and reflect on the assessment, subjective objective, etcetera afterwards; and then get it peer-reviewed; I am guessing like my other physio, sitting in and doing the same, watching through a patient, see what they think of my assessment and stuff. Probably, this is how I would do it. (Abbie, Interview2)

Also, Charlie describes how he continued learning with his MACP-accredited workplace colleague even at home.

[We] are good mates as well. I go over to his house, and we got to watch the boxing or watch a football game, and we end up talking about work. (Charlie, Interview3)

By the end of the programme, the students were confident and empowered to engage and in open and collaborative workplace environments. As an indication of self-efficacy (Ball, 2009), they became more inclined to ask their colleagues and bounce ideas off each other in a collective process of clinical reasoning and sensemaking.

Where I work now, you don't cover the curtains when you treat or assess [...] It is all open ... I think if I had not done the masters, I would have been more worried about being judged. (Danielle, Interview3)

Consequently, some students such as Charlie and Victoria advocated changes to the nature of professional development activities and in-service training at their places of work. Unlike their prior unidirectional, lecture-style training, the students transformed their in-service training to become more interactive in nature.

It [the in-service training] used to be one person giving the presentation, couple of questions, some food and drinks, and go home. Now, everyone is chipping in. Everyone is doing it, or doing something, and then we will ask, 'how do you do it? Why you are doing it like that?' (Charlie, Interview3)

In summary, supporting continued learning facilitates a non-stop learning engagement beyond educator-student interactions. The opportunities for out-of-class learning encounters facilitate effective communication and knowledge integration into practice.

7.3.4. Summary of category 2: Collegial knowledge exchange

The findings in these sections demonstrate that collegial knowledge exchange is a core component of facilitating the advancement of clinical reasoning skills. Sharing experiences is a valuable source of clinical evidence that informs practice. The engagement in collective knowledge construction and reasoning activities allows students to externalise their tacit knowledge. It also allows students to start considering other students' perspectives in their clinical reasoning. The following is a summary of these finding:

-) Students' professional learning is a process of knowledge exchange, collective reflection and meaning-making.
-) Students are valuable sources of professional knowledge.
-) Collegial knowledge exchange changes students' clinical practice.

-) Promoting horizontal (from one student to another) and vertical (from old-timers to newcomers) knowledge transmission within programmes facilitates professional learning.
-) Collective students' discussions and clinical reasoning ensures depth of analysis and develop comprehensive schemata of different patient presentations.
-) The sense of efficacy enables students to continue learning beyond their contact with educators.
-) The opportunity to share knowledge and expertise supports the development of student voice, agency and professional identity.

7.4. Category 3: Dynamic learning environment

The category 'dynamic learning environment' refers to a learning culture that is reconstructed and adapted to meet students' needs. Teaching activities were modified to reflect the cohort's learning needs and context. It drew on knowledge and clinical examples that are relevant to students. Therefore, it facilitated students' learning engagement. Within this conceptual category, two subcategories are encapsulated, namely:

Recognising cohort characteristics

Tailored and flexible learning environment

The definition and characteristics of these subcategories are considered in detail in the following sections.

7.4.1. Recognising cohort characteristics

In this subcategory the findings related to how the programme learning environment is set up to accommodate cohort's biographies, background knowledge and size are

examined. This started before students' enrolment and continued throughout the programme. At admission, educators assessed students' prior experiences and ability to contribute to the programme learning environment.

The students have to come with some competencies. So we interview all of our applicants. They have to come with certain experience of working within manipulative physiotherapy. We expect them to come with some knowledge and skills of different paradigms within manipulative physiotherapy (Educator)

At the beginning, I thought I don't have enough experience; but then, I spoke to other people on the course; and I have been selected through an interview; so, it gives you a bit of confidence that actually you have enough experience and you know what you're talking about. (Danielle, Interview1)

This did not only ensure compliance with admission requirements but also facilitated setting the scene for effective class discussions.

We tend to know what the level we are going to be working at by the time we get to the first day of the module through those informal discussions, through [students] interviews, through their applications forms, where they have worked. We usually know from the interview what level the cohort is going to be like. We evaluate their own understanding of their clinical reasoning as part of the interview process. Obviously, for part-time students, we would have known them from the [lower quadrant] module. (Educator)

As a result, the educators were able to tailor the learning process according to the students' backgrounds.

We give every [external] lecturer a brief about what the students are like. So, they can tailor it. In some years, the group may have a lot of overseas students. Sometimes it is a group that had a lot of sports [students] in it. We would describe the current cohort as having quite a lot of people from sport; there are a few from the military; a few from private practice, and very few from a non-UK trained background. And that just gives them [external educators] a flavour of how they may want to tailor their session. (Educator)

They all have different experiences. Some might be working purely with lower back pain patients in a spinal clinic; some might be working in a sporting environment. That gives strengths but also gives areas of weakness. So, if you are working within sport, you are not going to see as many lumbar spines; and some of the issues we are talking about won't be there in sports. So, there are lots of variables within the group; and one of the challenges in being a tutor is to try and pull out the differences in a positive way and turn them into a learning experience.

So, it is good to know from the sport [students] how they approach particular situations and then we can use that as a discussion point. (Educator)

For example, the following extract highlights how a planned session on psychosocial assessment in a lower quadrant module was replaced because the students demonstrated an awareness of its content.

From previous sessions, they [the students] were very comfortable about it before they got to the session, and you can see that in their contribution. So, they knew all of the answers. All of the activities they could do very easily. It was not challenging them; and that followed through into the feedback that they were comfortable about this. (Educator)

Another example of tailoring learning was the consideration given to the size of the cohort. During a patient assessment session with a cohort of more than 30 students, the lower quadrant module leader arranged to bring in an additional patient and educator to facilitate the session.

Unlike the patient's assessment session that I observed in the upper quadrant module where they have only 16 students divided over two groups, in this module, there is an extra patient and an additional facilitator. The students were distributed accordingly into three groups in three separate locations. (Researcher Observation, 9 June 2015)

I've got 30+ students on the module. So, what we do is divide them into groups of around 10. So, a tutor would take around ten students with one of the patients. One of the students would take the history, one of the students will then guide the planning stage, and one of the students would then do the physical examination. And we've got the patient there for a period of 3 hours. So, we've got the ability to make it an interactive educational experience. (Educator)

Moreover, the educators expressed that they would be willing to split up the students after judging their levels.

If you have two students from different universities, which I had to take before, their backgrounds are very different: one is high level, so [the student] wants to be challenged at a very much higher level, and the other is struggling. I think it is very difficult to meet their needs; and therefore, I split them up. I would only observe one and then the other. (Educator)

Because the needs of the adult learners were acknowledged, adapting content was not educator-led all the time. The students were able to request exploring certain areas or practical techniques.

There was the opportunity after the lecture to have the practical room, and where possible we always ask [educators] to stay, to supervise, to give us some feedback, and to discuss problems and techniques that we've gone through that day, or the things that we're having problems with. (Victoria, Interview3)

In summary, adapting programme content based on cohort characteristics facilitates a more sophisticated level of interaction between the educators and students, and between the students themselves. This ensures that students are engaged in relevant educational activities.

7.4.2. Tailored and flexible learning environment

This subcategory refers to how the programme facilitated a personalised learning experience; in other words, how the programme met students at their level and negotiated their learning needs. Tailored and flexible learning enabled professional learning and successful engagement. It empowered students and allowed them to drive their own learning.

Being able to decide what I want to learn and what are my weaknesses gave me more ... you feel more in charge of your own learning... you feel like you can take what you want from the programme. (Danielle, Interview2)

To begin with, assignments were kept flexible to allow the students to tailor them to their own learning needs. Box 7.1 is an extract from the assignment guide of the APPPD module, which demonstrates how flexible and tailored learning characterised the programme's learning culture.

The aim of the assignment is to examine past, current and future personal and professional development in the form of an individual development plan. The assignment brief remains sufficiently flexible for individuals to decide the focus and direction of their work. This will vary according to the various factors influencing developmental and learning needs (e.g. context, role, proposed career development etc...). There is no prescribed structure or form for the submission but clearly it is useful to produce a document that proceeds in a logical and coherent manner.

Box 7.1: Module assignment brief depicting flexible and tailored learning culture

The students expressed similar views about their ability to tailor their learning.

I think it [the reflective essay] made me personally reflect on where I was at in my career, how I got to where I was and how I wanted to progress to the next level. I was aware of what I needed to do. Just going through the process and seeing that in writing gives it a little bit more structure to future things. It was quite helpful. (Ethan, Interview2)

If you were told that you had to do this, then you are not going to have the same motivation to do it. So, you will not get as much from the situation. But being able to choose the case that I want to reflect on enabled me to look at an area of weakness, or an area of interest that I wanted to improve [on] further. (Danielle, Interview3)

Additionally, students had the opportunity to negotiate the place and time for the mentored clinical practice. For example, one of the students negotiated the need to engage in the mentored clinical practice before completing all modules because of travel arrangement.

Personal needs have to be taken into account, particularly when you have got someone who is a mother with childcare responsibility; but ultimately, it's also about finding the right match because all of our mentors are of different characters, and some might work better with some students, some work better with others. Also, the location where you have got students who have previously failed and you are looking for placement for them, you got to be again very mindful of who they are going to, how supportive they are going to be. (Educator).

Moreover, the mentored clinical practice was tailored to cater to the students' limitations in areas of clinical reasoning, such as history taking or physical examination.

At the beginning of clinical placement, they may only be seeing three or four patients a day; and then what happens depends on their needs. If their need is lots of assessment, the mentor will then tailor the learning to the requirements of the students. (Educator)

I think that if you have certain preparation and you go for your clinical placement... in my case, there were some basic issues that needed to be addressed. This took a little bit of time; and then we worked for the general part of it, like clinical reasoning etc. [...] And the general rules of clinical reasoning are going to be the same, but the mentor will suggest you focus more attention on different aspects that you didn't think of before. (Simon, Interview3)

Furthermore, the educators negotiated learning by drawing on personal learning outcomes. For instance, the students had the opportunity to negotiate their learning outcomes for the mentored clinical practice by writing learning contracts.

To me that's about benchmarking. So, they are coming in at the beginning, they are trying to self-evaluate their own capability, and then through having an awareness of what is the destination, what are the goals, then they would be able to reset some of the goals they want to achieve over the course of the programme. (Educator)

Finally, the students were able to choose optional modules. Due to the fact that they worked or planned to work primarily with elite athletes, three of the four full-time students chose to take an advanced sport-related module (Field note, 03 July 2015). This kept the students motivated and their learning relevant to their practice.

Students on the programme have a choice of an optional module. They can personalise their overall aims of the programme based on their choice. So, some students choose skill-based modules like acupuncture, injection therapy, some choose a research module, some choose sport science modules; it may be psychology, nutrition, metabolisms. So, it just gives them a way to further tailor the overall programme to their aims. (Educator)

In summary, tailoring the learning experience facilitates constructing knowledge that is personally relevant to the students within the frame of advanced musculoskeletal physiotherapy practice. The elements of social negotiation of the learning process empower the students and developed their agency.

7.4.3. Summary of category 3: Dynamic learning environment

The findings in this category highlighted the importance of a flexible and personalised learning environment in driving professional learning. The following points summarise these findings:

-) Recognising learners' biographies and prior experiences augments their motivation to participate in professional learning.
-) Tailored and personalised programme pedagogy promotes students' agency.
-) Personalised learning empowers students to be active contributors to the learning.
-) Recognising students' 'voices' maximises their readiness for advanced practice roles.
-) Negotiated learning facilitates the construction of knowledge and skills that are relevant to practice.
-) The flexibility of programme structure in recognising different fields of interaction supports knowledge integration.

7.5. Category 4: Context of clinical reasoning advancement

This category relates to programme constructs that supported professional learning and the advancement of clinical reasoning skills. These constructs impacted the students' perception of an effective learning environment. This category encapsulates two main subcategories, namely:

- Cohesive learning environment
- Effective facilitators of learning

The definition and characteristics of these subcategories are described in detail in the following sections.

7.5.1. Cohesive learning environment

This section comprises an examination of how the structure of the programme and the planning of sessions supported the student's synergistic interaction and learning transition. The cohesive structure allowed for continued learning engagement. The students were able to integrate the knowledge and skills constructed in a module into subsequent ones. Opportunities were given to integrate this knowledge throughout the interaction across lectures, assignments and the mentored clinical practice.

I don't feel that I ever gone into a module and thought: God, I have to start from scratch. So, the research methods underpin that one of the upper quadrant formative assessments. I just nicked references from that and use that there; and I took that theme and that underpins something else. So, you are not trying to re-invent the wheel every time you are writing an essay ... you just pick bits that you've already read. (Ethan, Focus Group1)

I think, being a part-time student, you get the research methods and A PPPD [a module name] as the first modules in the first term, and that sets you up nicely in terms of what is expected in the practical components; and obviously, it helps you with your dissertation as well, in terms of your literature review etc. So, I think having done it part-time, I quite liked the structure of it. I think it flowed quite well. The assignments were relatively spaced out. So, from my point of view, it worked quite well (Victoria, Interview3)

At the session level, the preparation and planning for sessions ensured a cohesive learning process that was aligned with contemporary learning theories. This started with pre-session activities that provided direction of what readings to explore. This also made the students' aware of the level of delivery of the sessions.

I preferred the way they set out the pre-work on the upper quadrant module. They gave us those questions, a set of 5-6 questions and then you go and research on it; whereas, in the lower quadrant modules, it was more of: read these five articles. (Danielle, Focus Group1)

The [preparatory] questions make it clinically relevant for them to think about their own practice, because it is all about them, and them tailoring their learning. So, for them to think about their current approach, they will come in with a mindset of thinking: this is what I do; this is why I do it. Then they're happy to engage in an academic discussion with someone talking about new or novel ideas. (Educator)

Box 7.2 is an extract from a session study guide of the AMP1 module, which suggests students to reflect on their assessment and management in preparation for the session.

Preparation for session
<ul style="list-style-type: none">• Critical reflection of your current approach to assessment and management of the foot and ankle• Key reading detailed below• Reflection on the principles of technique to allow adaptation of these principles to the foot and ankle region

Box 7.2: Module session study guide brief depicting cohesive learning through preparation

The sessions were followed by activities and reflections that facilitated continued engagement and learning transition.

I always put [a post-session activity] on the end slide of the power point. It is showing them how they take what we've done further forward. So, it might be applying what we've talked about on a different case. It might be going away and practising some skills. It might be trying to change their interview technique as part of the history to see if this changes data. It might be working on their individual planning sheet to try to ensure that they've got PROMs¹⁹ within it to avoid the errors. (Educator)

The cohesive learning process extended to the programme's virtual learning platform, which contained module-related material and a recorded lecture. Therefore, the students could continue their learning beyond educator-student interactions.

I am a big fan of the Panopto [a lecture recording system], and all of the canvas guides, lectures and PowerPoints because it was really a nice thing. It was really useful for the clinical placement as well to go back and listen to lectures to clear things up. Because sometimes you can read and read and read and read and it won't go in, and you need another way to learn. So, listening to those lectures is almost like a podcast, really. It was really, really useful. And especially for people who couldn't attend those days; they found them quite helpful. (Victoria, Interview3)

¹⁹ Patient Reported Outcome Measures

Finally, although the availability of external educators, after their contribution, was raised as an issue by one student, the programme showed coherency in planning follow-up sessions facilitated by the module leads.

We recognise the need for experts to come in and deliver some of the specialist knowledge. How we do that is that [educator] and I form a thread through the upper quadrant and the lower quadrant modules. So, students may think that the lecture has not been relevant; but that is then for us to pick up on within other sessions. (Educator)

Simon: I found the availability of the staff on the site good. So, if you have got a question for any of the teaching staff within the university, that is fine, they are within your reach. I sometimes find the external lecturers that come in – they did it at times – but if you got questions specifically about components of what they taught you, you don't really have access to them.

Researcher: So, what would you do regarding this issue?

Simon: Speak to [the module lead].

Researcher: How is that helpful?

Simon: [The module lead] tries to clarify things from her point of view. (interview3)

To summarise, the programme's cohesive structure ensures a continuous learning process. It also facilitates students' convergence into the learning environment. The findings suggest that professional learning is more than student-educator interaction. Material features such as programme coherency and ease of access to knowledge facilitates students' development.

7.5.2. Effective facilitators of learning

This subcategory encapsulates the level of preparation, attitudes and behaviours of educators that enabled them to effectively engage students. In other words, it relates to how educator's attitudes and competencies achieved the programme learning outcomes and supported the students' transitions. The findings indicate that educators who attended to the needs of adult learners were effective facilitators of learning.

To begin with, educators were in close contact with the students. They offered their time for meetings and tutorials based on the students' requests. They usually joined students during their self-directed activities. The educators' availability facilitated access to the knowledge and skills needed for clinical reasoning. It engaged the students in the learning process.

The students have the ability to approach me outside of the module for any individual support. A reflective learner, for example, might not be able to raise a personal issue within a session, but they are very happy to come and find me afterwards and talk through a particular issue. So again, we're sensitive that people learn in different ways. (Educator)

Ethan: To be fair, other than living hundreds of miles away, [educators] have always got their doors open so we can always catch them. They reply to emails at silly O'clock at night. So, they are really accessible.

Charlie: Or Saturday or Sunday

Ethan: Yeah, exactly right. I think they are really supportive, because we are effectively working seven days a week doing something on this master's. And it is, you never feel like, Oh, [sigh!] I've got to wait for Monday to find out an answer. (Focus Group1)

Also, educators who facilitated a transactional dialogue (Brookfield, 1986) were thought to have excellent pedagogy, particularly when their session was underpinned by a theoretical background and critical interactive discussion that drew on students' viewpoints and interpretations.

I think the lecture that [educator] did on the [medial, the lateral and patellofemoral] ligaments was really good. The way [the educator] presented the slide was: this is what is wrong; why is this? What can we test? The "so what" kind of things. The way [the educator] presented that lecture was how you want to do it in practice. (Abbie, Interview2)

Moreover, students preferred educators who closed the gap between theory and practice and therefore brought authenticity and relevance to this learning culture.

And then also to have that clinical educator there [at university], you know what level ... I mean; they say it is the level that you need when you go on placements.

So that [interaction with a clinical educator] has given me a good idea of where I need to be with my clinical reasoning by the time I get to placement. (Victoria, Interview2)

Sometimes you get lecturers who academically are clearly absolute geniuses and they publish like 50 papers a year. They can't hold a conversation and they don't know what physio is really like in the real world. They are not engaging [us]. The things they are talking about are not necessarily clinically relevant to us. (Ethan, Focus Group1)

Furthermore, in line with the programme's philosophy, the students favoured educators who facilitated critical interaction. In other words, educators were expected to encourage critical discussion instead of delivering content and giving them easy answers.

If students want to be taught, they don't have their Masters. They don't have a postgraduate mind if they just want the answer. To give somebody answers does not enable them to challenge their thought processes. (Educator)

According to the session study guide, the aim is to critically explore the components and effectiveness of a [physiotherapy] approach to assessment and management. The external educator kept on delivering content about the method itself without actual critique. It was prescriptive in nature. Students did not have the chance to critique the classification in the approach. Having done the formal training, I would say the level of the session was undergraduate. Informal discussion with Charlie and Danielle after the session revealed that they were disappointed about the level of the session. (Researcher Observation, 01 May 2015)

Rather than just talking off a PowerPoint, they [good educators] get you interacting with either practical stuff or with debates, or elements where you are not just sitting. (Victoria, interview2)

As a result, module leads ensured that all the educators were prepared to teach at M level and to interact with adult students.

What we need to do is to prepare [the invited educators] to teach at master's level. So, they need to know the philosophy of the programme, what we are aiming to do, and they need to know how to deliver at master's level. (Educator)

We ask every educator to prepare a study guide which has learning outcomes, preparatory readings and preparatory questions. Unfortunately, not all of the educators either get it to us early enough or get it to us in a clear way for students to access it. (Educator)

At the same time, critical discussions were embedded in a humanistic approach to learning.

If somebody is really frightened, they are not ... nobody works well under fear ... fear of failure, fear of looking stupid, fear of being made a fool. They are here to be challenged, not to be humiliated. (Educator)

Finally, acknowledging the educators' advanced level of specialist knowledge and clinical reasoning skills motivated the students to become part of their community. In other words, it facilitated professional identity development.

The programme exposed me to experts in the field: [educators named], the different lecturers who were coming in, and where I went on placement. To see all those practitioners motivated me to then want to be like them. (Danielle, Interview2)

In summary, to ensure positive learning outcomes, educators need to create a dynamic learning culture that facilitates the development of students' personal and professional identities. They need to provide an authentic learning experience that closes the gap between university and practice and assume a facilitation role that engages students in professional knowledge construction.

7.5.3. Summary of category 4: Context of clinical reasoning advancement

This category related to the context that supported the advancement of clinical reasoning skills and professional learning. The following points summarise these findings:

- J Coherent pedagogy ensures learners' development and learning engagement.
- J Learning extends beyond students' socialisation into educator's guided thinking and knowledge construction before, during and after learner-educator encounters.
- J Students' sense of belonging to a professional learning community drives successful learning processes and professional identity development.
- J Educators' synergistic interaction supports a thread of coherent pedagogy that ensures learners' development through the programme.

) The convergence of external educators with the programme philosophy determines the level of pedagogical coherency. They need to buy into the learning culture to ensure effective learning outcomes

7.6. Chapter summary

In this chapter the findings related to the programme's structure and activities were reported. It offered in-depth exploration of how these activities supported professional learning and led to the advancement of clinical reasoning skills. A close interconnectedness was identified between raising students' awareness, facilitating collegial knowledge exchange and providing a flexible learning experience within a context of cohesive structure and educator's support. In the next chapter, individual student vignettes are presented in an attempt to map-out how their biographies' and learning depositions influenced professional learning and the advancement of clinical reasoning skills.

Chapter Eight: Students' vignettes

8.1. Introduction

In this chapter, a cross-case analysis that draws on students' vignettes is presented to demonstrate how students' learning dispositions and biographies influenced engagement and interaction with the programme. The chapter sheds light on an interesting feature within each case. In this way both the risk of presenting overly detailed accounts that burden the reader and the risk of losing the richness associated with qualitative data is circumvented. Thus, examining each students' sensitive experience was an aid to interpreting actions and occurrences, and clarified influential variables in each student's context (Barter and Renold, 1999).

8.2. Danielle [A case of 'accelerating' professional development]

Danielle was the least experienced student in the cohort in terms of clinical mileage. She thought that the programme would be a pathway to accelerating her professional development. Her case demonstrates how the learning culture can support professional learning irrespective of her limited clinical experience. Danielle's motivation for M-level education was augmented by being a graduate of the same university in which the programme was presented. Therefore, she was already socialised in the culture of the department. She had preconceived ideas about the educators' expertise and the nature of the learning environment.

I know how good is the learning environment here; and the lecturers are the best. I thought it is the best place to do it [the Masters]. (Interview1)

Danielle's motivation to accelerate her professional development was conflicted with her limited experience. At the start of the programme, she did not think this limited experience would impact on her engagement in the programme activities.

I've only been qualified since [few] years. I don't consider myself an expert. But you see time is not the driving factor. It is how hard you work. I think by doing this master's I'll be accelerating my years in terms of... well, some people might work 6-7 years but they won't have the knowledge that I have... I don't think they are worth less but they are not knowledgeable like me. (Focus Group1)

However, by the end of the programme Danielle expressed that an experience of more patient cases could have further facilitated her engagement in reflective activities and interaction with peers.

I [would] just liked to have [had] more experience before I did the master's, because then I would have more knowledge; and therefore, I may take different things from it. (Interview2)

Moreover, because of being a full-time student, Danielle did not engage in clinical work during the programme. Nonetheless, she thought that the programme structure enabled her to engage in authentic learning activities. She was able to integrate the advanced knowledge and skills during in-class patient assessments, the mentored practice and the self-directed practice with her peers. Therefore, these activities bridged the lack of integration into workplace experience.

I suppose because I was not working full time, those sessions with other people on the course were even more valuable. It provided an opportunity to practise things as real as I can create. (Interview3)

Danielle's case also demonstrates that changing beliefs and assumptions can drive professional learning. Unlike her undergraduate degree, in which she also engaged in reflective activities and writing learning contracts, Danielle believed that putting these activities in the context of professional learning highlighted their importance and she therefore engaged more in developing her practice.

Before the master's, I did reflections, I did learning contracts; it was more as something I was expected to do rather than an opportunity to actually develop myself. Whereas the learning contract that I wrote for my placement has been really helpful and the [reflective] essay I wrote has been helpful as well in terms of putting on paper what sort of path my career will take; and how I see myself thinking about improving things. (Interview2)

As a sign of convergence with the programme culture, Danielle particularly appreciated how the educators encouraged her to speak her mind and to demonstrate criticality in communicating thoughts.

They would not say this is what you must do, you ask a question and they like, you tell me and they make you think out loud. And then without realising you are answering your own question. (Interview3)

This process of developing Danielle's voice gave her more confidence at the new workplace that she joined after the programme. She considered this workplace challenging since she was involved in the treatment of elite athletes as part of a rehabilitation team. She therefore valued the importance of being able to speak her mind in front of doctors, athletic trainers and other more experienced physiotherapists.

It increased my confidence in speaking up what I think. So, another good example when I worked at the NHS, everyone treated behind the curtains. And it was very much you are hiding behind your curtain; whereas now, where I work, you treat in an open space, everyone treats next to each other, and you can see what each one is doing. (Interview2)

The programme culture also impacted her ongoing professional learning. In her new workplace, Danielle started engaging more in interactive discussions with workplace peers instead of sole reliance on reading papers, as she used to do before the programme.

I think if I'd come into this [workplace] environment having not done the master's, it would be a shock to my system when someone started challenging me and asking me questions. I would get quite defensive. (Interview3)

In summary, in spite of having limited experience, Danielle was able to accelerate her professional development through a combination of internal motivation, changing beliefs and having a supportive learning environment. The programme structure enabled her to engage in authentic learning experiences. The safe environment also empowered her to become a critical thinker. Therefore, she continued advancing her clinical reasoning skills in an open and challenging workplace environment.

8.3. Charlie [A case of motivation to practice through professional development activities]

Charlie was the most experienced student in this cohort. He had engaged in many physiotherapy professional development activities. He got to a point where he was “about to start redoing courses”. According to him, these professional development activities kept him motivated for practice. Thus, he started the master’s programme. However, at the start of the programme he held assumptions that blocked learning engagement. Multiple unstructured observations identified Charlie as a silent student who did not participate in class discussion in spite of his many years of experience. He acknowledged this in an informal conversation. He lacked the confidence to share his wide experience with his peers.

I can honestly say I always looked down on myself ... I was being told by other clinicians that I underestimate myself. (Interview1)

However, as he became familiar with the programme structure, his learning dispositions changed. The programme’s safe, non-judgmental learning culture drove the confidence to interact and to share thoughts with peers and educators. Charlie believed that accepting this challenging learning culture changed him.

I think the thing was I was worried I would embarrass myself; and now I am not worried about that [...] If you put yourself into a difficult position and you realise that is not going to kill you, and it will make you better, then suddenly, it becomes much easier to accept ... If you never played [a sport], and you’re going to your first game, you’re going to be nervous, you think you would get hurt, you think you would do something wrong, [you think] you would drop the ball; but then you drop the ball, and you realise it is not the end of the world; and everyone else drops the ball. (Interview3)

He attributed this change of beliefs to the conversational nature (i.e. transactional dialogue) of the mentored placement.

I quite liked it because we came out, and we talked about [the patient]. It wasn’t that we were told what to do; we were being questioned and asked if there was a

better way; and saying: 'Have you thought about this?' if you didn't think of something. It was very much a conversation rather than someone actually dictating to you. (Interview2)

This safe learning environment extended to the sense of having peer support.

They [peers] pushed me on. It wasn't competitive between us in practice. It was always collaborative. I think it is the best way to put it. I think if you get into a group... I can see this sometimes happening where I have seen this kind of attitude: trying to score points off each other. I think this can be quite destructive. I think the people that I was working with were very much like collaborative. (Interview3)

Another example of how the programme changed Charlie's beliefs and assumptions is the expression of concerns about his inability to break the routine practice he had developed over the years. As he exited the programme, he admitted that he would still be using the same pre-programme assessment and management techniques. Nonetheless, because the programme advanced his frame of clinical reasoning, his interpretation of those techniques had changed. For example, if the patient was not improving, he would question himself sooner instead of doing a variation of the same treatment for three consecutive sessions.

I would say that I changed; maybe the structure; I question myself earlier; why I am thinking what I am thinking, have I misdiagnosed, if I misdiagnosed let's re-assess, what is the sensitivity and specificity of the tests? (Interview3)

Charlie believed that changing his frame of clinical reasoning (i.e. frame of reference) was a source of motivation for clinical practice and lifelong learning. By the six-month follow-up he had started working with a team of elite athletes in addition to maintaining his pre-programme private practice activities. He was also keen to start his own practice within a few months.

Now I feel okay, yes, I am learning something ... It has been a full 13 months so far and it kept me interested, as it were. So, instead of doing a course for a week and keep you motivated for a short while, this has been much more of an ongoing thing. (Interview2)

With my private practice – when I get one – I will not work as long hours. I would have a maximum of 10 patients a day. It is a number where I know I am still okay. I can still clinically reason things through. (Interview3)

The programme had an impact on Charlie's professional learning, which indicates a continuity of the programme's educational message. He changed the way he approached his professional development activities. He was motivated to engage in M-level modules as a source professional development because of the high level of criticality associated with it. He advocated changes to workplace in-service training, which became more interactive. Due to his sense of empowerment, Charlie engaged more in collegial knowledge exchanges and challenges, which indicated a movement into the centre of the workplace environment.

Before the programme, I might have been standing back-ish if I saw someone who had a stronger opinion. Now I think I would be more willing to be devil's advocate and question it; and say 'why do you think like that?' [...] I am more confident now to question something, so even if it is a doctor. You know doctors are supposed to be way up there, above the physio. If the doctor says something, I've got a little bit more confidence to say: 'Why you are doing that?' Like a shoulder surgeon. I would write a letter saying, 'I appreciate that this is going on, but I think whilst this is impingement, I think if we improve this and this and this, we could resolve the symptoms or get him to a point that we don't need to operate.' (interview3)

In summary, Charlie's case demonstrates that learners' dispositions can influence their engagement despite having extensive experience. As his learning dispositions changed, Charlie became more confident, engaged in interactive discussions, and motivated to continue his professional development. Such changes are an outcome of the safe, non-judgmental and conversational nature of the programme.

8.4. Ethan [A case of extrinsic motivation for professional learning]

At the start of the programme, Ethan had no explicit learning needs or expectations regarding the nature and the structure of the programme. His motivation to enrol in the M-level education was an outcome of career development plans. He had five years of

experience, which, according to him, meant it was just the right time to do the programme. Although Ethan did not have any expectations regarding the programme, his learning disposition allowed him to converge into its culture soon after enrolment. His transformation was attributed to awareness, social interaction, reflective activities and the tailored learning process.

As an outcome of having reasonable experience, Ethan had a '*misplaced confidence*' in his knowledge and the clinical reasoning skills he had developed over the years. As soon as he was socialised in the programme culture, he became aware of his knowledge gaps and errors in clinical reasoning.

The first time I did it [in-class patient assessment], I didn't really have a clue what we were talking about: the neurogenic and myogenic bits and pieces. It just wasn't the language that I was familiar with. (Interview2)

Ethan's awakening indicated a convergence into the programme culture. He attributed this transformation to his critical engagement in debates with peers and educators within the safe learning culture.

We just sit there and we just say: but why? That can't be true! And we do it to each other and we do it to [the educators] now. I think it shows that we are just a lot more critical about everything that we know. (Focus Group2)

He developed an attitude of acknowledging knowledge limitations, which led him to comfortably engage in critical conversations with his workplace colleagues after exiting the programme.

I am quite happy for the fact that I don't know the answers which are bounced around, and they [workplace colleagues] would do the same with me. I've worked there for 6-7 months now, so I think we kind of know what the other ones might have a bit more knowledge in. It is being kind of comfortable in the fact that we don't need to know everything, and just to ask questions. I think the course definitely supported that bit as well. (Interview2)

Moreover, his exposure to many patient presentations before the programme put Ethan in a good position to engage in reflective activities. For example, he ‘enjoyed’ the reflective assignment because it provided him with a structure for his future development.

I think it was another cog to facilitate reflection. When you sit down and do that essay, you reflect massively on what you have done. I thought it was really worthwhile. But at the time it was tough. (Interview2)

This facilitated transformative changes in becoming a critical practitioner who is able to justify his practice and drive his own learning.

But then after the first month of that when I realised that [the educator] would always kind of ask me why I needed to think of that first. I started to realise that when I write, [the educator] or someone is going to ask me why. And you just settled to answer your own questions. (Interview2)

Therefore he was able to maintain a high level of criticality in his workplace environment.

I am making sure that I’m not leading. I am making sure that when they give me an answer, I ask questions to support or negate a hypothesis down all avenues. I am thinking of, not just the knee, I am thinking the hip; the back; and the ankle that could contribute to that pathology. (Interview2)

Moreover, negotiating and tailoring the learning experience supported Ethan’s transition. His plans after the programme involved joining a physiotherapy team that is specialised in a particular area of the body. During the mentored clinical practice, Ethan negotiated attendance of the assessment sessions of a therapist and a surgeon specialised in that area. This enabled him to have an in-depth understanding of an area-specific methods of assessment and management.

I’ve never really done it. I thought it was good opportunity. We spent the morning with a therapist who all she sees is [this area]. You can see how they assess and treat. It was nice. I got a job starting in two months. I’ll see these types of injuries potentially. (Informal interview during mentored practice)

In summary, Ethan’s case demonstrates that even if there is a perceived lack of specific learning needs, synergistic learning dispositions enable learners to converge with the

programme culture. This enables them to embrace the programme's learning opportunities. Early convergence with the programme culture makes it possible to sustain changes beyond the point of exit.

8.5. Victoria [A case of convergence before starting the programme]

Unlike Ethan, after close examination of several M-level programmes, Victoria purposefully chose to come to this one. She had nine years of experience. Having gone to almost 'all' professional development courses and workshops, she described dispositions that were consistent with adult education in terms of being self-directed and willing to share thoughts and experiences. At the start of the programme she demonstrated some understanding of clinical reasoning and how peer interaction facilitated learning. Therefore, this early convergence enabled her to actively engage in the programme activities at early point.

You know life is busy but I try to read journal articles. If there is something that I don't understand from a patient, or if there is a complex case, I am like: 'Right, these bits work, but that bit – I just don't know what's going on here.' I try to inform myself or ask my peers. I would say: 'Look, I've got this case, this bit goes really well and these symptoms are settling down but he is still presenting with this'. And I've just tested it. You synthesise what you have done, almost like a tick box. You've done that, you've excluded that, you don't think it is that. Now what you are left with is this ... so, for me, clinical reasoning is much more of a process rather than a single point in time. (Interview 1)

Therefore, going through the M-level programme was more of identity development than changing identity. By the end of the programme, Victoria described learning dispositions that were similar to those she had when she started.

I think I am a new improved version of myself as a physio. I don't think I've changed identity. I was quite a hands-on physio before. I was quite into my clinical reasoning, I think the programme just honed it for me. (Interview 3)

Moreover, unlike what is expected from students in her position, she actively participated in the very first patient assessment at the university in the hope of being better prepared for the mentored clinical practice.

No one was that keen to do them [in-class patient assessments]. It didn't really bother me to volunteer. I found them useful. So, I volunteered for them. Every time we did one, I think I did something. (Interview 3)

Similarly to Charlie, Victoria's professional learning became more collaborative. While this demonstrated a continuity of the educational message in her workplace, it was possible because of her position in overseeing in-service professional development activities.

We do quite a lot of in-service trainings at work. I slightly changed how we run them. It used to be led by one person. To get more people involved, we would take a topic, so for instance we are doing an [X topic]. Instead of someone leading that, everyone has a particular [area of the topic] to go and research the most relevant or recent information on that, and then present that back to the group. So rather than having one person to do it all, we are actually incorporating everyone. (Interview 3)

Contrary to the abundant time that some of the other students enjoyed within their workplace, Victoria was concerned with the time available to integrate the M-level knowledge and skills into individual patient sessions. She remarked on this often throughout the programme, as well as three months after completing the programme modules. Although she achieved a more efficient and effective practice by decreasing the number of sessions needed for patient management, Victoria was reluctant to ask for more session time. Nonetheless, the evidence suggests that she continued her commitment to professional learning and integration of the advanced knowledge and skills.

I am just about to go on an [X] refresher course. You know, to keep your skills up to date. I'm using my clinical appraisal every year to try to set out timelines for my CPD over the year, and really try to keep to them. Because I think as a clinician, our CPD time is the first thing that tends to be eaten up ... I don't get

protected study time²⁰. So the motivation to keep up to date has to be purely from me. It is in my own time that I am doing it. (Interview 3)

In summary, the case of Victoria is that of a confident student who had a wealth of previous experience before she enrolled in the M-level programme. This enabled her to participate fully in the programme. Her position in her workplace made it possible for her to continue the pedagogical activities she had learned from the programme. However, the limited time in the workplace interrupted the process of integration.

8.6. Simon [A case of delayed convergence]

Simon is a non-UK trained physiotherapist. He described the educational system in his home country as a form of a prescriptive curriculum that does not promote critical thinking. The scope of physiotherapy practice in his country prevented him from trying to differentially diagnose cases. However, out of inner motivation, he continued his professional learning, pursuing specialist musculoskeletal certificates. He had been working in private practice in the UK for one year before starting the programme. Being the only physiotherapist in his private practice, Simon recognised how isolated he was. Therefore, the programme was intended to support his professional learning.

When I arrived to private practice in England, I have self-referred patients, and I didn't know what was wrong with them. So I was reading on my own and try to discuss it with my colleagues to try to improve my skills in that sense. That was the reason that brought me to the master. I really needed to learn how to do this thing. (Interview3)

However, at several points in the programme, Simon expressed 'negative' thoughts and attitudes about the structure of the programme. He did not understand why the educators were focusing on advancing clinical reasoning skills instead of advancing manual skills, as he had expected. Also, in spite of describing himself as a self-directed learner, he

²⁰ Throughout the duration of the programme, according to Victoria, the protected study time facilitated engagement in reflection and integration of programme activities during the programme. But it was limited afterwards.

expected that the programme would be unidirectional, as his undergraduate degree had been. He was reluctant to participate in class activities due to fear.

It's really frustrating because you are not coming from nowhere. You have a style. You have some things that are important for you, and to completely change those is frustrating. (Interview2)

However, as he engaged in the programme, Simon highlighted the importance of those conversations with the educators and his peers as a way of raising his awareness of knowledge gaps. This sort of interaction impacted the way he perceived clinical practice and professional development.

I would say the lecturers and discussions with peers have pushed me the most. I could see the gap. I do this thing in this way; everyone do it in another way. Some lecturers show you how to approach things, like clinical tests. That makes you think differently. (Interview2)

The change was further augmented by the personalised mentored practice. He explained that this was the point at which his critical reflection was advanced the most. His mentored practice followed a one-to-one model of mentorship. Although he thought that it would be a good idea to have another student with him so that they could discuss their cases together, this tailored mentored practice enabled him to comfortably share his thoughts with the mentor without the risk of being judged by other students. Considering his limited experience, Simon felt that this was a valuable method of developing his reflective practice.

Considering my background, which is quite different from the others, I had a more tailored approach. Being the only one there with my mentor; and not having to share my doubts with 300 other people made me comfortable. I think it worked very well from that sense. Because sometimes when I am with my peers, for example in class, I try to avoid saying some doubts that I have. (Interview3)

By the end of the programme, he attributed transformative changes to the programme structure, which enabled him to think creatively and critically, and confidently share his thoughts with others.

I mean if you feel less confident, you want a very supporting environment, or a prescriptive one, because you would feel that you are in your comfort zone. Probably the programme helped me to think out of the box. I would say, 'Okay, I want to go out of my comfort zone a little bit more.' And I did! (Interview3)

He was confident about his skill and ability to work in challenging environments.

Over there [in the new workplace], you have a big caseload, and also quite a lot of complex cases, which is interesting. You want to be challenged. From a clinical perspective, I am very happy. (Interview3)

In summary, Simon's case demonstrates that convergence with a programme culture could be delayed by the learning disposition of a learner. Moreover, it is evident that the programme's flexible learning culture could facilitate students' transition into adopting new learning dispositions, thereby maximising the learning transition.

8.7. Abbie [A case of the influence of workplace culture on engagement]

A combination of internal and external factors motivated Abbie to enrol in this programme. However, the social structure of her workplace was her prime motivator.

I think particularly in my environment, the demand we have makes you have to make sure you know that you are getting it right, and you question it all the time, because you need this person to be fit very quickly. Because if they can't pass this, they can't do that [...] you have to know you are getting it right. And also, you have the doctors coming down on you to ask you questions about 'why you have not tested this? Why have not you done that?' (Interview1)

Moreover, her workplace facilitated knowledge integration and internalisation. She described similar processes within the programme that supported the advancement of her clinical reasoning. For, example, she acknowledged the important level of support she received from the programme educators.

They are always available if you need them. They are good from that point of view. You can pick up the phone, you can email them, and you can sit down to have a chat with them. When we are actually in the lessons, they are always available to us, to chat to, to speak to. So, I think they are doing 95% of what you want already. (Interview2)

Similarly to other students, Abbie had attended many of the available physiotherapy professional development courses. However, she perceived them as lacking relevance to her practice. According to her, they did not challenge her clinical reasoning because of their prescriptive, uncritical and unengaging nature.

I've done lots of short courses. I've done lots of 'mobs', 'manip', Mulligan... It was good; but I did not think ... It wasn't advanced enough ... not advanced enough is not the right word; but it just did not give me that kind of reasoning. It was very prescriptive, and I think I want to provide the best possible care for my patients. (Interview1)

Therefore, the need for a professional development programme that would stimulate her thinking was the driver for doing this particular programme. Internally, Abbie felt that engaging in the programme would enable her to answer some of her questions about the effectiveness of the service she delivered.

Sometimes you just do it. You don't really figure out why something goes wrong. You need to know why it keeps on happening. You want to know why instead of keep repeating it. (Interview2)

Abbie believed there was a strong congruence between her expectations and the programme. She chose the programme because of the sense of convergence between the programme's MACP approved status and her expectation of advancing her problem-solving skills, management of complexities and structuring her thinking, which would enable her to deliver better patient care.

I think [this] MACP programme is one of the best there is. I think it is very challenging. It demands a lot of reasoning out of you. In this programme, you will be questioning yourself a lot more. (Interview1)

This strong sense of relevance was influenced by having workplace colleagues who had completed MACP approved programmes. Therefore, she had a pre-existing awareness of the level that she needed to demonstrate.

The current people whom I work with are 'very' MACP; they are very clinical; they have a very set way of doing things; and they do clinical reasoning from what

I think is very well. And I think this partly influenced me to get to this programme ... They critique themselves quite a lot; and it works very well; they make you question what you are doing all the time. (Interview1)

This awareness inspired her to actively engage in the programme. She acknowledged the importance of integrating self-assessment and reflective activities into her practice to advance her clinical reasoning skills. In contrast to Victoria, she was in a position that allowed her to see only a few patients per day, which gave her more time for both reflection in-action and on-action.

I go through my notes. I sit down and go through my day and really, really reflect on the patients that I have seen on the day. I sit down and ask: 'Why? What went well in that clinic day? What didn't? Why?' I always mind-map it a bit and then I have a think about why I did what I did. 'Do I need to do more reading on that condition? Do I need to spend more time?' etc. I think the programme definitely helped me to do that. (Interview2)

This was augmented by the time luxury at her workplace, which enabled her to practice the critical thinking skills she had developed over the course of the programme. The following extract indicates Abbie's response to the question of whether her workplace environment supported continuing critical thinking and reflective activities.

I think I can now, now I am in charge, do it a little bit more because I can set my own time. I found I do it a little bit more. I think I will never have enough time in the day to do everything that I always want to do, but I have found more time to do it now. And now I am seeing the importance of it more and more, I have put more time aside to do it. (Interview2)

Finally, going through this experience contributed to the development of her professional identity and self-efficacy that was associated with flexibility in thinking, generating multiple hypotheses, prioritising assessments, developing effective management plans and effective communication.

I think [the programme] made me look at things a little bit more. I never went and said that I'm a great physio. I know this and that, but I think it made me realise that there is so much to develop. There are different ways of looking at things that maybe I've missed [...] I think it changed the way I look at things, the way I read, the way I go about my practice and the way I re-assess. I consider things a little

bit more, I keep things quite broad now, for longer time, and I always question myself [...] I am able to start the treatment in the first appointment. I give the patients more specific treatment, and also [I am] being able to explain to them specifically what's going on. It is definitely beneficial for the patient. They are getting better quicker. (Interview2)

In summary, Abbie came into the programme motivated by and with an awareness of the level that she needed to demonstrate in terms of her clinical reasoning. Her workplace structure and demands, along with the positively-perceived programme pedagogy, facilitated her engagement and advancement of clinical reasoning skills.

8.8. Chapter summary

This chapter comprised a presentation of how students had different motivations for joining the programme. It highlighted how students interact differently with the programme's structure based on their learning dispositions and workplace structures. It illustrated that workplace structures influenced their engagement in learning activities and their ability to integrate the newly-learnt knowledge and skills. In the next chapter, the model of a culture of convergence and synergy offers an understanding of advancement of clinical reasoning through the learning culture of an M-level physiotherapy programme. The model conceptualises the relationship between students, the programme and the wider context.

Chapter Nine: Advancing Clinical Reasoning Skills through a Culture of Convergence and Synergy

9.1. Introduction

The model of “*A culture of convergence and synergy*” (see Figure 6.1) was briefly introduced in chapter six. In this chapter, an in-depth analysis of the model is offered to “weave the fractured story back together” (Glaser, 1978, p. 72). The synthesis of this model represents an abductive form of analysis to offer theoretical explanation of why the interaction between various levels of influence in the learning culture mediated the advancement in clinical reasoning, thus it answers the study’s fifth objective. Whilst the study did not aim to produce a model that can be generalised across all MACP-approved M-level programmes, it does offer opportunities for educators in similar contexts to relate to the findings and to examine their own practices in their programmes (Flyvbjerg, 2006, Smith and Caddick, 2012). Educators are also likely to recognise how synergy and convergence in the learning culture can be the driver for advancement in clinical reasoning skills. They can see the challenges in their own context and start to plan actions that overcome sources of conflicts and divergence. Finally, in the presence of limited theory about the processes and context of advancing clinical reasoning skills at M-level education (Rushton and Moore, 2010), sharing the experiences of students and educators through this model contributes to the wider healthcare literature. This offers possibilities of training practitioners who are better able to provide safe, efficient and effective level of patient care.

The four conceptual dimensions of the model, namely, reflective practice, authenticity, motivation and identity reconciliation are examined in this chapter. These dimensions represent the social structure that mediates the advancement of clinical reasoning skills.

Enacting these four dimensions at the micro, meso and macro levels supports professional learning. At the micro level, the process of change involves knowledge exposure and construction, awakening, integration and internalisation. These processes are driven by student-centred and educator-supported learning at the meso level. At the macro level, the model demonstrates that students' learning of clinical reasoning is also mediated by a wider workplace culture, external regulatory, educational and governmental policies. In particular, it is mediated by their ability to support continued learning. also, the model suggests that temporal, spatial and relational factors need to be accounted for when examining professional learning. To ensure an in-depth process of analysis in terms of capturing the complexity of the learner's transition, multiple models are embedded within the model of convergence and synergy.

Since individuals are “active meaning-makers and constructors of their knowledge from what they experience” (Billet, 2014, p. 7), it reasonable to start by analysing students' experience of knowledge transmission as a base for advancing clinical reasoning skills at the micro level. This experience began with exposure to new knowledge as well as assessment of existing knowledge and frame of reference (Mezirow, 1997), which created awareness of knowledge gaps and stimulated critical thinking. This developed frame of reference offered an alternative scope of practice that underpinned the students' clinical reasoning skills. The integration of M-level knowledge and skills into authentic clinical experiences inside and outside of the programme supported internalisation of knowledge.

9.2. Learner's individual processes: from knowledge exposure to internalisation

Exposure to new knowledge and an M-level scope of practice initiated a cyclical process of awakening, integration and knowledge internalisation (Figure 9.1). This evolving process was mediated by ongoing processes of reflection, authentic integration,

motivation and identity reconciliation. In the following sections the characteristics of each of these processes are examined.

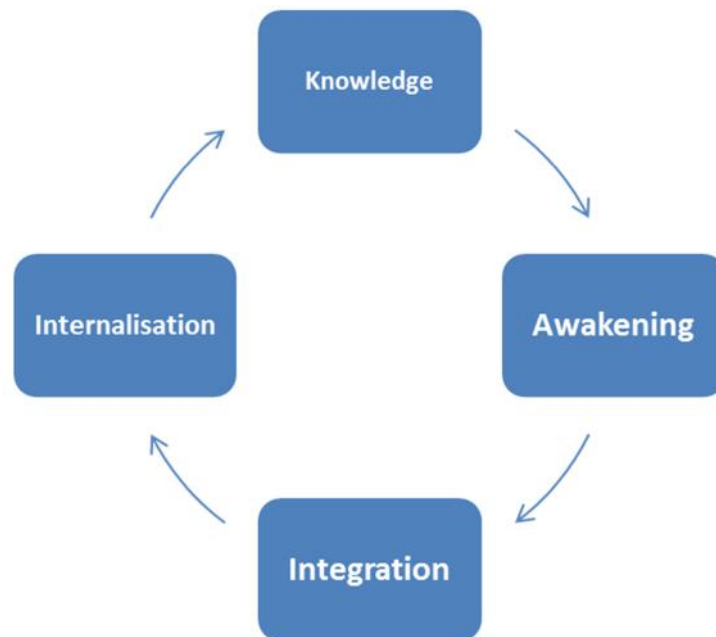


Figure 9.1: Process of change: advancing clinical reasoning through processes of knowledge construction, awakening, integration and internalisation

9.2.1. Knowledge Exposure

The model of knowledge transmission (Figure 9.2) shows that professional learning was more than a linear process in which educators were attempting to introduce external propositional knowledge into the students' places of work. Instead, this model of knowledge transmission suggests a dynamic process of learning that is co-constructed, reinforced and mutually negotiated. The challenging nature of M-level education and the need to meet the standards of clinical practice were recognised, particularly the value of practice-based evidence in preparing practitioners to manage uncertainties (e.g. Bohlinger et al., 2015). Because of this theoretical underpinning, the learning was underpinned by the explicit and tacit dimensions of knowledge of the students and educators.

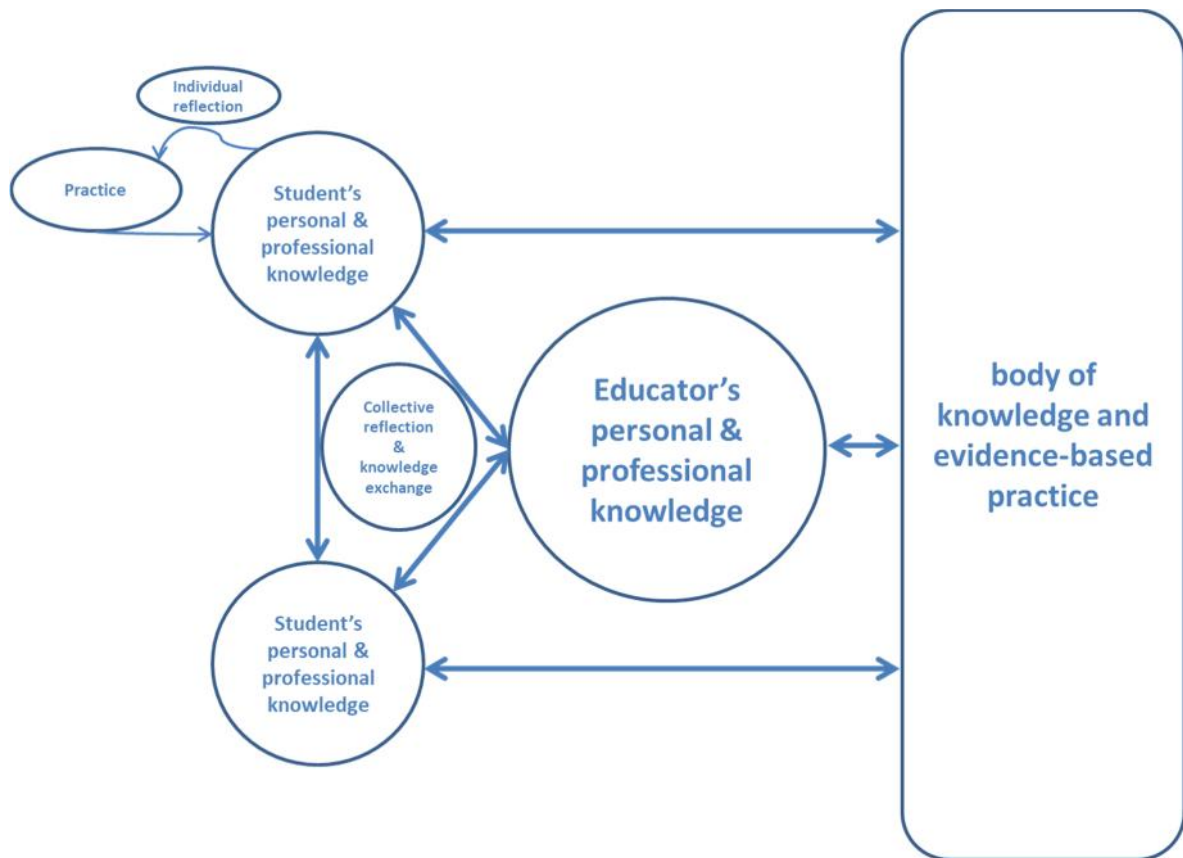


Figure 9.2: Model of knowledge transmission

Individual and collective processes of reflection supported knowledge construction. In addition to evidence-based propositional knowledge, the students' personal and professional knowledge constituted the basis of shared and negotiated student-student and educator-student interactions. This facilitated drawing on multiple sources of knowledge and a critical analysis of experience, as highlighted in section 7.3.2.

The mock patient that we saw a couple of times helped in terms of working as a group. It is always good to have more heads than just yours, and to see how other people reason around it. (Victoria, Interview2)

The programme culture supported this student-centred learning. The educators worked as facilitators who modified the nature of interactions to ensure that the knowledge and experiences brought by the students was considered. The educators were selective in introducing knowledge that was relevant to the students' personal and professional biographies, yet within the frame of an advanced level of knowledge. Therefore, the

knowledge transmission model indicates that knowledge construction is emergent in response to the nature of cohort interaction. This flexible structure of the programme personalised the learning experience.

Other times it might be trying to get an example from the group; and then use that as a learning point. (Educator)

In summary, this model of knowledge transmission suggests a dynamic process of learning that recognises the individual student's contribution and the influence of the learning culture in driving critical analysis though drawing on multiple sources of knowledge.

9.2.2. Learners' awakening

The second part of this cycle of clinical reasoning advancement was students' awakening. Drawing on the work of Ball (2009), the findings highlight the importance of awakening as an important concept in driving professional learning, identity reconciliation, and convergence to the programme's intended learning outcomes. As the students became aware of gaps in their knowledge, they started to take action to change their practice. As detailed in section 7.2.3, this was associated with decreasing defensive attitudes and accepting feedback from educators and peers. In so doing, the students started to consider the new knowledge and frames of reference offered by the programme, such as considering a patient-centred practice within a biopsychosocial framework of clinical reasoning. This process of awakening is depicted in Figure 9.3.

They need to prove that they are clinically reasoning during their subjective and objective [examinations]; they [need to] choose the treatment according to their findings, and justify why; and if they miss anything, they would come back and say: I should have done this... I missed that ... As long as they know what they have not done or know what they should have done, that is fine ... We are looking at the bigger picture. (Educator)

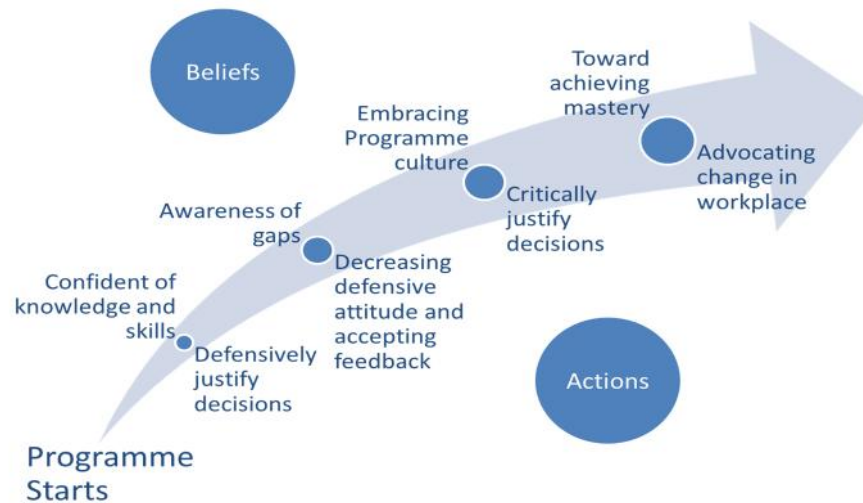


Figure 9.3: Process of awakening in a challenging learning culture

During the early phases of the programme, advancing clinical reasoning skills was not an explicit aim for most of the students. Also, some of them were not aware of the nature and structure of M-level education in terms of its challenging, interactive and collaborative culture. For example, Simon did not perceive the importance of thinking within a new frame of reference and Ethan had defensive attitudes because of a confidence in his level of knowledge and experience had been constructed over several years. With exposure to the programme’s learning culture (i.e. philosophy and intended outcomes), they became reconciled to its challenging, critical and collaborative nature and therefore engaged more.

When we first started, sometimes when people [educators] asked you ‘why’ constantly, it’s like: [in anger] you know why, I don’t know why, just tell me the answer, or tell me where to read it. It was really annoying! But now, I’ve embraced it. I am like okay, well, I know I am going to be asked ‘why’ on that thing I’ve just read; so, I will ask myself ‘why’. I am going to find out why before I give it to you. (Ethan, Focus Group1)

The concept of awakening was associated with the programme’s safe learning environment as indicated in Charlie’s case vignette (section 8.2). As such, students’ awakening motivated them to initiate transformative changes.

I find those kinds of paradigm shift of individuals incredibly rewarding, because you can see that it actually gives them [the students] some affective joy, they get excitement, it fires them up, they get a passion and that to me is the driver, the motivator for lifelong learning. (Educator)

The impact of the students' awakening extended beyond the lifespan of the programme. Ethan and Charlie described how embracing the challenging and critical nature of M-level education was helpful for lifelong learning. They were motivated to engage in standalone M-level professional development modules instead of other forms of professional development activities, which indicates an acceptance of its challenging and critical nature of this level of education.

Charlie: I think I might do more modules as well, not always at [this university] but I think...

Ethan: Yeah, M-level modules

Charlie: Yeah M-level study rather than just a generic course.

Ethan: I agree. (Focus group 2)

Also, the students were aware of the mastery level they had achieved. Danielle, for example, expressed a preference to work in an open, interactive and challenging workplace. As such, they started to advocate changes in their workplace environments, and to make in-service professional learning more collaborative, interactive, critical and tolerant (section 7.3.3).

You would rather work with someone that you know would probably disagree, than someone who just accepts everything you say. (Danielle, Focus Group2)

In summary, students' awakening was an important phase for them to initiate transformative changes. It preceded the integration of knowledge and skills, and supported the development of personal and professional identity, which changed how they clinically reasoned.

9.2.3. Knowledge Integration

As a consequence of their awakening, the students started to integrate the newly constructed knowledge into practical experiences. The most distinctive programme feature that facilitated integration was offering relevant and authentic learning experiences. Also, all the students except for Danielle had the opportunity to gradually integrate knowledge and skills in workplace settings while studying. Drawing on the concept of praxis, in which actions are informed by reflection on theory (Huber, 2011), the integration of knowledge was the connection that contributed to identity reconciliation.

When we were doing those [patients assessment] sessions, they [educators] are like: right, take the time, sit down, and plan, look at your hypotheses, look at your kind of genics, and all that kind of stuff. (Abbie, interview2)

Because we know when the students arrive, they think the placement is miles away, they possibly, if they have a choice, won't be thinking about the placement because they see it as being at the end. But actually, they can't put it off. Very early on in both [upper and lower quadrant] modules, there is a patient, a real patient ... In terms of timing, that is planned not accidental. (Educator)

The process of integration was nonetheless slow and challenging for some students. Students at this stage began to think within the new frame of reference. This was highlighted in the model of knowledge transmission by depicting it as a curved arrow (Figure 9.2). The challenged integration was also inferred by the slight drop of DTI flexibility-in-thinking mean scores during the programme (see Figure 6.5), which resonated with the students' suggestion of an ongoing process of knowledge integration.

By no stretch of imagination, we are going to walk away from this year and will be able to implement everything that we learn. I think the knowledge is there; but we need to employ it practically. (Ethan, Focus Group1)

Moreover, the students' perception of synergy in the workplace environment played an important role in facilitating integration. Perceived barriers to integration in workplace settings included workplace colleagues' attitudes, because some of them did not value the

importance of the knowledge and skills that the students were developing during the programme.

I think it is shaped a lot by the people around you; if they are willing to be critical and develop. They [workplace colleagues] have done it for 20 years and they are a bit stuck in their ways which probably impact you a little bit. (Ethan, Focus Group2)

Also, time-constraints made integration into workplace settings difficult for some students; rendering it an ‘inauthentic’ experience.

One of [an educator’s] suggestions for us was to add an extra 15 minutes to every appointment so that we can input these skills; but you know that there is no way that I could go back to work and say I need 15 minutes extra per patient, because I wouldn’t get it. So, it is all very nice and well in the research world that you have got this time, but you got to be balancing this with finances and what your employer wants from you. (Victoria, Interview3)

In summary, data highlighted the importance of knowledge integration in situ. It supported the coherency in educational messages during and beyond the lifespan of the programme. While an authentic learning experience supported the integration of knowledge, temporal and relational factors form a barrier for integration.

9.2.4. Knowledge internalisation

As the students integrated knowledge through authentic learning experiences, they began to internalise it. Such internalisation was conceptualised as a process of meaning-making of external knowledge, and therefore, it does not imply that external knowledge is internalised unaltered (Billet, 1996). The knowledge transmission model (Figure 9.2) demonstrates that this translation is an individual meaning-making process. Each student interpreted and internalised knowledge differently based on his or her personal and professional experiences.

Right from the beginning, it is about trying to get students to evaluate what they know already. What they are happy with, what they are not happy with, and areas they need to develop within that. (Educator)

I think [the programme] is opening up my thinking ... before, if a patient said something to me, I would – out of a ‘closed mind’ – think, ‘okay this is because of that problem’ ... Whereas now, if someone says I got ... I had a patient the other day who said I have got a heavy leg... and before I would be just like: oh, it is because you got a hip and knee pathology; whereas now I thought ‘ok, is there something else?’ It turned out [the patient] had positive neurogenic tests which maybe I would not have considered before. (Ethan, Focus group1)

Additionally, such internalisation had an expansive nature (Figure 9.4). Because of the longitudinal nature of the programme, the students revisited and reinterpreted knowledge differently at various points throughout and beyond the lifespan of the programme. Therefore, not only did they gain breadth of knowledge, but also depth. SCT data concurred with this expansive knowledge construction as students’ scores increased each time they attempted the same set of questions. The following data extracts offer further evidence of this.

For every session that we do, they have pre-session activity. And then following the session they have post-session activity. Each session is not an isolated learning event. They have to do a lot before they get there and then they have got to do a lot to follow up with it. (Educator)

I did do the pre-reading for most of the blocks, and there was quite a lot for some of them. It was quite a lot of work in-between the blocks to keep you abreast of it on top of the other assessments; but it did make my clinical placement easier because a lot of the pre-reading material was the most current and the most relevant for whatever topic we were discussing. So, actually, having had a bit of a broad knowledge base over those areas has particularly helped me on my placement because I could draw from them. I didn’t have them at my fingertips, but if something was pulled up on a day where I haven’t done so well, I could definitely use that information. (Victoria, Interview3)

You go away and you have the lecturers saying stuff, and then you are looking at the papers, and you read that at your time (sic), and then go back over the lecture notes, and listen to the Panopto again. Even if I am listening back to things, you take different things from it again. So, I suppose they send you in a direction, and then you can go into more details; and depending on how much time you got, and how much detail you actually want to learn. (Danielle, Focus Group 2)

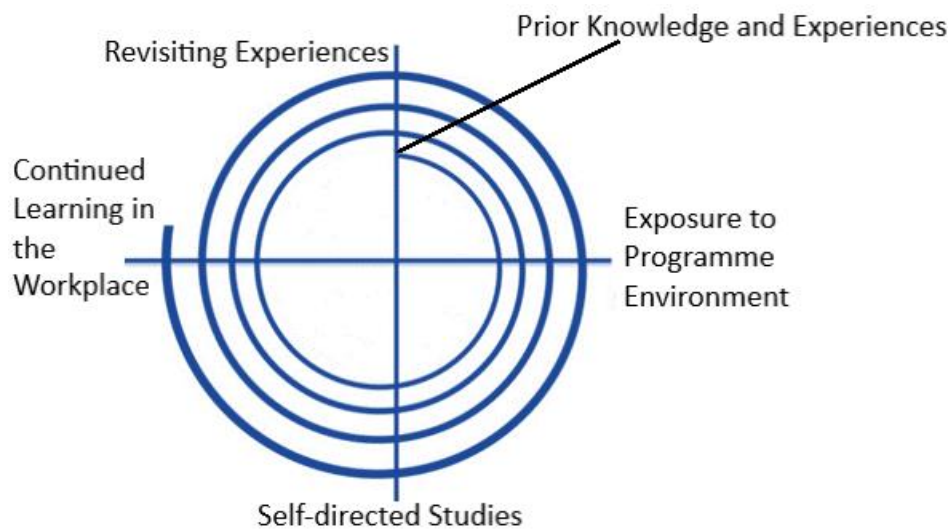


Figure 9.4: Representation of expansive knowledge construction at each learning encounter: throughout and beyond the lifespan of the programme

The collaborative interaction with educators and peers facilitated this process of internalisation and meaning-making. The findings indicated a process of balancing students' tacit assumptions of what was relevant and applicable to their practice on the one hand and their practice-based experiences, and the national (e.g. NHS) and international (e.g. IFOMPT) standard of practice on the other.

Transferring knowledge from university to the practicality of somebody in front of you is paramount. That is what we're here for. So, you have a knowledge base from university, they transfer that knowledge base, but it is in a different environment. (Educator)

The following extract is taken from an interview with Simon describing how his workplace experience in private practice during the programme influenced the way he perceived relevance of thinking within a biopsychosocial frame of reference.

I think that you can take on board some of these things they give you from a biopsychosocial perspective; but at the same time, you need also to understand how can you integrate that in your practice very carefully because sometimes people just don't accept... it is also hard to follow up on things that you may pick up, but then you say 'what can I do for it?' It is not so easy. (Simon, Interview3)

In summary, the outcome of reconciling tacit procedural and explicit propositional knowledge is the internalisation of a developed frame of reference. This new frame of

reference forms the basis for subsequent learning encounters, and underpins processes of advanced-level clinical reasoning. In the following sections, the interconnectedness between these ongoing cycles of learning and the four conceptual dimensions of the model of culture of convergence and synergy is examined further.

9.3. Reflective Practice

The focus of this analysis is on how the student-centred learning culture and educator's support contributed to the synergistic interaction and engagement in reflective activities. An in-depth exploration of how programme activities supported reflection was offered in section 7.2.2. These activities contributed to the advancement of clinical reasoning skills by supporting the continuation of reflection beyond the lifespan of the programme.

In accordance with the UK Health and Care Professions Council's standards of practice, that expects physiotherapists to 'understand the value of reflection on practice and the need to record the outcomes of such reflection' (2013, p.10), the programme promoted reflective practice as a core competency for advancing clinical reasoning skills. The structure of the programme enabled the students to progressively converge into this culture of reflection. This began with modules that encouraged students to examine their ontological and epistemological assumptions, as well as examining the concept of reflection and its importance for practice. Subsequent modules offered opportunities for students to engage in reflection within the context of the programme.

Within the framework of IFOMPT, MACP and the master's education, students are actively encouraged to look at what their needs are, what their aspirations are and to tailor their learning accordingly [...] the development of a personal development plan gets students to critically reflect on who they are, where they are and where they are going. (Educator)

Box 9.1 is an extract from a module outline. It provides evidence of an emphasis on promoting self-evaluation and reflective practice.

Learning Outcomes: *The module will enable you to:*

- Explore assumptions concerning your own learning
- Investigate strategies to manage self-learning effectively
- Use strategies to facilitate personal and professional development through critical enquiry & problem-solving
- Demonstrate critical evaluation of professional development through presentation of documentary evidence
- Evaluate own developmental needs through critical reflection of your professional knowledge
- Plan future developmental needs through the understanding of skill acquisition and expertise

- Critically appraise the ethical & legal dimensions of your advancing practice
- Engage in collaborative reflection on practice to enhance the overall quality of provision.

Box 9.1: Module learning outcomes depicting self-evaluation and reflective practice as central to learning.

The students have equally acknowledged how such a structure supports reflection and thinking within their new frame of reference.

[The programme] improved my knowledge base. You are constantly challenged by your peers. You are constantly challenged by the exams. [They challenge] the stuff that you've said. You are constantly challenged by the lecturers to clinically reason, to justify what you're doing, to underpin your results, to think of things more multidisciplinary. There is no one specific thing that does that. I think that is the whole course, from the research module that make you aware of the evidence base and how to appropriately assess evidence, to the reflective module that enables your ability to reflect and start thinking about that. The clinical reasoning is underpinned through the upper and lower quadrant modules. The knowledge base increases. You are given good tasks that underpin those as well. So, there's not one specific thing. (Ethan, Interview2)

As an outcome, students started to dedicate time for reflection and sought to integrate it into their practice.

I think I have learned how to look at myself and my practice a lot more reflectively. [I have learned] the need to make time for reflection ... We all get so busy in our jobs. Sitting down and reflecting is the last thing that you do when you got a zillion things to do ... But I can see it is important; and it is needed to develop ... I set more time aside for reflective practice now, I have some good reflective sheets that I use for in-service courses and for after patients I go through my notes, sit down and go through my day and really, really reflect on the patient that I have seen on the day ... (Abbie, interview2)

They started to think about how the programme would (re)structure their practice in the context of advanced M-level healthcare.

I think it made me think a little bit more about where I wanted to go in terms of my clinical practice. In relation to clinical reasoning, it made me look at where I have been, where I am going to, and trying to input that into where I am going to

focus my attention. Do I want to be focusing on an area of the body, or a type of pathology, or where do I really see myself in five or 10 years' time. I don't think I have done this before. (Victoria, interview2)

Also, offering multiple models of reflection (such as Goodman's levels of reflections) to the students contributed to their synergetic interaction with the programme activities. These models offer a spectrum of complexity in analysing and evaluating experiences. Therefore they enable students to select and contextualise the model that is appropriate for them and their practice.

Students use different models of reflection. They do typically light upon cognitive, analytical and evaluative models because often they can be a lot simpler. Some of the other models are staged. So, there are certain requirements that need to be in place in order to demonstrate their responses at a much more holistic and global level in terms of managing patients. (Educator)

Moreover, embedding reflective activities within the programme drives students' engagement. For example, during the mentored clinical practice and in-class patient assessments, the students had extended time to think and reflect on their history taking, planning physical examination and management options. This eliminated the time constraints that students would otherwise face in their workplace environments.

As Ethan completed the first stage of patient assessment, the clinical mentor is encouraging him to think and reflect on his decisions. The mentor is using questions like "what is your aim?" "How would you do that?" And "Why would you do that?" to stimulate reflection before continuing into physical examination. Similarly, as Charlie had a follow-up patient with sacroiliac joint dysfunction, the mentor was asking if he would change anything he did in the previous assessment. (Researcher observation, 15 July 2015)

If the claims are that we want people to be thinkers and reflectors, we must do it within the context of the session. (Educator)

The best part [of these patient assessments] is when people are watching you, and then you sit around and chat. You have that group discussion: what we are going to do with the objectives; what are the percentages for the genics (Charlie, FGI)

However, the students' workplace structure either facilitated or interrupted continuing reflective activities. Abbie, Danielle and Ethan indicated the availability of time and colleagues who supported continuing reflective activities.

There is no time pressure of having to... I don't have back-to-back diary of half an hour [sessions]. I'm seeing few patients. I've got time to sit down with my patients and not rush doing things. It gives me a lot of time to reflect and to learn from my mistakes. And also, because it is that environment where I work close to other healthcare professionals, they are constantly challenging you and giving you feedback. (Danielle, Interview3)

Victoria, on the other hand, did not have much time for reflection. Therefore, the authenticity of reflective practice is questioned when a student has busy workplace.

I think that transition has probably been quite hard. And I think this is something I learned to be better at [...] So it was very nice in the University where you have got all these days where you can go and learn, but in the real world it is slightly difficult, different even. (Victoria, Interview3)

Charlie is a good example of how time constraints in workplace settings can impact reflective practice. At the end of the programme, he was working in two different clinical settings. At one of them he saw only a few patients and, accordingly, his engagement in reflective practice changed.

I use it [reflection] more than I did pre-course. I would say probably in the [X workplace setting], I do it a lot more because I see only four people a day. I have lots of time to go through it and things like that. In [Y workplace setting], it is much more hit and miss; but that is down to not me not wanting to use it; it is just the time, the fatigue. (Charlie, Interview3)

In summary, the findings highlighted how engagement in reflective practice contributed to the advancement of clinical reasoning skills. Although the students developed positive attitudes about its importance, the workplace environment can either augment or hinder reflection, indicating the need for synergy and convergence across the individual, university and workplace levels to support reflective practice.

9.4. Authenticity

The concept of authenticity was an integral dimension of the model of convergence and synergy as it supported this by the internalisation of knowledge. While authenticity refers to engagement in real-world examples and experiences (Maina, 2004), it was determined in this study that authenticity moves beyond this conceptualisation to include individual, institutional and organisational dimensions. At micro individual level, authenticity was shaped by analysing the students' personal experiences during individual and collective class activities. At the meso institutional level, the programme structure and activities were consistent with the requirements of advanced level of practice. Moreover, at macro level, workplace settings and standards of practice were integral in defining authenticity. At micro level, having students who brought relevant experience in musculoskeletal physiotherapy contributed to this authentic learning environment. Students who shared similar interests in advancing their musculoskeletal physiotherapy practice were admitted to the programme, thus ensuring synergistic interaction (Box 9.2).

Applicants must provide documented evidence of a minimum of 1500 hours experience post qualification of using manipulative physiotherapy within a neuromusculoskeletal context (this is in line with the IFOMPT guidelines). Supporting evidence of appropriate continuing professional development during this experience will be required.

Box 9.2: Module guide extract depicting the need to have relevant musculoskeletal experience.

Moreover, the learning experience and assignments drew on the students' personal experience and knowledge, which gave them a sense of authentic and relevant learning.

I used some of the clinical reasoning literature and tools within that [case presentation] which really helped me dissect where I had possibly gone wrong, and where I did better, and how to improve that for the future. (Victoria, Interview2)

We are trying to get the students to pull on their experiences with patients who presented atypically. To pull the issues that [the patient] presented with from a clinical reasoning perspective (Educator)

Box 9.3 depicts a module guide extract that demonstrates how the programme supported the analysis of personal knowledge and experiences as a base for advancing clinical reasoning skills.

This module facilitates analysis of the student's prior experience in manipulative physiotherapy to enable the exploration of this specialist area in the context of evidence based practice. It builds upon the student's existing knowledge and experience of the assessment and management of neuromusculoskeletal dysfunction of the lower quadrant to enable understanding and effective management of the complexity of clinical presentations. This is achieved through the establishment of a framework of Continuing Professional development and a focus on the development of clinical reasoning and clinical expertise.

Box 9.3: Module guide extract depicting reliance on analysis of personal knowledge and experience.

Due to this sense of personal involvement, sharing prior authentic experiences during the collective class discussion enabled students to consider integrating their peers' insights in their workplace.

The fact that they are hearing it from a fellow student is a strong motivator or potential influence for someone else to go and perhaps try that themselves in their own practice. (Educator)

Right now, where I work, you bounce ideas to other people. You don't necessarily know if what they are saying is evidence-based, but it is their clinical practice, they have benefited from it. (Danielle, Interview3)

You see the problem from other perspectives. You just think: okay, this might be helpful and maybe you take it on board, or you think about it at least. Otherwise, if you don't confront your peers, you just go with what you know. (Simon, Interview2)

At the meso level, its structure supported knowledge integration, thus enabling an authentic learning experience. This was facilitated through multiple in-class patient assessments and the mentored clinical practice. Having patient assessments at the beginning and end of the specialist modules allowed for early integration of M-level

advanced knowledge and skills. Also, patient cases were purposefully chosen to ensure an interactive patient assessment session that stimulated the students' clinical reasoning skills, and engaged them in collective sense-making.

It is trying to look at something not very complex but there is an element to it that you know is going to provide a challenge ... It might be that we are purposely selecting something that is chronic ... it might be that it is multiple areas of symptoms; it might be a post-surgical example of someone that has got ongoing problems. (Educator)

As the educators facilitated making sense of these patients' cases, the students articulated an understanding that was in accord with the programme designer's understanding of advanced level of practice, indicating that exposure to authentic cases could close the gap between university and workplace settings, thus facilitating the continuation of the educational message.

I think it is almost definitely better to learn through doing than watching. [In the mentored practice] we did a lot of discussions after the patient as well [...] it really put into context everything that the lecturers tried to put into the practical experience for us over the upper quadrant and lower quadrant modules. (Victoria, interview3)

Moreover, the structure of the programme made it possible for the students to continue with either part-time or full-time work. Although all of them except for Danielle continued working during the programme for financial reasons, they perceived this as an opportunity to integrate knowledge into their workplace practices.

Ethan: If I was not working, when I come out of all of this, I'd feel like I've got all of these skills, but how do I shrink that down into 45 minutes! Whereas since September, I've been slowly integrating this into my practice.

Charlie: So yes ... integrating. Whereas, if you left it until the end and then you start trying to integrate it, you're going to miss things, you're going to forget things...

Danielle: It is my challenge. I didn't have much experience in integrating what I've learnt here. So, it is going to be a bigger challenge at the end. I would imagine at the end of the year I will be getting through what they went through. (Focus Group1)

Authenticity was also conceptualised as effective communication with patients and the professional community of students' peers and colleagues as part of the educational standards of M-level graduates in the UK and IFOMPT. The following extract from an interview with Victoria highlights that although the patient population in her mentored clinical practice was not comparable to her workplace, it enabled her to advance her communication skills, which contributed to her professional development.

I did my clinical placement in a different part of [the city] than I would normally work in. The [patients'] demographics were slightly different. I had to adapt my communication styles to get that good information you are trying to glean from a patient. I think from that point of view, it really helped my communication skills, although that is not necessarily applicable where I am now. I am back in my current workplace. But it definitely made me more flexible in terms of ongoing employment, and having more confidence in working in a diverse environment rather than what I would say is mainstream private practice. (Victoria, Interview3)

At the macro level, authenticity is conceptualised as continuing with what the students are exposed to in the programme. While the programme introduced a learning experience that is consistent with an advanced level of practice, some students questioned the authenticity and relevance of some of the programme's activities because of workplace restrictions. That is, the workplace structure was either a facilitator or a barrier in terms of the availability of resources and time to utilise the tools and activities the students were exposed to in the programme, such as the use of validated patient-reported outcome measurements. While Simon described limited time to administer questionnaires at his workplace, Ethan's workplace allowed him to do so.

I still don't use clinical scales, outcome scores for depression et cetera, simply because I don't have the time. If I think that the mechanical treatment is not effective, I will then think about that, I know it is part of our thing, but I really know very few people that actually address that part. (Simon, interview2)

...and some of it is down to the environment, some of it is down to things that we have at our disposal. Today, for example, we had a shoulder injury [...] and I have gotten the opportunity and the time to look at everything, so we could take a

video, we could use biomechanical analysis, we could measure strength, and we could get real objective numbers and measures... (Ethan, interview2)

Moreover, the limited access to databases after the students' graduation was perceived as a barrier to continued learning.

I think one of the big things that kind of comes out from the course is that learning; and one of the big things of being part of the [University] is the access to all resources, access to people with knowledge, just the simple things, access to books, access to electronic databases, and those sorts of things. Obviously once they are taken away that is a massive knowledge base that you can't access. That's a massive limitation on lifelong learning; although it started to become better with open access and stuff like that. (Ethan, interview2)

In conclusion, the findings suggest that authenticity needs to exist across the three levels of influence. Continuing programme activities in workplace settings was an important criterion to understand authenticity. While some students perceived the programme's activities to fit within the structure of the workplace, others perceived it to be inauthentic. Therefore, the interruption of learning beyond the programme's lifespan can impact on the pace of professional learning.

9.5. Motivation

Motivation is one of the attributes that underpin learning dispositions (Bloomer and Hodkinson, 2000). Therefore, examining various sources of motivation can yield in-depth insight into how it impacts on learning engagement and, in particular, how internal and external motivators interact in achieving a programme's outcomes. The students' motivation explained why they engaged in the programme, and why some students were willing to sustain and keep drawing on the knowledge and tools they constructed during the programme. Students' motivation was influenced by meso and macro levels, suggesting that learning goes beyond being a situated activity. Figure 9.5 depicts the internal and external motivators that contribute to advancing clinical reasoning skills.

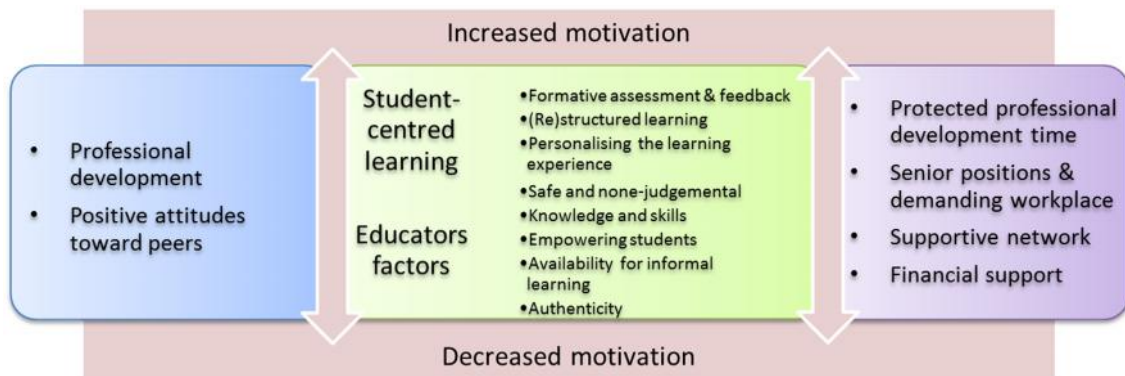


Figure 9.5: Motivators for professional learning and clinical reasoning across, from left to right, the micro, meso and macro levels

At micro level, motivation for professional development and becoming better practitioners was a driver to participate in the programme for most students. This sense of inner motivation drove students to fully engage in programme activities.

I want to provide more efficient and better outcomes for patients; I want to inform myself; I want to feel the breadth of knowledge and depth of knowledge in a number of areas; that I can synthesis journal articles better; that I know what I am looking at; that I can understand it better and therefore apply it to practice more efficiently ... I want to develop ... I have not learned stuff for ages like this in-depth. (Victoria, Interview1)

In the case of Abbie, her motivation to participate was also a response to a demanding workplace environment as highlighted in section 8.7. This resonated with educators' expectations of students' motivation to attain advanced levels of professional practice.

We have got students who are just motivated to learn and to develop and they are like sponges. They will put a 100% into trying to get a 100% out. (Educator)

The programme structure utilised this motivation to achieve successful engagement in its activities, as the following data extract from a module guide demonstrates (box 9.4).

The achievement of the module outcomes relies heavily on your involvement and input in order to ensure the content is related to your area of practice/interest. The combination of lectures, workshops, presentations and seminars used in the module is designed to provide you with a range of learning opportunities. Additionally, at M level there is a strong emphasis on self-directed learning. If you check the allocation of hours to learning and teaching activity for the module you will see that you cannot rely solely on the sessions where there is staff/student contact to achieve the learning outcomes. In order to engage fully with the material, much of which will be new to you, there is an expectation that you will undertake a range of activities to prepare for sessions.

Box 9.4: The students' motivation as a cornerstone for professional learning.

However, fears regarding participation in large-group collaborative activities were thought to block engagement. For example, although Simon was motivated to engage in professional learning (see vignette 8.5), he expressed fears about participating in large group discussions. This was attributed to the instructor-dominated learning culture from which he came. Therefore, in spite of having an interesting clinical experience, and a safe learning culture, Simon's learning disposition interrupted learning.

It's frustrating because you come from a different environment, and if you don't really understand something, maybe you are afraid to ask. (Simon, Interview2)

Simon really lifts it in terms of how I think; which is great because some of the stuff that he talked about I'd never even thought of. I can hear him in the back of my mind just saying certain things. (Ethan, Focus group1)

At the meso level, augmenting students' motivation throughout the programme facilitates engagement. The programme achieved this by implementing various strategies. These strategies, which were detailed in chapter seven, are linked to student-centred learning and the educator's character (Figure 9.5). The findings demonstrated that the safe learning environment that enabled students to voice and communicate their thoughts was the main motivator for learning engagement, interacting with peers and educators, acknowledging knowledge gaps and thinking innovatively. As a consequence, the students were able to externalise their tacit knowledge and develop confidence in their decision-making abilities.

The student asked me a question, and I said: what do you think? And she just then talked for two minutes. And then another student said, 'you answered your own question' ... invariably students can solve their own problems or answer their own questions. (Educator)

I felt really comfortable to say what I thought even if I was wrong. And obviously, the lecturers and peers did not judge you; they just wanted a good discussion and for people to learn. (Danielle, Interview2)

I think that I don't mind getting things wrong. When we were in lectures, I didn't mind asking questions. If I didn't know the answer, I would ask. If something didn't quite make sense to me, I would challenge it. (Ethan, Interview2)

At the macro level, workplace settings and workplace colleagues' interactions impacted on the motivation to continue participating in the programme activities, which in turn could interrupt continued learning. This was clearly evident in the case of Victoria who had protected study time only during the programme. Thereafter, her motivation became purely internal (see vignette 8.5).

On the other hand, the sense of awakening and empowerment also motivated students to engage more in workplace cultures.

I think that the programme helped me in terms of being more sure and more secure in what I'm doing on my own. I can be in a peer discussion that I can defend. Because if you don't have much experience, then you always think that someone else has a better idea, and they know what they are doing, etcetera. It feels like you know nothing, and then the other people tell you what to do. If you are more confident about yourself, and about your testing, and about your reasoning, then you can say; well, okay you think this, but actually I did this and this and this... You know, it is a more balanced situation. (Simon, Interview3)

Moreover, in comparison to her pre-programme employment, Danielle expressed that the new workplace culture was a source of motivation, not only because of working with elite athletes, but also because of working with colleagues who supported continued professional learning.

Prior to the master I worked in NHS and it was much less about being the best, it was more kind of show up; your work was what you did nine till five. People were not as motivated. There was not the same emphasis on CPD, and trying to be the best at what you do. So that was the big difference [...] where I work now, if you don't know what's going on, you've got to go and make sure you got someone else's opinion. And in NHS you obviously need to do that as well. But people are not grounded as much. So, there isn't much support. (Danielle, Interview2)

In conclusion, the findings demonstrated that the students' motivation supported professional learning and transforming practice. Students' motivation explains why they

sustain and draw on the advanced knowledge and skills in their practice. This highlights the importance of this learning disposition in driving professional learning.

9.6. Identity Reconciliation

The findings indicate that transformative changes occur when the students reconcile their pre-programme identity with the expected M-level standards of practice. This convergence of students' identity into the programme's identity was important for professional learning. The analysis in this section starts with examining the learning culture of the programme as a distinctive identity. It then shows how students' convergence into this identity was an outcome of their biographies and learning dispositions, the programme's pedagogy and workplace structures.

The programme as distinctive identity (meso level of influence)

Data highlighted that the programme has a distinctive identity that consisted of three main facets: firstly, that the programme is under the international/national umbrella of IFOMPT/MACP; secondly, the educational philosophy of the programme is centred on advancing clinical reasoning skills within an adult and constructivist pedagogical framework; and thirdly, it is grounded within a research-intensive university.

Most of the people who're teaching on the module have advanced qualifications. And you're aware of IFOMPT as an international group that sets the international standards. The majority of tutors have been through that process in one of the IFOMPT countries; and therefore, their clinical reasoning is developed into a higher level. In here, [we] have clinical reasoning as a particular area of interest and research; so that supports clinical reasoning being a strength of this programme; whereas another programme might have the practical as its particular strength, for example. (Educator)

I think for clinicians, who are in practice, to have a chance to discuss and engage with researchers, who are particularly doing clinically relevant research, is the real strength of the programme ... also, the researcher's report back to us that actually they are getting information from the students; the questions that the students asked, make them think about the research they are doing and the direction of the research. So, it's a two-way process. (Educator)

The educational standards of IFOMPT played a key role in shaping the structure of the programme and the development of the aims of its curriculum. IFOMPT Member Organisations need to demonstrate convergence with those educational standards that prepare graduates from postgraduate²¹ programmes to become expert clinical decision makers, communicators, collaborators, managers, health advocates, scholars and professionals (IFOMPT, 2008)²².

However, within these educational standards there are no restrictions around the programme's educational philosophy or its pedagogy. While the 2008 IFOMPT's educational standard document did not suggest any pedagogical strategies to achieve learning outcomes, the most recent 2016 standards document has indicative guidelines, allowing each institution to have its unique educational philosophy. For example, in the evaluated programme, students can achieve MACP membership at postgraduate diploma level because its structure is inclusive of small-scale research that serves to meet one of the requirements of IFOMPT. The programme's educational philosophy recognised students as significant members and contributors to its learning culture, which drove the synergistic interaction between students and the programme, as highlighted in the following module preparation guide (Box 9.5).

Our aim is that all participants will be able to articulate their learning needs and prospective development by the time we reach Christmas. Usefully, the assignment that makes up the assessment for the module is an individual development plan that is used to support aspects of both personal and professional development. We are quite clear in how we view this, essentially in terms of how adults learn and develop with awareness that fitness for purpose and knowledge and skills remain key attributes within the public domain. We spend time for those who need and wish to examine this and what this means for us as 'M' level learners.

Box 9.5: Module preparation guide depicting the programme's student-centred learning philosophy.

²¹ This term is purposefully used instead of M-level education to account for the residency and fellowship programmes that lead to IFOMPT membership.

²² IFOMPT educational standards are available in the public domain. The 2008 standards document was updated in 2016.

Moreover, students as applicants needed to demonstrate personal and professional attributes that would enable them to develop through the programme.

At interview, we will be asking students: why you are doing this programme? what were your aims from this programme? It is important for us to check that we are suitable for our applicant as applicants are suitable for us. (Educator)

Also, the programme's flexible structure enabled it to be responsive to the developing wider context.

The curriculum has to be responsive to the wider world ... It's one of those ironies, isn't it? How can I have any credibility - I probably don't - but if I've got any credibility going in there and talking about development if I am not engaged in development myself. That development for me is about awareness of what's going on in practice; of what's going on in policy; what's going on in the country; what's going on in the international sort of stage, in terms of health development, and trying to bring in some of those emerging ideas. Quite often strategies for challenging what we already know. And also setting up ideas for future exploration. We know this, but we don't know that, so what we can do about it in the future, and trying to pose some questions for future development. (Educator)

Further, being a regulated profession, the programme strived to achieve the skills necessary for professional expertise.

All of these attributes are developed in terms of professional identity and professional practice from the Health and Care Professions Council baseline requirements of therapists working within clinical practice. It is also drawn from UK health care policy that requires practitioners to demonstrate skills of leadership, effective management and competence, ability to provide service, ability to analyse and evaluate service. (Educator)

In conclusion, the programme was seen to have an identity that served the need to provide a high quality educational experience for students, and the need to meet the requirements of external regulatory bodies. Therefore, the students' clinical reasoning was kept relevant to practice, and within a framework that facilitated transition and sustained ongoing professional learning.

Reconciling with the programme identity (micro level of influence)

The findings suggest that the students' identity reconciliation was influenced by their biographies and learning dispositions; and driven by the longitudinal and coherent structure of the programme as well as workplace structure. The temporal dimension of this identity reconciliation was identified in terms of being exposed to different learning activities that allowed the students to increasingly appreciate the value of musculoskeletal practice at M-level. They also had sufficient time to engage in a collective process of reflection, debates and clinical reasoning that enabled identity development. Such reconciliation resulted in synergistic interaction between the students and the programme.

In the second week of the mentored clinical practice. Both Charlie and Ethan sat down to reflect on the case that Charlie had just managed. The mentor was not present. Ethan acted like a mentor for Charlie, started to reflect on the things he should have done or asked about. For example, including more function-related questions like dressing up. Ethan started then to ask questions like "what your hypotheses was?" "how would you differentiate between myogenic and arthrogenic pain?" which demonstrate having a sense of self-efficacy, advocacy and convergence into the culture of the programme. (Researcher Observation, 22 July 2015)

For some students, the proximity to the MACP practice culture contributed to their readiness to converge into the programme. The following extracts are evidence of how Victoria converged into the programme's culture as early as at the time of application.

I quite like some of the lecturers on it [the programme] ... I've read stuff about it as well ... I worked with some of the guys that teach on the upper and lower limb before. They are people that I look up to in terms of their knowledge base [...] so I'd definitely say the upper and lower quadrants and the lecturers you have on it. The way they spread out the course, it is modular, it really suits me, and it is flexible, I can carry out my work. (Victoria, Interview1)

For other students, convergence into the programme's identity developed over the lifespan of the programme as they began to acquire an informed understanding of the programme philosophy, aims and pedagogy. Such understanding enabled their engagement, even if they were unable to perceive the immediate relevance to their

practice. For example, one of the M-level learning outcomes is to develop skills in managing uncertainties (The Quality Assurance Agency for Higher Education, 2010). Therefore, the students needed to demonstrate clinical reasoning abilities in ill-defined situations. However, at the early stages of the programme, the students who did not have this perception demonstrated a lack of learning engagement.

... at master's level, a lot of sessions can't do that because we don't know clearly how it should influence their [students'] assessment. So, it is getting them to think. And it is all of that thinking that they are building as they go through the module that then shapes what they do on the clinical at the end of the programme. [...] one of the key things about master's level is managing uncertainty, and making them uncomfortable. Because if they are uncomfortable, that is a good way of developing their learning. [...] It is about how they feel at the end of the journey when they look back on that. Discomfort in master's is something that makes me happy; because it means that you've got below the surface and you got them thinking about something and they quite don't know what to do with it. (Educator)

The students demonstrated convergence into this understanding at different points in the programme.

On placement, I would say that the patient population wasn't the type of patients that I normally see, but from my perspective, that is not the point of the programme, and in fact that is probably not a bad thing, because you can say it's not relevant to my patient caseload, but the way in which we do the subjective, and go through the objectives; clinical reasoning is the relevant thing to it. And it depends on what you are taking as relevant, it could be what is important to me... and this is why some of the guys hated some of the modules, because they did not think that is relevant to them. And actually, I think what they were missing was what it was that they are looking to develop, and it wasn't always what the person wanted to develop, it is what the IFOMPT, isn't it? IFOMPT has said that these are the things that you need to develop. (Charlie, interview3)

Also, Simon used to uncritically dismiss the importance of establishing objective and subjective markers²³ during patient assessment. However, at the mentored clinical practice, he recognised how important it was for patient management.

I think that one of the things that helped me a lot was the fact that at the end of the session, what we did during my clinical placement was putting objective and

²³ A particular sign from the subjective examination or a result of the objective examination that a physiotherapist uses to (re)assess the effectiveness of a particular treatment. An asterisk is marked next to it to denote its importance in further assessments.

subjective markers. When they taught that at lessons, I was like: well, [sign of carelessness] it's not really useful. But in the end actually, I now use it a lot with my patients because I think, apart from giving me the idea whether the patient is progressing or not, it also helped me to see some of the things that have improved. (Simon, Interview3)

Moreover, Victoria had a personal coping strategy, namely taking some personal time to continue the process of reflection and professional learning.

We don't have time to go and read 10 articles a night, but actually using things like that regularly has really helped me to keep on top of things; keep relevant; keep current; and discuss it with colleagues... that is probably the biggest change in my CPD... And other things like, being a member of the MACP now ... I am getting manual therapy journal, that is quite an interesting read. (Victoria, Interview3)

Understanding the programme structure reduced the students' tension during activities. It changed the way they perceived the importance of collegial knowledge exchange and interaction in advancing clinical reasoning skills. For example, Danielle demonstrated reconciliation with the fact that being wrong in a conversation was far less important than having the conversation and she therefore began to feel comfortable sharing her thoughts.

I think the biggest factor, I went from being scared of being wrong to being happy to be wrong ... You know, I wanted to learn, so if I was wrong, I'd embrace it ... There is more space to know more really. (Danielle, Interview2)

Also, Ethan pointed out that convergence into the programme structure and pedagogy contributed to development.

I got better in accepting the things that I need to work on, [and then] act on the things that I need to work on. Again, because you have done all thing before it [the mentored clinical practice], you are able to reflect and realise that they [educators] are right. (Ethan, Interview2)

With this transformation, students were able to regulate and monitor whether they were being critical in their practice.

I think when I exited the programme six months ago I was definitely away from doing routine things, I think actually that I maybe falling back... Not falling back into it, but I think when you are under pressure, it is easy to fall back into those

kind of more routine assessments, or routine behaviours. But I think the thing that is about them now, which I didn't do before, or during particularly the early stages of the course, either one I wasn't aware that I was doing that; just going to routine behaviour, or two I didn't think about it when I was doing routine behaviour. (Ethan, Interview2)

In conclusion, identity reconciliation was seen as an ongoing process that continued throughout and beyond the lifespan of the programme. It was seen as a step towards achieving mastery. It was a longitudinal process that varied in pace depending on each student's background. Identity reconciliation was influenced by workplace settings, as examined next.

The impact of the workplace culture (macro level of influence)

During and beyond the lifespan of the programme, the students expressed a tendency to work with workplace colleagues who were critical, open minded and able to challenge them. They reported a preference to work in communities that either appreciated or allowed them to integrate their new skills and knowledge. Moreover, they became more confident in moving to these communities. The findings indicate the impact of the students' workplace culture on their professional and social identities; in particular, whether students are able to integrate knowledge and skill, and sustain professional learning. This highlights dependency on the working paradigm of those settings. Therefore, the programme impact could not be only attributed to individual cognitive changes such as knowledge construction and the process of awakening, but also extends to the collective interaction with peers and the wider support students receive within the system.

In contrast to Stathopoulos and Harrison (2003), who indicated the underutilisation of physiotherapy M-level graduates' potential, the context of practice for students in this study was different because it supported the integration of advanced knowledge and skill, promoted autonomy, and enabled the students to demonstrate confidence in clinical

reasoning skills and decision-making. Thus the students continued practicing the interactive and collaborative reasoning they were exposed to in the programme.

I had a situation the other day where me and the other physio at [X workplace] were on the phone with the doctor; and we were talking about [a patient case] and the other physio was saying, I would like [the patient] to be steroid injected. The doctor was saying we can do that, and then I went: why are we doing it? [...] we are going to give him a problem later on with what we do now [...] At the end we didn't do it. The doctor agreed that [the patient] was actually physically improving. (Charlie, Interview3)

Moreover, although some students felt an ease with integrating knowledge and skills, it was more difficult in other workplace settings. Simon developed an M-level professional identity towards the end of the programme and he started working in a new work environment. He felt that, unlike his previous restrictive workplace, the new one supported his professional transition and identity reconciliation.

There are some places where you work and you use lots of machines; you just do not think; and just put things on people. [These workplaces] are very set in the type of treatment they want you to deliver. They want you to do just passive treatment with the use of a device etcetera. I think [at] the place that I am working in I have more independence in selecting what type of treatment [...] As long as people are getting better, there is no general rule that you need to follow. So, you are in a less prescriptive environment. (Simon, Interview3)

Workplace colleagues also impact the process of translating the programme learning culture to workplace settings. The findings highlight that the social and professional identity of workplace colleagues impacted sustaining an advanced level of professional learning and practice. For example, as an outcome of the programme, students embraced the idea of being critical and challenging each other. In the programme, most of the students did not mind being “devil’s advocate”, “mean to each other”, or “putting a spanner in the works”. They were comfortable doing that because they had developed a good personal relationship or because they had the motivation for professional learning. However, when they tried this in their workplace settings, Charlie, for example, described a selective approach to challenging his workplace colleagues, depending on whether the

latter shared similar learning dispositions, such as whether his colleague was an MACP member or not.

With the other physio that works [with me], what I found is that I need to be very careful the way I question something or do something, because [the physio] becomes very defensive. So, depending on the person that I am with, I will change the way that I reason or talk to them about treatment. (Charlie, Interview3)

Colleagues who were open minded or have been through similar education supported students' transformation.

You need to have the people that you are working with happy to do that, and have time to do that. If they haven't necessarily been through the master, they might have looked at it as something that would stress them out, and make them apprehensive, and highlight their weaknesses rather than looking at the great learning opportunity. (Danielle, Interview3)

Ethan raised a similar point that, namely colleagues who were not open to being challenged limited professional learning in the workplace.

Where I worked previously, when I was doing the course, I worked with a physio; he has done this for years; he's fantastic at what he does, but I would ask him a question, and trying to get his thoughts on something, and he didn't even get the question; [he is] very closed book, very biased, not willing to think of things around in another way. That person is not willing for that conversation. (Ethan, Interview2)

On the contrary to Ethan's experience, Charlie's manager, a B.Sc. qualified physiotherapist, was described as open to change in terms of supporting Charlie's ideas about the nature of in-service training.

Before the programme, [the in-service training] used to be very much more of: this is what I do here, off you go! I was chatting with the boss and said, 'look, why don't we do something like this?' and she was a bit more like, 'yes that is not a bad idea' ... (Charlie, Interview3)

Therefore, reconciling identities extended to the social dimension in terms of changes in the social group the students belonged to. As students moved from a general to a specialised physiotherapy practice, they showed a preference for engagement with

practitioners with similar backgrounds or learning dispositions. This enabled them to continue working at M-level, which is consonant with the educators' expectations.

The intention of the module is to get people to consider either enhancing or beginning to work in a critically reflective cycle. [...] So, at any point within the future, they can apply the critical self-reflective skills in any situation. Whether a learning situation within the specialist modules, the clinical practice module, or in their practice in the future. Because we seek to draw upon the policy directives, the professional requirements, the regulatory requirements, and the evidence we have from the theoretical positions in the literature around professional development, we are at least giving them a framework for sustaining their ongoing professional development. (Educator4. Interview1)

In summary, identity reconciliation was dependent on changing the students' beliefs and attitudes to what was suitable for their practice (i.e. micro level), the programme beliefs regarding what was suitable for an advanced level of practice (i.e. meso level), and continuous development at the workplace (i.e. macro level). Therefore, student-programme interaction alone cannot explain the impact of the programme. Convergence across these three levels supported developing students' professional and social identities.

9.7. Chapter Summary

This chapter examined the integrated interpretive model of convergence and synergy. It conceptualised the relationship between the learners, the programme and wider organisational culture. The need for convergence and synergistic interaction across these levels was identified. Within this, the interconnectedness between reflective practices, authenticity, motivation and identity reconciliation were recognised as important dimensions that support change. Temporal, spatial and relational factors were identified to be integral in supporting coherency of the educational message. Students' agency and programme structure need to be recognised in supporting professional learning. Learning was not only a product of situated social interaction; the learners' contribution was integral in (re)constructing a socially-mediated experience within a wider workplace culture. These dimensions of the learning culture are discussed in the next chapter.

Chapter Ten: Discussion and Conclusion

10.1. Introduction

The study aimed to understand how the learning culture of an MACP approved M-level musculoskeletal physiotherapy programme facilitates the advancement of clinical reasoning skills. It was established that the learning culture involves three levels of influence: (1) the micro level of influence in terms of the learners' biographies and learning dispositions, (2) the meso level of influence in terms of the programme practices and (3) the macro level of influence in terms of professional regulatory policies, educational standards, and workplace culture. Drawing on findings of qualitative and quantitative data collected over an 18 months period, the study offers a novel understanding of the structure and nature of the learning of an M-level MACP approved programme. It also offers a novel explanatory model to understand why clinical reasoning skills are advanced as an outcome of participating in M-level education.

In this chapter the key findings regarding the learning culture that drove changes in clinical reasoning skills and supported professional learning are discussed in relation to previous literature, with an emphasis on this study's original contribution to knowledge in the context of physiotherapy education. In particular, the way in which learning cultures need to cultivate effective and valuable pedagogy. The chapter is structured around key findings in the context of the five study objectives. It begins with discussing the advancement in clinical reasonings skills. This is followed by a discussion of the model of a culture of synergy and convergence to account for advancement in clinical reasonings skills. The study's limitations, strengths, implications and conclusion are examined thereafter.

10.2. The advancement of clinical reasoning skills throughout and after participating in an MACP approved musculoskeletal physiotherapy programme (Objective 1)

While advancing clinical reasoning skills is one of the main intended learning outcomes suggested by MACP approved M-level musculoskeletal physiotherapy education (Rushton and Lindsay, 2010, IFOMPT, 2016), this study captured the dimensions of change empirically by means of a longitudinal mixed-methods data collection. The value of drawing on mixed-methods research has been communicated in chapter five. The raw quantitative data of SCT and DTI were descriptively reported in chapter six. Data were further analysed and synthesised through a process of “following a thread” analysis (Moran-Ellis et al., 2006). This approach supported looking for particular data threads that examines students experience and then looking how qualitative and quantitative data support or reject such interpretation. Thus, avoiding the frequent criticism of mixed-methods research studies that report data separately (Morgan, 2014).

Measuring students’ development by the use of SCT was of a particular significance. By comparing students to a group of clinically active musculoskeletal physiotherapy experts, the study evaluated if the students were making progress toward expertise in clinical reasoning skills (Lubarsky et al., 2011, Groves et al., 2013). Using a short questionnaire to elicit students’ experience of SCT (Figure 5.6), five students agreed that SCT reflected the uncertainty associated with advanced clinical practice and they welcomed the idea of being evaluated against a panel of experts instead of generating an absolute one answer. Notwithstanding the one-dimensional focus of SCT in terms of only evaluating clinical reasoning in ill-defined clinical scenarios, using the test allowed an evaluation of how the students intuitively analysed clinical information in comparison to a group of experts in the field, which served the overall objective of the study. Thus, providing a novel

evidence that practitioner's intuitive clinical reasoning can be advanced throughout their participation in M-level education.

Because of the retrospective nature of the evidence reported in chapter two, determining the point at which M-level graduates demonstrate change was not possible. Perry et al. (2011), who evaluated an MACP approved programme, suggested that the 'actualisation' of knowledge and skills in practice occurs sometime after graduation. However, evidence from this study identified that the advancement in clinical reasoning skills start as early as the students are able to integrate M-level knowledge into clinical experience. Both qualitative and quantitative data indicate that the advancement of clinical reasoning skills was gradual and progressive throughout the lifespan of the programme. In agreement with evidence from Rushton and Lindsay's (2010) study of M-level clinical practice in musculoskeletal physiotherapy, this advancement in students' clinical reasoning was captured in multiple domains, including, flexibility in thinking, advanced illness scripts, prioritising assessments, advanced communication skills, and personalised patient management.

There was a steady increase in SCT and DTI structure in memory scores over the lifespan of the programme at three points of data collection (Table 5.4). This indicates that students become progressively familiar with illness scripts that are specific to musculoskeletal physiotherapy practice. In other words, they developed schemata of cognitive frameworks throughout their programme experience (Charlin et al., 1998). At the same time, students also embraced collaborative learning and collective clinical reasoning in university and workplace environments. This exchange of knowledge and thoughts with peers and workplace colleagues informed their clinical decisions. In the context of Gabbay and LeMay's (2011) concept of 'clinical mindlines', this indicates that

students' clinical reasoning processes did not only rely on the developed illness scripts, but also on a collectively reinforced and socially constructed professional knowledge.

While Gabbay and LeMay (2011) found that there is a reason to suspect that developing expertise in clinical reasoning requires abilities beyond patterns recognition, it was determined in this study that advancing clinical reasoning skills was driven by collective sensemaking during in-class patient assessments and the mentored clinical practice. Such collective practices aided the students to be aware that, for example, they assumed too much, missed potential causes of patients' problems or failed to think of enough hypotheses. The students' acknowledged drawing on peers' experiences irrespective to the underpinning evidence. Therefore, changes would have been less likely to occur if they had focused only on construction of cognitive frameworks through individual processes of reflection, which indicates that the advancement of clinical reasoning skills is characterised by both advancing illness scripts and collective processes of clinical reasoning. This has an implication in terms of the need to support pedagogies that promote individual as well as collective reflection and sense-making.

Moreover, while the students continued to draw on peers' experiences beyond the lifespan of the programme, it was also identified that the collective construction of knowledge and experiences is context-bounded i.e. students internalised knowledge that fits their scope of practice (see section 9.2.4.). This implies a limit to the degree to which collective sensemaking and sharing of experiences would change practice (Fish and Coles, 1998). Educators need to recognise that knowledge construction cannot be separated from social interaction across various fields, such as from university to the workplace, or between alternative workplaces. Deciding how and when the collectively constructed knowledge would inform clinical reasoning requires contextually adroit practitioners. This contextualisation of knowledge to inform clinical reasoning and decision making is linked

to professional artistic behaviours (Higgs et al., 2004a, Gabbay and LeMay, 2011, Petty et al. 2011b) and advanced level of metacognition (Doody and McAteer, 2002, Edwards et al., 2004, Norman, 2005).

As an outcome of the collaborative learning and collective knowledge construction, the students started to demonstrate behavioural changes that are linked to an increased sense of self-confidence, self-efficacy and agency (Ball, 2009, Neary, 2014). For example, the student started to express thoughts around the importance of personalising patient care toward the end of the programme. They also expanded their understanding of patient presentations, as well as of assessment and management methods, thus became more inclined to ask the patient to clarify ambiguous expressions precisely before going on with assessment as highlighted by the DTI score. These outcomes characterise expertise in clinical reasoning in terms of developing strategies for patient-centred care (Haynes et al., 2002); recognising the complexity and uncertainty of clinical practice (Mantzoukas, 2008); and promoting students' abilities to learn in and from practice (Petty et al., 2011b, p. 223).

This evidence of a movement toward expertise in clinical reasoning supplements the accumulating evidence of the role of M-level education in supporting advanced practice roles (Jensen et al., 2000, Titchen, 2001, Rushton and Lindsay, 2010, Petty, 2015). In the following sections, a discussion of the learning culture that supported change is offered. This begins with the overarching model of convergence and synergy. It is then followed by a discussion of its components to offer insights to changes in pedagogy that educators may consider.

10.3. A culture of convergence and synergy: Capturing how the learning culture of M-level musculoskeletal physiotherapy education advances clinical reasoning skills (Objective 5)

One of this study objectives was to develop a theoretical explanatory model to bridge the limited understanding of the learning cultures that drive the advancement of clinical reasoning skills. The model of a culture of convergence and synergy, synthesised from the collected data, offers a plausible theoretical explanation that conceptualises how different levels of influence (i.e. micro, meso and macro) mediate the advancement of clinical reasoning skills. The concept of convergence and synergy in learning cultures is novel in this context and has been used by only one group of researchers (Hodkinson et al., 2007b; 2008) to describe the structure of programmes operating under the umbrella of English Further Education.

The incorporation of the micro and macro levels is particularly significant as it illuminates the need for an interconnected and cohesive learning trail to advance clinical reasoning skills. Educators need to acknowledge how the individual learner (i.e. micro level of influence) and external organisations (i.e. macro level of influence) can also influence the extent of synergy in the learning culture as much as their own practices. This calls for a recognition of the overlapping fields that can either enhance or interrupt the professional learning. Such an understanding is particularly novel in the field of physiotherapy, in which previous research tended to focus only on capturing programme outcomes (Stathopoulos and Harrison, 2003, Perry et al., 2011, Petty et al., 2011a, Constantine and Carpenter, 2012), with no evaluation of the sociocultural dimensions of learning.

Professional learning was found to be more effective when the actors in the learning environment (i.e. students, educators, and workplace colleagues) interact together in synergy. These findings suggest that the interruption of the learning trail occurs where

there is incongruity between learners' expectations or learning dispositions and the learning culture. This was particularly evident with some cases early in the programme. For example, in the event that the students are unable to perceive the relevance of some programme activities or when an external educator's pedagogy was inconsistent with the identity of the programme (see section 7.5.2). These incongruities have transiently interrupted learning engagement. Therefore, what is significant about these findings is that learners can change expectations, attitudes, and behaviours if they perceive a supportive learning environment that can be connected to workplace experiences. Sources of incongruity have been identified as:

- 1) Students' perception of their learning dispositions and biographies, e.g. Ethan's perceptions of the most effective learning strategies.
- 2) Students' interaction with educators and peers, e.g. Simon's perception of peer pressure during collaborative activities instead of opportunities for learning.
- 3) Students' inability to integrate knowledge and skills into workplace experiences, e.g. Danielle's inability to perceive the relevance of programme knowledge.

These findings are consistent with the evidence that learners' reactions to programme activities determines the extent of learning transition (Spence, 2004b, Petty et al., 2011a). As identified in section 9.2.2, the students' awakening (Ball, 2009) was an important phase in driving transformation by narrowing the gap between the students' learning disposition and the actions that are considered to be congruent with the learning culture. The following is a detailed discussion of this culture of synergy and convergence in the context of the study's objectives.

10.4. Examining how the programme advances clinical reasoning skills (Objective 2)

In capturing the advancement of clinical reasoning skills, this section discusses how the programme drove changes in clinical reasoning skills. In particular, how its pedagogies, processes, relationships, social interactions and contexts modulated change. The hallmark of this programmes' learning culture is the synergistic interaction between the students' and their educators and peers. This culture of synergy and convergence was an important vehicle for driving transformative changes in clinical reasoning skills terms of:

-) Offering a safe learning environment for knowledge construction that supported synergy and convergence.
-) Ensuring the authenticity and relevance of programme activities.
-) Augmenting students' motivation and identity reconciliation.
-) Supporting evidence-based practice and practice-based evidence during reflection.

Recognising these drivers of change is significant for pedagogies at M-level as it emphasises viewing learning as a continued process. That is, instead to thinking of professional learning as process of transferring M-level knowledge into practice, it is important for educators to recognise that the individual learner was learning before engagement in their programme and will continue to do so afterwards. To over details, these drivers of change are discussed next.

Offering a safe learning environment

The programme's safe and non-judgmental learning environment drove valuable learning that advances clinical reasoning skills. It was successful in offering a safe space for students to develop their agency and to control what and how to learn through educator-

guided conversations, which in turn supports professional identity formation (Brown, 1997). In agreement with Hodkinson et al. (2007b), educators had an active role in driving convergence and synergy in this learning culture during both formal and informal conversations as reported in subcategory 7.5.2. Moreover, it allowed the students to draw on ongoing feedback generated through a range of formative and summative assessments, which according to Petty and Morley (2009) demonstrates that achieving expertise is likely to occur.

In the context of advancing clinical reasoning skills, this safe learning culture exposed errors in clinical reasoning through collaborative open discussions, which according to Martinez (1998) needs to be viewed as an opportunity to learn instead of something to be avoided. Both educators and students' peers were tolerant of such errors, enabling the students to feel safe whilst sharing and exposing their clinical reasoning, in spite of the risk of looking 'stupid' in front of others; a thought that adult learners frequently have (Fisher-Yoshida et al, 2009). On several occasions students were happy to say, "I don't know", which was interpreted as a driver for change, enabling students to collectively make sense of various patient presentations.

Moreover, the programme's safe learning culture were identified to be an inclusive and student-centred in terms of valuing the position and experiences of the students as adult learners (Murray et al., 2001, Knowles et al., 2014). Thus, consistent with Hodkinson et al., (2007b), this learning culture cultivated engagement and synergistic interaction, which made learning more effective and centred around establishing goals.

Ensuring the authenticity and relevance of programme activities

While Petraglia (1998) suggested that educators' ability to pre-authenticate learning before learner engagement is limited, this study identified that using the individual

experiences of students (i.e. personalised learning) as learning points made the programme activities more authentic and clinically relevant by facilitating introspective discussions and the internalisation of a knowledge that is relevant to students' practice. This echoes Eraut's (1994) assertion that professional practice is characterised by internalisation of knowledge, not receiving knowledge:

Knowledge [...] does not become part of professional knowledge unless and until it has been used for a professional purpose. (p. 120)

This use of knowledge in practice closes the gap between theory and practice (Huber, 2011). To understand this further, it is useful to draw on Brown et al.'s (1989) definition of authenticity as the "ordinary practices of the culture" (p.43). This definition closely relates authenticity to the concept of synergy and convergence as the learning in this programme was validated by the culture of organising bodies e.g. MACP and IFOMPT (Rushton et al., 2016). Such a culture was perceived as a framework of practice that was governed by what is regarded as authentic. However, while the programme was not separated from its MACP and IFOMPT contexts, this does not imply that there was a cloning or reproduction of exact activities. For example, module sessions were (re)structured to meet the cohort needs and support authentic learning experiences by adding or removing certain topics. The learning encounter was changed based on what students were willing to share. According to Hager and Hodkinson (2009), this environment connects the students to the wider culture and enables the interaction across multiple fields.

The study identified that learning was not an isolated event in which there is a separation between different fields. Advancing clinical reasoning skills was an outcome of "inventive heuristics that students bring to the classroom" (Brown et al., 1989, P.36). This is consistent with adult learning theory, which suggests that learner's engagement is an

outcome of perception of relevance (Lave and Wenger, 1991, Knowles et al., 2014). Students appear to learn when they see a need to do so and when learning is related to authentic challenges (Knowles et al., 2014). This ensured the relevance of programme activities and thus, promoted creativity in management, intuitive thinking and problem solving. The emphasis on these activities are tightly linked to promoting students' agency (Merriam, 2001, Sandlin et al., 2013, Griffiths et al., 2016). It also enables solving ill-defined problems by producing negotiable meanings and socially-constructed understanding (Billet, 2014).

The mentored clinical practice and university case-based learning were also an integral part of creating an authentic and relevant learning experience (Herrington and Herrington, 2006) in terms of offering challenging, complex and ill-defined patient presentations that would better prepare learners for advanced level of practice (Rushton and Lindsay, 2007). This form of authentic learning facilitates the development of critical reflective practice (Dahlgren et al., 2004) and metacognitive awareness (Ball, 2009). It also facilitates a reconciliation of experiences across university and workplace environments (Billett, 2014), and thus, closes the gap between formal university-based learning and clinical practice. This explains why mentored clinical practice is considered an integral element of developing clinical expertise (Petty, 2015, Rodeghero et al., 2015). Creating these learning connections is believed to enhance the ideological becoming of learners in terms of being ready to learn from the new context (Gallacher et al., 2007). Therefore, an authentic learning culture requires the utilisation of meaningful activities that are closely linked to both of the learners' needs and advanced levels of practice.

Augmenting students' motivation and identity reconciliation

Integrating pedagogy for motivation and identity reconciliation within M-level education can maximise learning outcomes through developing genuine interest in learning. The

findings of this study demonstrate that while recognising learners' biographies and prior experiences contributed to authentic learning, it also augmented their motivation and learning engagement throughout the lifespan of the programme. Augmenting students' motivation at the level of university environment was identified to be valuable for professional learning and transforming practice (Figure 9.5). While this extrinsically-augmented motivation has been identified previously in physiotherapy M-level education literature, in terms of funding, political climate and familiarity with certain people or places (Glover et al., 2008), there was almost no reference to programme pedagogy and how it augments motivation. That is, M-level physiotherapy literature seems to overlook how maintaining motivation at the learning site is as important for learning as intrinsic motivation. In agreement with Illeris (2004) learning in this programme involved complicated patterns of intrinsic motivation that is at interplay with the culture.

The findings also identified how reconciling identity is a key dimension in advancing clinical reasoning skills. The structure of the programme facilitated identity reconciliation in terms of supporting a student-centred learning that allowed a dynamic process of learning and collaborative knowledge construction (McWilliam et al., 2009, Salter and Kothari, 2016). For example, having students with a genuine interest in advancing their musculoskeletal skills facilitated synergistic interaction by engagement with like-minded peers. According to Riley and White (2016), this engagement with like-minded peers drives the sense of belonging and facilitates the reconciliation of identities.

As such, the sense of connection between students drives the development of what Hughes (2010) called 'knowledge-identity congruence'. Formal learning cultures that allow this type of collective interaction have been identified to facilitate knowledge-related identity congruency (Gagliardi et al., 2007, Mulcahy, 2014). This explains why

most students expressed a sense of belonging and willingness to work in communities that supported collaborative learning.

For some students, like Simon, this learning culture was transformative in terms of changing multiple dimensions of his practice. For other students, such as Victoria, change for her was about verification, reinforcement and refinement of what she already knew and did in her practice (Billett, 2014, p.4). Therefore, these findings reflect the complexity of developing a physiotherapist identity in terms that it could follow either evolutionary or revolutionary pathways. Hammond et al. (2016) referred to this as fluid identity that develops across time and place. For these students, change is a dynamic process of (re)interpretation of professional self-concept based on evolving attributes, beliefs, values, and motives (p.71). This necessitates giving more attention to the processes that facilitate (re)interpretation of experiences, instead of debating pathways of learner's transformation.

Participants in formal learning groups or communities of practice are thought to bring their knowledge and skills to negotiate full participation (Wenger, 1998, Hodkinson et al., 2008, Knowles et al., 2014). As pointed out in Danielle's case, engagement in this programme was a key to reconceptualise her position in the workplace and to negotiate full participation. Personalising the learning experience and promoting a diversity of opinions appeared to drive her new reconciled identity. Such an inclusive learning culture is capable of establishing sufficient congruency between the learner's identity and the collective group identities, i.e. MACP organisational culture (Hughes, 2010). Therefore, findings suggest that identity reconciliation across fields should not be overlooked because it requires mutual effort from the individual learner and the learning group with which he or she engages.

Supporting evidence-based practice and practice-based evidence during reflection

The importance of critical reflection for the advancement through M-level education was noted in multiple studies identified in the literature review (e.g. Chaboyer and Retsas, 1996). While these studies are limited regarding how the learning culture drives and sustains engagement in reflective practice, this study suggests that sustaining reflective activities requires an engagement in processes of collective sensemaking of experiences (Knipfer et al., 2013, Rantatalo and Karp, 2016). The findings of this study are consistent with accumulating evidence of the importance of several forms of knowledge in informing expert-level clinical practice (Schön, 1987, Higgs et al., 2004b, Christensen et al., 2008, Petty et al., 2011a). Advancing all types of knowledge (i.e. propositional, tacit and procedural) was found to be an integral component of advancing clinical reasoning skills.

While there is a tendency within M-level musculoskeletal practice to emphasise the role of propositional knowledge to underpin clinical reasoning (Rushton and Lindsay, 2010, Kent and Hartvigsen, 2015), it is reasonable to propose that the personalised learning, and the safe non-judgmental peer interaction strategies utilised in the programme made the students aware of the impact of tacit dimensions of knowledge on clinical reasoning. The students were therefore not only expected to integrate evidence-based (propositional) knowledge, but also to construct personally relevant knowledge that would inform their practice. Such approach is similar to authentic clinical practice environments, in which the level of evidence is replaced with clinical reasoning processes that best inform effective and efficient patient care (Fish and Coles, 1998, Higgins et al., 2011).

The findings related to educators' and students' perceptions suggested that the programme's structure supported externalising tacit knowledge and experience through individual as well as collective reflection and critical peer-to-peer conversations. This

was particularly evident during interactive activities and patient assessments. Therefore, in alignment with Schön's (1987) observations, these processes of reflection-in-action can transform the tacit knowledge into more explicit understanding. This highlights the value of learners' active engagement in order to initiate transformation, something that is contingent on their learning dispositions and abilities to converge with the learning culture, as noted in previous sections.

Blending personal and peers' experiences in clinical reasoning processes make it difficult to judge which knowledge informs practice (Eraut, 2004). In other words, it is hard to isolate what knowledge the students are using to inform clinical reasoning processes. Therefore, unlike Whitcombe (2013), who suggested that becoming a lifelong learner, is superior to having context-specific specialist knowledge, it was identified in this study that both domains are important to support and sustain an advanced level of clinical reasoning skills.

The model of synergy and convergence explains how students developed and translated knowledge across different contexts, such as translating knowledge from university into workplace situations and vice versa. It demonstrated that learning engagement was facilitated when the programme recognised and accommodated learners' biographies, their learning dispositions and their behaviours in the classes. For example, the experience of some students in methods of assessment and treatment of musculoskeletal problems was the centre of small group discussions (e.g. description of Simon's case in sections 8.6 and 9.5). Thus, the programme was able to (re)shape and (re)construct students' knowledge, beliefs and identity (Hodkinson et al., 2004, Evans and Kersh, 2006). Understanding these individual student's experiences is integral to support professional learning. In the next section, the influence of learners' biographies and learning dispositions on learning engagement is further discussed.

10.5. Understanding how learners' biographies and learning dispositions influence how they engage in M-level education (Objective 3)

Students' previous educational experiences and lack of 'familiarity' with the requirements of M-level education were identified in the literature as barriers to successful learning engagement (Glover et al., 2008). In this study, it was identified that students' convergence and synergistic interaction with the educators and peers was an outcome of becoming aware of the nature and structure of M-level education. That is, they recognised the reasons for the components of the programme. This concept of 'familiarity', which is related students' awakening proposed in this study (section 9.2.2), explains why certain M-level students initially faced incongruencies in terms of dissatisfaction with some of the programme activities, such as a minimal focus on manual skills; or rebounding students' questions. The study identified that these attitudes changed as the students engaged in the programme.

To further understand the influence of learners' biographies and learning dispositions on engagement in M-level education, it useful to draw on Bourdieu's (1977/2013) concepts of 'habitus' and 'field' that account for the interrelationship between the individual learner and social structure. In the context of this study, the existence of convergence and synergy in the learning culture was associated with congruency between the students' learning dispositions and the learning opportunities offered. However, for some students, this congruency was not clear from the point of enrolment. It was found that learners' biographies either drove engagement for some students or acted as a barrier for development for other students. The findings suggest that the students who embraced the programme's culture, such as collaborative pedagogy, were more likely to internalise collectively synthesised knowledge to their own contexts. An early demonstration of

these attitudes and behaviours is interpreted as an indication of the movement towards expertise (Petty, 2015).

The programme student-centred structure progressively raised students' awareness of the characteristics of clinical expertise. Thus, their estimation of their ability to successfully manage the programme's activities and successfully achieve its outcomes grew further (Glover et al., 2008), which diminished the likelihood of continued incongruencies. Therefore, unlike Petty et al. (2011b), who suggested that learning is initiated when learners demonstrated positive reactions to learning contradictions, findings of this study suggests that initiating learning is much more complex, with students' reaction being one of its dimensions. Specifically, changes in learning dispositions and manifesting the convergence and synergy needed to advance clinical reasoning skills were also influenced by the prolonged period of engagement in the programme, which indicates a temporal dimension to changes.

The prolonged period of engagement in a professional development activity supports going through a process of sensemaking of past and present experiences as well as imagined future possibilities (Guette and Vandenbempt, 2016). Thus enabling students to eliminate their stress and anxiety, appreciate the value of peer learning, understand the need to think critically, recognise gaps in their knowledge, identify errors in their clinical reasoning processes, and to find reasons for unsuccessful previous practices. Therefore, in line with Sjögren (2016), who examined musculoskeletal physiotherapy workplace learning, sufficiently long and progressive learning opportunities can successfully bring about changes at individual as well as workplace levels. This is likely to explain why participants in short musculoskeletal professional development courses reported modest changes in clinical reasoning, even when the short in-service training is combined with follow-up sessions (Banks et al., 2013, Chipchase et al., 2016).

Bloomer and Hodkinson's (2000) concept of 'learning careers', facilitates understanding of how changes in learning dispositions transform students over the course of the programme. In the case of Simon, the programme's longitudinal nature enabled him to take an introspective stance and thereby reinterpret the value of collaborative activities. That is, while the programme activities and the nature of the interactions (external structure) remained unaltered, there was a development in how Simon perceived himself within the structure of the programme. Similarly, if this concept is to be applied in the case of Danielle, her learning dispositions i.e. attitudes toward reflective activities (important for clinical reasoning advancement) changed (in the course of the programme) from something that is done as part of an educational process to something that is integral for professional practice, leading to more frequent utilisation of reflection. This remaking of meanings through programme activities (Bloomer and Hodkinson, 2000), enables students to transcend the programme culture into their lives and workplace environment beyond the programme's lifespan and therefore, engage in a lifelong learning process. Such transformation extends beyond just having tools for learning or learn how to learn as suggested in the literature (Wildman et al., 1999, Conneeley, 2005, Petty et al., 2011a). Therefore, while situated learning theories emphasise the social dimension of learning, in this study an individual dimension of learning that is consistent with Hodkinson et al.'s (2008) cultural theory of learning was emphasised. In other words, as an outcome of interpreting the learning culture as a supportive environment where open opportunities for success exist, the students altered their attitudes and behaviours to meet the norms and expectations of the programme. Hence, their engagement in learning activities was evident. These findings consolidate Evans' (2002; 2007) empirical evidence that suggests a tendency to attribute lack of engagement to external factors when the individual learner perceives the programme as highly-structured. For example, a learning environment that

focus on a unidirectional and educators-led pedagogy. Such learning environment can drive competition between learners (Hodkinson et al., 2007a). In this study, the programme structure supported synergistic interaction between all actors, which made the students realise that they could learn from each other. This synergy made learning more accessible, effective and centred on establishing goals.

Moreover, the students who negotiated their expectations with the requirements of the programme's culture perceived its authenticity and relevance to their practice. This suggests a close relationship between the perception of learning environment as authentic and learning engagement, in particular, when learners value the relevance of the learning activities to workplace practices (Barab et al., 2000). Failure to perceive such relevance drives feelings of anxiety and uncertainty about how the programme's activities will advance skills. For examples, the perception of strong learning opportunities within the programme drove Victoria to converge into its culture, engage in its activities and continue to do so even within a tough workplace environment (section 8.5). On the other hand, the limited degree of autonomy that Simon (section 8.6) exercised before the programme interfered with his perception of what was relevant for his practice. Moreover, upon realising that the learning was collaborative instead of competitive, Charlie manifested a redefinition of social relations (altered habitus), which led him to engage more in whole-class interactions. In these examples, convergence in the learning culture can be understood as a process of redefining social relations through cyclic evaluation of self-beliefs in relation to the standards (i.e. norms) of advanced level of practice (Evans, 2002), which makes learning valuable and responsive to workplace requirements and transformation in musculoskeletal physiotherapy practice (Billett and Choy, 2013).

To conclude, the advancement of clinical reasoning skills is associated with changes in students' habitus and learning careers i.e. (re)making of meanings. The positive

perception of programme activities drives professional learning by changing students' attitudes and behaviours inside the learning environment. Convergence is therefore understood as changes in the learning career. This has an impact on the need to understand learners' expectations early on in order to maximise learning opportunities and engagement.

The influence of motivation on advancing clinical reasoning skills

The study identified that augmenting students' motivation was valuable to professional learning and transforming practice. Multiple intrinsic and extrinsic motivators were identified across individual, university and workplace settings (Figure 9.5). Most of the students cited becoming better practitioners as a reason for embarking on M-level education. However, some students, such as Charlie, enjoyed being in the learning community to maintain their motivation for practice. This suggests that learner's motivation is not always instrumental (MacIntyre et al., 2001), where learners enrol in an educational activity for the purpose of achieving something else. Similarly, Ethan and Charlie preferred to engage in standalone M-level modules instead of other learning activities. Moreover, Victoria developed strategies for continued learning that she was not familiar with before the programme.

Maintaining motivation and enthusiasm for clinical practice, as in these cases, is one of the most cited reasons for embarking on professional development activities (Glover et al., 2008, Haywood et al., 2013, Pettersson et al., 2015). Such practices are consistent with the suggestion that practitioners, as adult learners, need to overcome the busyness of their practice and set aside time for reflection, seeking peer feedback and internalising constructed knowledge and skills (Chipchase et al., 2012, Kember, 2016). Therefore, students' intrinsic motivation explains why they sustain and draw on the advanced knowledge and skills in their practice. On the other hand, the study identified that

extrinsic motivation in the form of workplace pressure to become efficient and effective practitioners was identified in the case of Abbie. In either case, this motivation to engage in professional learning enables students to overcome the emotions of anxiety, stress and the sense of annoyance evoked by the challenging nature of M-level education, which ultimately drives convergence and synergy in the learning culture.

To offer details, the students' responses to the programme's learning opportunities, such as collaborative interaction, were strongly influenced by their motivation for learning. This resonates with previous literature that strong personal motivation drives practitioners to short professional development activities (Gunn and Goding, 2009) and M-level education (Glover et al., 2008). It was found that the students' motivation for professional learning enabled them to accept educators' and peers' feedback, thus maximising the effectiveness of formative assessments (Biggs, 1998), and the likelihood of actively engaging in self-assessment and self-evaluative activities (Rushton, 2005).

Moreover, the findings of this study support previous studies in which motivation is a complex construct and unstable attribute that can be influenced by the surrounding context (Pintrich, 2003, Illeris, 2004, Kember, 2016), thus, conceptualising motivation as a stable cognitive style of students is rejected. Therefore, in line with Pintrich (2003), studying learning cultures that drive motivation is more important than focusing on individual and intrapsychological processes.

In this study, the students' learning dispositions and beliefs about the learning culture represented a barrier or motivator for participation. Nonetheless, the students demonstrated altered beliefs as they engaged in learning activities. This is in line with Evans' (2007) concept of 'bounded agency'. It appeared that clear communication of students' and programme expectations prior to or at the start of M-level education drives motivation for learning engagement, because students become less likely to see

challenges as barriers to learning. One example is engaging in reflective practices even if they are not naturally reflective, as in Ethan's case, or did not initially understand the importance of reflection, as in Danielle's case. Therefore, augmenting students' motivation resulted in them having a sense of empowerment. For example, by the end of the programme, the students were confident to engage in open and collaborative workplace environments.

To conclude, students' intrinsic motivation was a driver to converge into the programme learning culture. This intrinsic motivation was also evident in the fact that they transferred the programme's skills and knowledge to their workplaces.

The influence of identity reconciliation on advancing clinical reasoning skills

Although individuals strive to maintain a stable identity and remain in their comfort zones, facing learning contradictions does not always allow them to do so (Gallacher et al., 2007, Black et al., 2010, Petty et al., 2011b). Such constrained identity means that individuals participating in a learning community need to reconcile their identities with the requirements of that community. Similarly, the study highlighted the complexity associated with developing professional identity. Mediators that range from internal, e.g. students' biography and learning dispositions, to external, e.g. the programme structure, were in a dynamic interplay (Neary, 2014). The students in this case study negotiated their identities in the context of advanced professional practice. Whilst an examination of how the programme facilitated identity reconciliation was offered in section 10.4, this section is related to examining the characteristics of this process.

This study identified that identity reconciliation was an outcome of changing students' beliefs and attitudes of what was suitable for their practice (i.e. individual level) against the institutional and organisational beliefs of advanced level of practice. In line with Rao

et al. (2014), readiness to reconcile identities varied between students. Nonetheless, as they exited the programme, the study demonstrated that the students exhibited professional identities that enabled them to become members of the MACP culture. For example, their routine assessments became much more critical and reflective.

While Wenger (1998) asserted that learners should shift identity if learning is to occur, it is not clear what dimensions of identity need to be reconciled. Using the concept of “identity congruence”, Hughes (2010) identified three different forms of identities with which learners need to reconcile: social identity, operational identity and knowledge-related identity (Table 10.1). While Hughes’ discussion is limited to how these three identities influence group dynamics, their use as a theoretical framework is useful to understand dimensions identity reconciliation. In particular, how they support social learning and belonging to a learning community. The following is a discussion of how the participants in this study reconciled these three identities.

Table 10.1: Forms of identity congruence, adapted from Hughes (2010, p. 48).	
Social identity	Personal identification with peers, which draws on representations of identity
Operational identity	Identification with the processes, practices and technologies of social learning
Knowledge-related identity	Identification with the ideas, concepts and knowledge that are under construction

Consistent with Hughes (2010) findings, little evidence was found in this study that social identity congruence is vital for learning. The non-academic based social relationship was not a main driver for learning engagement. Although there was no evidence of out-of-class social interaction between Simon and the other full-time students, they looked up to him as a source of professional knowledge that they used to inform their clinical reasoning skills. Moreover, Simon and Ethan, who described good social interaction with workplace colleagues, moved to different workplace cultures after the programme. Although they

did not, at the time of data collection, establish similar social relationships, they suggested that the open and collaborative nature were beneficial for identity reconciliation. Therefore, albeit being beneficial, social identity congruence is not a major contributor to learning engagement (Jensen and Jetten, 2015, Riley and White, 2016).

Moreover, while issues of operational identity congruence were not explicitly captured during data collection, some of the data reported across chapters seven and nine indicated this socio-material dimension of learning in terms of using Canvas (the university virtual learning platform), Panopto (the university lecture recording system), Podcasts, Dropbox and WhatsApp for social and collaborative learning. The value of some of these tools in supporting learning has been explored recently by several researchers (Goodband et al., 2012, Willemse, 2015, Sandpearl, 2016, Cook et al., 2018).

Further, as the students moved to different workplace environments, the pace of identity congruence was influenced by the availability of time and tools that supported the integration of programme experiences. Nonetheless, the new experiences did not appear to have significant impact on sustaining advanced clinical reasoning. This might be attributed to facilitating continued learning even in complex and challenging workplace settings. Thus, operational identity congruence was of little relevance because of the students' ability to interact in and learn from the new settings.

Furthermore, consistent with Hughes (2010), findings of this study suggest that the existence of knowledge identity congruence required negotiating engagement in various types and sources of knowledge without causing conflict. In particular, determining the authenticity and status of knowledge in learning cultures (Fairclough, 2012). Thus, successful identity reconciliation started with students' preparedness to share knowledge so that it can be examined and critiqued by fellow students (Hughes, 2010). This preparedness indicates a commitment to facing challenges and learning from each

encounter (Hodkinson et al., 2008). At the same time, this involves other students' reactions in the form of offering constructive feedback. Some of the participants in this study underwent similar experiences. They started with a hesitation that changed to a sense of comfort about sharing knowledge and experience, and enjoying feedback, or what Danielle described as wanting "a good discussion, and for people to learn". Such learning disposition facilitates the integration of research-based evidence into practitioners' scope of practice (Thomas and Law, 2013).

To conclude, the study determined that internal and external mediators drive identity reconciliation. Students' participating in M-level education need to reconcile their identities with the expected advanced level of physiotherapy practice. It became evident that some students were ready to reconcile identity more than others as an outcome of previous experiences. Effective pedagogy requires encouraging drawing on diverse types of knowledge. As an outcome, identities are reconciled and learning can be claimed.

10.6. Examining the potential of an MACP approved musculoskeletal physiotherapy programme in enhancing the professional learning (Objective 4)

One of the study's objectives was to understand how the programme supports professional learning, and in particular how it promotes continued learning beyond its lifespan. The convergence and synergy in the learning culture offers an explanatory account of professional learning in M-level education, and how learning is linked to the individual learner, university and organisational levels of influence. Learning was not only an outcome of a situated transactional relationship between the students and educators, but was also a product of interaction with by a wider organisational culture that modulated outcomes.

Whilst the findings are consistent with current evidence that participatory learning has superior outcomes over didactic unidirectional professional development activities (Vachon et al., 2010, Trede and Smith, 2012, Manuti et al., 2015), the findings also suggested that professional learning is more than a situated activity, and therefore, de-contextualising professional learning is problematic. This is consistent with the view of learning as becoming (Colley et al., 2003, Hodkinson et al., 2008, Billett, 2014, Reich and Hager, 2014). Learning was not only an outcome of participation (Lave and Wenger, 1991, Nicolini, 2011, Zukas and Kilminster, 2012), but also comprised an interaction between what the university was offering and how learners responded to learning opportunities, constructed meanings and reconciled experiences.

Therefore, the findings of the study confirm Hager and Hodkinson's (2009) suggestion that learning is a continuous process that begins before engagement in an educational programme and continues afterwards. Knowledge construction was embodied in transactions with the environment through recognising the individual learner in relation to the context of learning (Hodkinson et al. 2008), which facilitated its transition across boundaries. That is a transition from the workplace into the university which was followed by integration into workplace experiences. This was not at odds with the need for professional learning to challenge physiotherapy practitioners across various settings (Pettersson et al., 2015).

Changes in students' learning dispositions, as an evidence of learning (Elkjaer, 2004), were valuable in relation to their function in advanced workplace environment. These changes were associated with being active member of the learning culture. The value of multiple programme pedagogies has been discussed in earlier sections in terms of augmenting motivation to participation, empowering students, driving a sense of agency, facilitating knowledge integration, ensuring relevance to practice and facilitating identity

reconciliation. Yet, there is a need to examine how these programme pedagogies maximised student's readiness for advanced practice roles and learning in the workplace. In particular, where the students needed to reconcile their developing personal and professional identities within their workplace environments (Hager and Hodkinson, 2009).

While Wenger (1998) perceived identity reconciliation as an outcome of social learning whereby a group of learners move from the peripheral to assume full participation in the group, this does not explain how students' learning dispositions are influenced by socialisation across various fields (i.e. the learning and workplace environments). The findings indicate that although the programme was a driver for identity reconciliation, the social interaction in the workplace was influential in terms of the students' need to renegotiate their new identities in the context of advanced professional practice. Therefore, reconciling identities was found to be a dynamic process that is mutually influenced by the power relationships in the wider learning culture (Nicolini and Roe, 2014, Neary, 2014). While these power relations between the actors across various fields influence learning, through a process of identity reconciliation the students were able to integrate M-level knowledge and skills in the workplace. The study identified that the programme's student-centred learning environment empowered the student and enabled them to develop a strong sense of agency that facilitated the creative and artistic behaviours associated with expert-level practice (Haskins et al., 2014, Thomson et al., 2014b, Grace et al., 2016).

Empowerment of students put them in a position to negotiate their needs and continue drawing on collaborative learning, collective clinical reasoning and reflection beyond the programme's lifespan. They also developed positive attitudes and became active contributors to the learning environment in terms of motivation to articulate their views,

which increased the likelihood of producing positive and measurable learning outcomes (Gallacher et al., 2007, Kember, 2016). For a student such as Simon, this involved a movement away from the ‘restrictive’ workplace environment into a workplace that facilitates the continuation of professional learning. Nonetheless, while Haywood et al. (2013) identified the positive role that physiotherapy professional bodies and employers play in supporting practitioners’ professional learning when compared with other healthcare practitioners who manage musculoskeletal conditions, some barriers in the workplace environment were identified in this study.

These barriers were attributed to the structure of the workplace environment, such as the difficulties in continuing reflective activities because of the limited time available for reflection. Similar issues were raised in Cunningham and McFelea’s (2017) study of the Postgraduate Orthopaedic Manual Therapy Residency Programme²⁴, in which limited time was identified as an initial barrier to integrating knowledge in spite of the evidence of advanced clinical reasoning skills and positive patients’ outcomes. While other barriers to integration have been identified when M-level graduates have less clear job descriptions or career prospects (Glover et al., 2008, Zahran, 2013, Cobbing et al., 2017), these issues do not seem to exist for the students in this study.

Therefore, findings from this study raise the need to recognise cultural dimension of learning if practitioners are to engage in lifelong professional learning. In particular, the study emphasises the need to develop pedagogies that empower learners such as drawing on all sources of evidence and engagement in a collaborative process of reflection, and collective processes of clinical reasoning. This emancipatory approach empowers individuals to lead practice transformation (Higgs et al., 2004a, Cranton, 2016).

²⁴ The residency programme in Cunningham and McFelea’s (2017) study was based on the educational standards of the American Academy of Orthopaedic Manual Physical Therapy (AAOMPT), the USA Member Organisation of IFOMPT, thus, their findings are relevant to the context of this study.

10.7. Strengths and limitations

This is the first longitudinal study that explored the learning culture in the context of physiotherapy and healthcare M-level education. The longitudinal nature of the study made it possible to capture the progress of clinical reasoning advancement. It also made it possible to capture a longitudinal perspective on learning, which is important to understanding students' transformation and changes in their learning dispositions in situ (Bloomer and Hodkinson, 2000). The six-month follow-up interviews, with full-time students, made it possible to go beyond the context of the programme to examine the whole learning culture in terms of supporting professional learning (Hager and Hodkinson, 2009). This contributed to the understanding of the programme's impact and the development of the model of synergy and convergence as transformative changes were captured when students move to alternative learning contexts.

Because the students maintained some form of clinical practice during the programme, their DTI and SCT scores were likely to be valid and reflect real clinical changes. Previous studies that utilised both tools to capture changes after short-term professional development activity have used it before and directly after the activity, without assessing learners after an actual clinical experience (see section 3.3). In this study, the identified changes indicate a change in terms of constructing collectively-reinforced advanced musculoskeletal illness scripts.

Moreover, most of the previous researchers used a single method of data collection with a strong dependence on self-reported data collection using surveys or interviews. The mixed-methods design of this study eliminated the risk of self-presentation bias, in which interviewees present themselves and their practices in a favourable way (Kopcha and Sullivan, 2007). The experiences of students and educators were reported after a rigorous

process of data collection. A depth of analysis was achieved by exploring the perspectives of participants using various methods of data collection (Flick, 2009).

On the other hand, due to the socio-cultural view of learning, it was difficult to draw real boundaries for the case. Whilst case study research is characterised by exploring a bounded system (Thomas, 2016), these boundaries represent the physical as well as the social spaces within the system. Certainly, using Bourdieu's concept of 'field', other fields had the potential to influence the learning culture of the programme (Hodkinson et al., 2008). For example, how the interaction with individuals outside of the case boundaries might have contributed to students' learning process.

The study was limited to a sample that was drawn from the immediate programme environment. In retrospect, the inclusion of visiting educators, and workplace colleagues could have yielded further insight into understanding the programme impact. It could have strengthened the credibility by providing additional sources of data. Nonetheless, their contribution to the construction of the learning culture was captured indirectly and included in the model of synergy and convergence through talking to students and onsite educators. Recruiting a clinical mentor at a later point added a valuable dimension to the overall understanding of the programme's learning culture. This was achieved by asking questions related to the impact of the workplace culture on sustaining the learned skills (Appendices 5.6 and 5.7). Future research could source such participants directly to understand their contribution to the learning culture.

Moreover, the significance of advancing a clinical skill such as reasoning is to ensure safe, effective and efficient clinical practice (Greenhalgh and Selfe, 2009, Thomson et al., 2014a). Within musculoskeletal physiotherapy context, this might not be related directly to duration of hospital stay, but it can be linked to the duration or the quality of illness experience. In either case, this necessitates examining the long terms impact of the

programme using appropriate research methodology such as patients' reported outcomes, which was not possible due time and resources restrictions.

Further, drawing on multiple programmes could have offered further understanding on how various programmes under the umbrella of the MACP re-contextualise professional knowledge and IFOMPT guidelines that target the advancement of clinical reasoning skills. For example, an educator in this case suggested that advancing clinical reasoning was a particular strength of the programme, in contrast to other IFOMPT-MACP approved programmes, which might focus more on advancing manual handling skills. Evidence suggests that in spite of drawing on the same source of a governing body guidelines, various institutions might re-contextualise and interpret professional development differently (Griffiths et al., 2016). At one of eight locations explored in their study, Griffiths et al. (2016) identified a resistance to applying the governing body guidelines due to such re-contextualisation. Nonetheless, this issue might be of minimal relevance given that IFOMPT conducts three-year-cycles of evaluation to ensure that programmes are adhering to its educational standards (Rushton et al., 2016).

Furthermore, while Hodkinson et al. (2008) claimed they provided a holistic view of learning, their theory has been criticised recently for ignoring how social media and digital technology fits within their cultural theory (Enright and Gard, 2016). While this fits under Hughes's (2010) operational identity congruence examined earlier (see section 10.7), in retrospect, it could have been insightful if this dimension had been examined in depth. In particular, how the university-mediated virtual learning environment (e.g. Canvas) is different from students-used social platforms (e.g. WhatsApp) in terms of supporting students' synergistic interaction and continued learning (see section 7.3.3).

10.8. Implications and recommendations

As the study aimed to explore and understand M-level learners' experiences in a way that might be useful for M-level educators and policymakers, I engaged in naturalistic generalisability (Smith, 2017), with the aim of producing interpretations that resonate with the experience of others (Charmaz, 2014). In doing so, a thick description of learners' biographies and the context of learning was offered; and a transparent communication of the stages of data collection, the number of participants in each stage and detailed accounts of the rationale and procedure of each of the collected data elements were reported in the thesis. The model of the culture of synergy and convergence offers a significant contribution to the current literature. It demonstrates that the advancement of clinical reasoning skills through M-level education was shaped by learner's remaking of meanings that are influenced by wider fields. Thus, learning is not only an outcome of a situated student-educator interaction, but is also connected to a wider environment that modulates outcomes.

The model can be used as a "tool for thinking" (Hodkinson et al., 2008, p 41) that provides insight about the characteristics of effective learning cultures, which I suspect will resonate with the experience of educators and students in similar programmes. It could aid educators to conduct learning activities that are well-received by learners, and therefore achieve the intended learning outcomes. Seeking convergence and synergy in learning cultures and workplace environments can maximise chances of valuable and effective learning. This study particularly indicated the interconnectedness between reflective practices, authenticity, motivation and identity reconciliation as important dimensions that support learning transition. A learning culture that supports the existence of these four dimensions across the three levels of influence supports the advancement of clinical reasoning skills and maximise the potentials for safe, effective and efficient

patient care. The implications of this research to physiotherapy professional learning and future research are examined in the following sections.

10.8.1. Implications for workplace-based professional learning

It was identified that workplace environments modulate the pace of integrating new knowledge and skills into a clinical context. Whilst all workplace locations in this study promoted autonomy, a high case load and compact appointments interfered with students' ability to integrate knowledge, with the result that some students were more successful than others. This implies that M-level graduates should be allocated some extra time for each appointment in order to accelerate the learning transition. This extra time will enable them to hone new skills such as reflection-in-action. It is acknowledged that such changes might not be possible at some locations, such as at private practices. Nonetheless, employers need to realise the importance of offering this window for developing efficient and effective care. This can be negotiated on an individual basis.

In terms of work-based professional learning, finding that most students lacked any form of collaborative interaction or collective clinical reasoning skills prior to the programme is disturbing. Students' professional development activities and in-service training were described as being unidirectional, which isolated the students from engagement in critical debates. The lack of collaborative interaction or collective clinical reasoning skills might be explained in the light of principles of clinical autonomy and ensuring patients' privacy. However, this led to developing an uncritical and unchallenged framework of practice. This would certainly compromise the delivery of advanced level patient-centred care. Therefore, it is suggestive that workplace learning is underpinned by collective processes of clinical reasoning in which practice knowledge is examined. Graduates who worked in open workplace environments have greater potential to maintain engagement in critical reflection and debates. Whilst this might not be possible in some workplace settings,

creating physical or virtual communities of practice in which patient data can be shared anonymously can ensure collaborative learning and collective clinical reasoning. As the students in this study demonstrated variabilities in the pace of identity reconciliation, there is a need for sufficiently long work-based or informal learning to maximise the effects of collaborative learning. In particular, having the sufficient time to draw on the given feedback.

As indicated in this study, collegial-guided reflection on real patient cases is a powerful learning tool that can help practitioners to evaluate and re-examine the knowledge that underpins their practice and how research evidence is utilised. The value of this form of learning should be stressed in professional learning guidelines of regulatory organisations such as IFOMPT and MACP as well as HCPC and CSP. Forming and engaging in communities of practice facilitates collaborative processes of learning that draw on multiple sources of evidence. Such communities need to be safe, supportive, mutually respectful and inclusive of different levels of expertise, i.e. junior and senior therapists, to maximise their impact. Employers or physiotherapy managers need to keep an open mind toward building these communities of practice. However, this may require time and financial commitment.

At the same time, the aim and nature of these learning communities must be stressed and communicated, especially with less qualified practitioners who may perceive challenging and reflective conversations as threatening. Communicating the nature of these communities of practice might increase the practitioners' tolerance to challenging conversations or the constructive criticism offered by peers or senior practitioners; thus, practitioners are likely to develop a sense of belonging and began to reconcile their personal and professional identities.

10.8.2. Implications for university-based professional learning

The main implication of this study for programme design and delivery is that creating synergy and convergence in formal learning environments as in M-level education should be planned carefully in order to improve learning outcomes. Seeking such synergy and convergence across learning environments can maximise the chances of valuable learning. Incongruencies between learners' dispositions and a programme's structure could be threatening to the learning process and learning engagement. This can limit the possibilities of advancement of clinical reasoning skills. The careful planning does not only involve developing educators' pedagogy, but also attending to other mediators that could facilitate or interrupt learning, such as the interaction between forces in the learning environment. Thus, students' expectations, perception of power relations and the impact of the programme on career progression need to be communicated at an early stage.

This has an impact on educational programmes in terms of creating an environment that facilitates learning transition through motivation and identity reconciliation. In accordance with the principles of adult learning (Knowles et al., 2014), it was found that educators not only need to ensure the relevance of sessions to practice, but also need to clearly communicate this to students. This might be problematic in M-level education courses in which the focus is on preparing students to manage complex ill-defined situations, for which the direct relevance of some sessions might not be wholly clear. Nonetheless, it might be worthwhile to communicate that the immediate relevance of an individual session might not be clear, but that it contributes to the learners' advancement in multiple domains. Having such a conversation might prepare the learners to adapt to the programme culture and act on formative feedback. Changing students' beliefs regarding what constitutes an effective environment for professional learning drives continued advancement in clinical reasoning skills.

In attempting to offer personalised pedagogy and to augment students' motivation, M-level educators need to integrate tools that facilitate the analysis of learners' biographies and experience. At an early stage, they need to communicate programme expectations so that students can start to renegotiate their professional identities. This is particularly necessary when students are unfamiliar with the importance of engaging in critical conversations, or when they come from an environment in which critiquing practice is assumed to be personally offensive. Therefore, M-level educators have a huge role in driving convergence and synergy.

Educators need to carefully plan sessions to maximise peer learning i.e. student-student interaction. In particular, they need to dedicate time slots for in-class and out-of-class interaction to initiate critical discussion, collaborative interaction and knowledge exchange. Sharing thoughts on patient management as well as the acceptance of either observing or being observed by a colleague support the social dimension of reflection and knowledge identity reconciliation. The students would not only have opportunities to defend their knowledge, but also to examine the contextual relevance of such knowledge (Higgs et al., 2004a, Gabbay and May, 2011). As an outcome of the engagement in such learning culture, the learners begin a movement towards artistic behaviours associated with advanced levels of practice (Evans and Kersh, 2006, Sandlin et al., 2013, Knowles et al., 2014, Petty, 2015).

Allowing this purposefully planned knowledge exchange and peer interaction means that students are exposed to different experiences that would eventually (re)shaped their identity. Therefore, there is a need to reconceptualise the relationship between educators and learners beyond a didactic instruction to include transactional relationships in which practitioners as adult learners contribute to the creation of the learning culture, and to choosing what knowledge is to be shared. Acknowledging this relationship requires

changing the learning environment to make available the time and resources to make the interaction successful. In so doing, educators do not only need to be familiar with the principles of adult learning and constructivist learning environments, but also need to recognise the sources of practice knowledge that inform practitioners' clinical reasoning. In this way they will be able to draw on tools that facilitate collegial knowledge exchange and support the development of students' agency.

Moreover, while the ability to externalise tacit knowledge lies in an easy-to-difficult continuum (Lam, 2000, Koskinen et al., 2003), challenging students' beliefs through critical and challenging conversations is a valuable pedagogical strategy to encourage students to verbalise knowledge. Through these conversations, students can introspectively articulate their thoughts and how they arrived at clinical decisions step-by-step, instead of being something buried or taken for granted. This awareness makes knowledge more explicit and transmittable to educators and peers (Biesta and Tedder, 2007, Ball, 2009).

This is linked to the need to promote students' ability to learn from their experiences through analysis and reflection on these experiences. Such introspective learning opportunities do not only constitute an invitation to re-examine practice in the context of an advanced level of knowledge and skills, but also an opportunity to explore alternative sources of knowledge that inform clinical practice. The ability to learn in and from practice has been argued to characterise M-level graduates (Petty et al., 2001b). In so doing, graduates would be able to synthesis and evaluate knowledge that potentially informs clinical reasoning, in particular, abductive or intuitive forms of reasoning.

An authentic learning culture requires the utilisation of meaningful activities that are closely linked to both of the learners' needs and advanced levels of practice. The value of negotiating clinical mentorship needs to be emphasised and integrated in university

education as it closes the gap between university and workplace experiences. The relationship between the mentor and students needs to go beyond an apprentice framework, where there is a unidirectional flow of knowledge. Clinical mentors need to promote a dialogical and transactional relationship and sharing of expertise. Through this relationship, it become possible to identify gaps in students' knowledge, and personalise learning through agreed learning contracts. Also, drawing on challenging and ill-defined patient problem allows learners to recognise the uncertainty of clinical practice and the need to evaluate clinical reasoning strategies consciously and critically which is pivotal for advancing expertise in clinical reasoning (Rushton and Lindsay, 2007). Moreover, the structure of the programme needs to support some form of complementary clinical practice where possible. This might be through promoting part-time enrolment, or spacing programme teaching sessions. Having this opportunity to practice *in situ* accelerates the pace of knowledge integration and identity development.

Furthermore, physiotherapy undergraduate education needs to invest more in collaborative student interaction, and creating an environment where student can learn from each other instead of creating a competitive environment. Sharing knowledge has greater potentials to contextualise the learning experience. Equally, since the programme's learning culture is influenced by the students' biographies, students need to recognise that working as a group can optimise the effect and the benefit from the programme learning culture.

The findings suggest that M-level programmes, as well as in-service and weekend courses can advance students' manual handling skills. However, whilst acknowledging the importance of manual handling skills in gathering reliable patient data that informs clinical reasoning, surprisingly, none of the participants - educators and students - stressed its importance in driving transformative changes. This has an implication in terms of

balancing the focus of professional development activities and inclusion of more collaborative discussions of how and when manual handling skills can be used.

Finally, in comparison with the 2008 IFOMPT's educational standards document, the recently published 2016 guidelines has some similar recommendation of activities that musculoskeletal physiotherapy educators can utilise to engage students in authentic, collaborative and personalised learning. Therefore, the application of this study's recommendations is not unconceivable. There is a need however to (1) point out how the activities listed in the educational standards document can drive valuable learning, and (2) stresses the relevance of collective (student-student) process of clinical reasoning and sense-making to the advanced level of musculoskeletal physiotherapy practice.

10.9.3. Implications for future research

At the beginning of this thesis, gaps in the literature were identified and some research objectives were formulated to address those gaps. The findings of this study indicate some directions to be explored in future research. Firstly, findings are constructed from the data of one M-level programme, therefore, they are not representative of other programmes. Future researchers could seek to test the model of culture of convergence and synergy across other M-level programmes in physiotherapy and in other healthcare professions. The model could be further refined and strengthened after exploring the learning cultures of other programmes. Moreover, the model can be tested by seeking whether the creation of a culture of convergence and synergy can lead to advancement of clinical reasoning skills in other contexts.

Secondly, future research needs to extend the analytical lens when examining of professional development activities. For example, future research can examine how

different university institutions re-contextualise or reinterpret organisational guidelines of professional development. In so doing, it would be possible to understand how such re-contextualisation can drive synergy and convergence, or alternatively conflicts and divergence in the learning culture.

Thirdly, while the study offered a comprehensive account of the processes and activities that drive synergy and convergence in this learning culture, future research can closely examine how the use of social media and digital technology in the learning culture contributes to creating such synergy and convergence. In particular, looking at differences between the university-mediated virtual learning environment and the other social platforms used by the students.

Fourthly, while a relationship between the learning environment and augmenting motivations for learning were identified in this study, future researchers might explicitly examine how augmenting motivation changes learners' behaviours and attitudes toward engagement in programme activities. Moreover, an additional period of follow-up would be valuable to explore how workplace culture continues to support development.

Finally, due to following up on some students six months after graduation, the study identified advancement in clinical reasoning skills in multiple domain, including students' reported impact on patients care. However, a longitudinal research with five to seven years of follow-up can provide further insight into the programme's impact on patient care. Patients' reported outcomes such efficiency and effectiveness of management can be comprehensively captured. This could be associated with eliciting patients, colleagues and managers' accounts.

10.9. Concluding Thoughts

Although case study research is not intended to generalise the findings in the same way as a positivist researcher (Thomas, 2016), the concept of ‘analytical or theoretical generalisation’ is suggested (Brannen, 2005, Stake, 2005, Yin, 2009, Charmaz, 2014). This is where the researcher captures all concepts within the case study to achieve theoretical sufficiency (Yin, 2009). The outcome of the study was expected to resonate with similar cases, thus offering a valuable learning opportunity (Flyvbjerg, 2006). Such theoretical application makes the case worthy of investigation, which supports the trustworthiness of the findings (Smith and Caddick, 2012). Therefore, while the selection of a case study as a methodology limited the scope of generalising the findings, as noted in chapter five, offering a thick and comprehensive account of activities within the case provides a window that allows transferability to similar contexts (Flyvbjerg, 2006).

This study broadened the evaluation lens beyond narrow accounts that focused on the understanding of the individual’s outcomes and impact (i.e. exploring changes at the micro level). It is hoped that the knowledge provided in this thesis will change how individual learners interact with the learning opportunities offered in M-level programmes. Such context-bounded knowledge can also support policymakers and educators to better plan and design M-level curricula or examine the impact of their educational activities (Smith and Caddick, 2012).

The development of physiotherapy’s scope of practice, the consequences of professional autonomy and having to deal with increasingly complex clinical conditions have all increased the demand for highly qualified and skilful practitioners. Advancement of clinical reasoning skills supports musculoskeletal physiotherapy practitioners in meeting those demands. There is a need for engagement in sufficiently long post-qualification education to drive the synergy and convergence that facilitate reinterpretation of practice.

Clinically-oriented M-level programmes offer opportunities to develop safe, effective and efficient practice. Avoidance of traditional didactic learning and promoting student-centred learning minimises dysfunctional forms of interaction. Together, there is a need to pay attention to programme details to ensure it supports valuable learning.

This study offers a novel evidence of how an MACP approved musculoskeletal physiotherapy programme can support professional learning and advancement of clinical reasoning skills. Engagement in learning activities that promote convergence and synergy constitutes an opportunity to drive valuable learning outcomes. The proposed model of convergence and synergy supports the value of congruency in the learning culture at the individual, institutional and organisational levels. An understanding of professional learning as knowledge bounded by a particular context requires educators to actively seek learners' interpretation of the impact of M-level education on practice.

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APPENDICES

Appendix 1.1: Timeline of literature review

Date	Focus of review
Oct-Dec 2013	Scoping professional development and clinical reasoning literature
Feb-Mar 2014	Review of programme evaluation literature
May-Jun 2014	Review of clinical reasoning assessment literature
Aug-Sep 2014	Review of professional development and Masters level educational literature
Oct-Nov 2014	Review of Social constructivist and adult learning theories
Nov-Dec 2014	Systematic review of output, outcomes, and impact of Masters level education
Jan-Feb 2015	Update Review of clinical reasoning literature
May-Jul 2015	Review of socio-cultural learning literature
Sep 2016	Review of learning and professional identities
Oct 2016	An update of the systematic review of output, outcomes, and impact of Masters level education
Sep- Oct 2017	Update of the literature review chapter

Appendix 2.1: An Example of Data Extraction: The Form is Adapted From A Cochrane Collaboration's Data Extraction Form.



Data collection form

This form can be used as a guide for developing your own data extraction form. Sections can be expanded and added, and irrelevant sections can be removed. It is difficult to design a single form that meets the needs of all reviews, so it is important to consider carefully the information you need to collect, and design your form accordingly. Information included on this form should be comprehensive, and may be used in the text of your review, 'Characteristics of included studies' table, risk of bias assessment, and statistical analysis.

Notes on using a data extraction form:

- Be consistent in the order and style you use to describe the information for each included study.
- Record any missing information as unclear or not described, to make it clear that the information was not found in the study report(s), not that you forgot to extract it.
- Include any instructions and decision rules on the data collection form, or in an accompanying document. It is important to practice using the form and give training to any other authors using the form.
- You will need to protect the document in order to use the form fields (Tools / Protect document)

Review title or ID
Master level education: In what way it supports professional learning in health care professions
Study ID (<i>surname of first author and year first full report of study was published e.g. Smith 2001</i>)
Stathopoulos, I. and K. Harrison (2003).
Report IDs of other reports of this study (<i>e.g. duplicate publications, follow-up studies</i>)
Notes:

1... General Information

1. Date form completed (<i>dd/mm/yyyy</i>)	0/12/14
2. Name/ID of person extracting data	MM
3. Report title (<i>title of paper/ abstract/ report that data are extracted from</i>)	Study at Master's level by practising physiotherapists
4. Report ID (<i>if there are multiple reports of this study</i>)	34
5. Reference details	Stathopoulos, I. and K. Harrison (2003). "Study at Master's level by practising physiotherapists." <i>Physiotherapy</i> 89 (3): 158-169.
6. Report author contact details	-istathop@yahoo.com
7. Publication type (<i>e.g. report, abstract, letter</i>)	full
8. Study funding source (<i>including role of funders</i>)	
Possible conflicts of interest (<i>for study authors</i>)	-
9. Notes:	

2... Eligibility

Study Characteristics	Review Inclusion Criteria <i>(Insert inclusion criteria for each characteristic as defined in the Protocol)</i>	Yes/ No / Unclear	Location in text <i>(pg & ¶/fig/table)</i>
10. Type of study <i>Refer to the MMAT study type tutorial</i>	Qualitative: Phenomenology	...	160
11. Participants	5	...	160
12. The level of the programme being evaluated	MSc	...	160
13. Types of outcome measures	self	...	161
14. Decision:	...Eligible		
15. Reason for exclusion			
16. Notes:			

DO NOT PROCEED IF STUDY EXCLUDED FROM REVIEW

3... Population and setting

	Description <i>Include comparative information for each group (i.e. intervention and controls) if available</i>	Location in text <i>(pg & ¶/fig/table)</i>
17. Name of the master level programme	2 physio programme: MSc Physio & MSc manipulative Physio	160
18. Programme context or background (why it is put together) <i>(including location, country, and social context)</i>	physiotherapy-focused taught master's courses at a British university in a five-year period (1996-2001),	160
19. Aims of the programme		
20. Population description and characteristics <i>(from which study participants are drawn)</i> RR	A number were unable to do so because of clinical commitments. Seven graduates undertook to attend a focus group, of whom five attended on the day. homogeneous group of people for whom undertaking study at master's level and working in clinical practice were common experiences.	160
21. Inclusion criteria	Only those maintaining a clinical workload were to be recruited to the study, since the area of relevance to clinical practice was of particular interest.	160
22. Exclusion criteria		
23. Method/s of recruitment of participants	A list was obtained of all of the graduates from physiotherapy based master's degrees at a specific university in the United Kingdom over the previous five years	160

	Description <i>Include comparative information for each group (i.e. intervention and controls) if available</i>	Location in text <i>(pg & ¶/fig/table)</i>
24. Ethical approval	-	
25. Consent obtained	-	
26. Notes:		

4... Description of the Master level programme

Features of the programme (Mechanisms of change)	Description as stated in report/paper	Location in text <i>(pg & ¶/fig/table)</i>
27. Provider philosophy		
28. Purpose		
29. Professional background of the instructors		
30. Considerations of team formation mixed vs focused		
31. Status (<i>Do the students have to join the programme?</i>)		
32. Duration and Timing		
33. Concrete aims of teaching-learning situations		
34. Formats & Contents (How instructions are delivered)		
35. Methods: <i>(Courses, Self-study, Group, work, Project work, Self-assessment, Practice/stimulation, Direct integration, Collegial exchange, Reflection and planning)</i>	Participants articulated that this liberal context was largely absent in their previous educational experiences. They characterised the approach of their diploma level education as that of 'rote learning' with much 'spoon fed' information, where critical thinking and selfdirection were not particularly valued.	163
36. Economic variables <i>(i.e. cost, changes in other costs as result of programme)</i>		
37. Notes:		

5... Methods

	Descriptions as stated in report/paper	Location in text <i>(pg & ¶/fig/table)</i>

38. Aim of study / Study context (why researcher have evaluated the programme)	to explore the impact of undertaking study at master's level on practising physiotherapists from the perspectives of the master's qualified physiotherapists themselves.	160
39. Design <i>(refer to MMAT classifications)</i>		
40. Level of evidence		
41. Time at which graduates were approached	1-2 y 4 y	160
42. Unit of allocation <i>(by individuals, cluster/ groups or body parts)</i>		
43. Start date		
44. End date		
45. Duration of participation <i>(from recruitment to last follow-up)</i>		
46. Is there an evaluation model that the researcher used to frame data collection and analysis?	n	
47. Notes:		

6... Quality assessment

Refer to the MMAT results

7... Participants

Provide overall data

	Description as stated in report/paper	Location in text (pg & ¶/fig/table)
48. Total pop. at start of study		
49. Job Profile		
50. Educational aims		
51. Baseline imbalances	4 MSK experience 1 Cardiothoracic 3 manipulative physio master 2 MSC physiotherapy 2 full time 3 part time 3 have worke >6 years beore the master 2 worked for 14 y 4 have 2or less working experience after the master only 1 have 4 years	160
52. Withdrawals and exclusions <i>(if not provided below by outcome)</i>		

	Description as stated in report/paper	Location in text (pg & ¶/fig/table)
53. Age	31-40	160
54. Sex	4 f 1 m	160
55. Race/Ethnicity		
56. Other relevant sociodemographics		
57. Notes:		

8... Outputs

Direct products of program activities and may include types, levels and targets of services to be delivered by the program

Features of the programme (Mechanisms of change)	Description as stated in report/paper	Location in text (pg & ¶/fig/table)
58. Participation of the programme (Attendance, Intensity (actual learning time), Active (visible) participation)		
59. Perception of the programme*		
60. Notes:		
*(Effect of programme promotion, Effect of actual conduction [personal experience], Congruency between conception & implementation, Expected relevance, usefulness, satisfaction)		

9... Outcomes

Outcomes are the specific changes in program participants' behavior, knowledge, skills, status and level of functioning.

<i>participants' behavior</i>	Description as stated in report/paper	Location in text (pg & ¶/fig/table)
61. Outcome name	Development of Confidence mainly attributed to their enhanced ability in the workplace, their increased credibility in front of others and the sense of achievement that was developed as a result of their master's level study. Development of Expertise Much more critical and much more analytical than it was before	163
62. Time points measured (specify whether from start or end of programme)		
63. Time points reported		
64. Outcome definition		

<i>participants' behavior</i>	Description as stated in report/paper	Location in text (pg & ¶/fig/table)
65. Person measuring/ reporting		
66. Unit of measurement (if relevant)		
67. Scales: upper and lower limits (indicate whether high or low score is good)		
68. Is outcome/tool validated?	... Yes/No/Unclear	
69. Imputation of missing data (e.g. assumptions made for ITT analysis)		
70. Assumed risk estimate (e.g. baseline or population risk noted in Background)		
71. Notes:		

<i>knowledge</i>	Description as stated in report/paper	Location in text (pg & ¶/fig/table)
72. Outcome name		
73. Time points measured (specify whether from start or end of programme)		
74. Time points reported		
75. Outcome definition		
76. Person measuring/ reporting		
77. Unit of measurement (if relevant)		
78. Scales: upper and lower limits (indicate whether high or low score is good)		
79. Is outcome/tool validated?	... Yes/No/Unclear	
80. Imputation of missing data (e.g. assumptions made for ITT analysis)		
81. Assumed risk estimate (e.g. baseline or population risk noted in Background)		
82. Notes:		

<i>skills</i>	Description as stated in report/paper	Location in text (pg & ¶/fig/table)
83. Outcome name		
84. Time points measured (specify whether from start or end of programme)		

<i>skills</i>	Description as stated in report/paper		Location in text (pg & ¶/fig/table)
85. Time points reported			
86. Outcome definition			
87. Person measuring/ reporting			
88. Unit of measurement (if relevant)			
89. Scales: upper and lower limits (indicate whether high or low score is good)			
90. Is outcome/tool validated?	...		
	Yes/No/Unclear		
91. Imputation of missing data (e.g. assumptions made for ITT analysis)			
92. Assumed risk estimate (e.g. baseline or population risk noted in Background)			
93. Notes:			

<i>status and level of functioning</i>	Description as stated in report/paper		Location in text (pg & ¶/fig/table)
94. Outcome name			
95. Time points measured (specify whether from start or end of programme)			
96. Time points reported			
97. Outcome definition			
98. Person measuring/ reporting			
99. Unit of measurement (if relevant)			
100. Scales: upper and lower limits (indicate whether high or low score is good)			
101. Is outcome/tool validated?	...		
	Yes/No/Unclear		
102. Imputation of missing data (e.g. assumptions made for ITT analysis)			
103. Assumed risk estimate (e.g. baseline or population risk noted in Background)			
104. Not es:			

10. Impact

Impact is the fundamental intended or unintended change occurring in organizations, communities or systems as a result of program activities within 7 to 10 years. The impact of the programme may first of all be observed on two levels: the level of the entire group of participants (collective impact) and the level of the individual participant (individual impact) Huber 2011

	Description as stated in report/paper	Location in text (pg & ¶/fig/table)
105. collective impact	!! 'life-changing' and 'careerchanging' with particular reference to the enhancement of participants' clinical practice.	162
106. individual impact	acquisition and utilisation of new skills, as well as the refinement and development of already existing skills, The development of skills, such as criticality, analysis, communication and research related skills,	163
107. change occurring in organizations, communities or systems	feel more confident, more able to deal with complex situations within the workplace and better able to adopt a strategic approach to the development of clinical and organisational practice deep lifelong approach towards learning. They articulated a constant process of questioning of their own and others' practice They did not perceive physiotherapy as a 'threatened profession' any more, but instead viewed it as a 'changing profession'. And be active contribution to this change	163
108. Notes:		

11. Applicability

109. Have important populations been excluded from the study? <i>(consider disadvantaged populations, and possible differences in the intervention effect)</i>	... Yes/No/Unclear	
110. Is the intervention likely to be aimed at disadvantaged groups? <i>(e.g. lower socioeconomic groups)</i>	... Yes/No/Unclear	
111. Does the study directly address the review question? <i>(any issues of partial or indirect applicability)</i>	... Yes/ No /Unclear	
112. Notes:		

12. Other information

	Description as stated in report/paper	Location in text (pg & ¶/fig/table)

113. Key conclusions of study authors	Participants appeared to be well motivated and wishing to remain in clinical practice. They expressed the desire to implement the changes that they had been learning about during the course of their master's study and to develop practice on an individual and organisational level, always within the clinical context.	167
114. References to other relevant studies	(Daley, 1999). Expert learners were self-directed and motivated, taking a very active role in seeking out the information they needed. They also were able to assess their learning needs, and perceived learning as being a life-long process that is something to be disseminated and shared with others in a multi-disciplinary context. Daley concludes that experts 'appeared to have learned how to learn, learned how to teach themselves, and learned how to construct a knowledge base' and she further hypothesises that the development of expertise	165
115. Correspondence required for further study information <i>(what and from whom)</i>		
116. Further study information requested <i>(from whom, what and when)</i>		
117. Correspondence received <i>(from whom, what and when)</i>		
118. Notes:		

Appendix 2.2: Criteria for methodological quality assessment: Mixed Methods Appraisal Tool

Types of mixed methods study components or primary studies	Methodological quality criteria (see tutorial for definitions and examples)	Responses			
		Yes	No	Can't tell	Comments
Screening questions (for all types)	· Are there clear qualitative and quantitative research questions (or objectives*), or a clear mixed methods question (or objective*)?				
	· Do the collected data allow address the research question (objective)? E.g., consider whether the follow-up period is long enough for the outcome to occur (for longitudinal studies or study components).				
	<i>Further appraisal may be not feasible or appropriate when the answer is 'No' or 'Can't tell' to one or both screening questions.</i>				
1. Qualitative	1.1. Are the sources of qualitative data (archives, documents, informants, observations) relevant to address the research question (objective)?				
	1.2. Is the process for analyzing qualitative data relevant to address the research question (objective)?				
	1.3. Is appropriate consideration given to how findings relate to the context, e.g., the setting, in which the data were collected?				
	1.4. Is appropriate consideration given to how findings relate to researchers' influence, e.g., through their interactions with participants?				
2. Quantitative randomized controlled (trials)	2.1. Is there a clear description of the randomization (or an appropriate sequence generation)?				
	2.2. Is there a clear description of the allocation concealment (or blinding when applicable)?				
	2.3. Are there complete outcome data (80% or above)?				
	2.4. Is there low withdrawal/drop-out (below 20%)?				
3. Quantitative non-randomized	3.1. Are participants (organizations) recruited in a way that minimizes selection bias?				
	3.2. Are measurements appropriate (clear origin, or validity known, or standard instrument; and absence of contamination between groups when appropriate) regarding the exposure/intervention and outcomes?				
	3.3. In the groups being compared (exposed vs. non-exposed; with intervention vs. without; cases vs. controls), are the participants comparable, or do researchers take into account (control for) the difference between these groups?				
	3.4. Are there complete outcome data (80% or above), and, when applicable, an acceptable response rate (60% or above), or an acceptable follow-up rate for cohort studies (depending on the duration of follow-up)?				
4. Quantitative descriptive	4.1. Is the sampling strategy relevant to address the quantitative research question (quantitative aspect of the mixed methods question)?				
	4.2. Is the sample representative of the population understudy?				
	4.3. Are measurements appropriate (clear origin, or validity known, or standard instrument)?				
	4.4. Is there an acceptable response rate (60% or above)?				
5. Mixed methods	5.1. Is the mixed methods research design relevant to address the qualitative and quantitative research questions (or objectives), or the qualitative and quantitative aspects of the mixed methods question (or objective)?				
	5.2. Is the integration of qualitative and quantitative data (or results*) relevant to address the research question (objective)?				
	5.3. Is appropriate consideration given to the limitations associated with this integration, e.g., the divergence of qualitative and quantitative data (or results*) in a triangulation design?				
<i>Criteria for the qualitative component (1.1 to 1.4), and appropriate criteria for the quantitative component (2.1 to 2.4, or 3.1 to 3.4, or 4.1 to 4.4), must be also applied.</i>					

*These two items are not considered as double-barreled items since in mixed methods research, (1) there may be research questions (quantitative research) or research objectives (qualitative research), and (2) data may be integrated, and/or qualitative findings and quantitative results can be integrated.

Source: <http://mixedmethodsappraisaltoolpublic.pbworks.com/w/file/fetch/84371689/MMAT%202011%20criteria%20and%20tutorial%202011-06-29updated2014.08.21.pdf>

Appendix 2.3: Excluded Studies.

Reason for exclusion	Total Number	References
Clearly not meeting inclusion criteria	40	E.g. (Dehn, 2007); (Evans et al., 2006); (Fraser and Titherington, 1991); (Hooker, 2009);
Other non-health care master	6	(Balogh, 2012); (Spigulis, 2000); (Edgar and Hyde, 2005); (Filizetti, 2003); (Fletcher, 2005); (Wilson and Wen, 2000)
No full text	2	(Pelletier et al., 1998); (Ruth et al., 2006)
Potential impact	11	(Beeston et al., 1998); (Caldwell, 2001); (Darby, 2009); (Finocchio et al., 2003); (Gerrish et al., 2003); (Hardcastle, 2008); (Gosling, 1997); (Gosling, 1999); (Rushton and Lindsay, 2008); (Rushton and Lindsay, 2010); (Brody et al., 2012)
Online master's degree	2	(Baker and Lewis, 2007); (Richardson et al., 2008)
Off-campus studies	3	(Bethune and Jackling, 1997); (Davis et al., 2004); (Schattner et al., 2007)
Combined programmes evaluation	2	(Boore, 1996); (Hardwick and Jordan, 2002)
None master-level PG programme evaluation	4	(Stacey et al., 2010); (Ikai et al., 2012); (Glaze, 2001); (Stellman et al., 2008)
MAAT Quality of evidence	4	Baron et al. (2001); Gill et al. (2005); Harris et al. (2008); Plugge and Cole (2011)

Appendix 2.4: AMSTAR appraisal of included systematic reviews

A measurement tool for assessment of multiple systematic reviews (AMSTAR) Criteria (Shea et al., 2007).	Gijbels et al. (2010)	Cotterill-Walker (2012)	Zwanikken et al. (2013)
1. Was an 'a priori' design provided?	Y	Y	CT
2. Was there duplicate study selection and data extraction?	Y	N	Y
3. Was a comprehensive literature search performed	Y	N	Y
4. Was the status of publication (i.e. grey literature) used as an inclusion criterion?	Y	N	N
5. Was a list of studies (included and excluded) provided?	N	N	N
6. Were the characteristics of the included studies provided?	Y	Y	Y
7. Was the scientific quality of the included studies assessed and documented?	N	N	Y
8. Was the scientific quality of the included studies used appropriately in formulating conclusions?	Y	N	Y
9. Were the methods used to combine the findings of studies appropriate?	NA	NA	NA
10. Was the likelihood of publication bias assessed?	N	N	N
11. Was the conflict of interest stated?	N	N	N
12. TOTAL SCORE Y: Yes, N: No, CT: Can't tell, NA: Not applicable	7	2	5

Appendix 2.5. Classification of included studies according to time of approaching participants.

Time	Total	References
Directly after	8	Bearn and Chadwick (2010); Conneeley (2005); Chaboyer and Retsas (1996); Cragg and Andrusyszyn (2004); Cragg and Andrusyszyn (2005); Drennan (2012); LeCount, (2004); Pelletier et al. (1994)
One year after	1	Barnhill et al. (2012)
between 2-6 years	7	Drennan (2008); Baron et al. (2006); Gerstel et al. (2013); Pelletier et al. (2003); Petty et al. (2011a); Petty et al. (2011b); Stathopoulos and Harrison (2003)
Between 7-10 years	1	Pelletier et al. (2005)
Unclear, but retrospective evaluations	18	Calvert and Britten (1999); Calvert and Britten (1998); Constantine and Carpenter (2012); Drennan (2010); Green et al. (2008); Perry et al. (2011); Le et al. (2007); Murray et al. (2001); Nicolson et al. (2005); Spence (2004a); Spence (2004b); Spencer (2006); Stark (2006); Tsimitsiou et al. (2010); Whyte et al. (2000); Wildman et al. (1999); Zahran (2013); Zwanikken et al. (2014)
* Drew on recent graduates as well		

Appendix 2.6. Synthesis of M-level Programme Outputs

Output	Description	Data Source
Successful collaborative work and student's engagement	Successful formation and support of learning groups, including small class size and diversity of opinions. Lack of peer's engagement hinders collaborative interaction	Baron et al. (2001); Calvert and Britten (1998); Calvert and Britten (1999)
Perceiving relevance	Lack of perception of relevance to clinical environment compromise satisfaction and engagement	Chaboyer and Retsas (1996); Constantine and Carpenter (2012); Bearn and Chadwick (2010)
Deconstructing knowledge	Questioning the effectiveness of practice and level of criticality that leads to reconstruction of M-level knowledge	Conneeley (2005); Constantine and Carpenter (2012); Nicolson et al. (2005); Perry et al. (2011); Petty et al. (2011a)

Appendix 2.7. Synthesis of M-level Programme Outcomes

Outcome	Description	Source of Data
High level critical thinking skills and/or analysis	Locate and understand arguments, relationships, make sound inferences, and warranted conclusions, including evaluation and applying research evidence into practice	Barnhill et al. (2012); Calvert and Britten (1999); Chaboyer and Retsas (1996); Constantine and Carpenter (2012); Drennan (2010); Green et al. (2008); Petty et al. (2011a); Spence (2004a, 2004b); Spencer (2006); Stathopoulos and Harrison (2003); Tsimtsiou et al. (2010); Whyte et al. (2000)
High level clinical reasoning skills	Context-bounded cognitive processes used during problem solving and clinical decision-making that draw on advanced level of knowledge	Constantine and Carpenter (2012); Green et al. (2008); LeCount (2004); Nicolson et al. (2005); Pelletier et al. (2003); Petty et al. (2011a); Spence (2004b); (Stathopoulos and Harrison (2003)
Understanding of ethical issues	Understanding and engagement in ethical decision-making	Pelletier et al. (2003); Tsimtsiou et al. (2010); Wildman et al. (1999)
Changing scope of practice	A shift from biomedical model into a biopsychosocial approach of management, and patient-centred practice	Calvert and Britten (1999); Tsimtsiou et al. (2010); Petty et al. (2011a); Wildman et al. (1999)
High confidence and motivation to practice	Developing senses of efficacy and advocacy that motivate practitioners for clinical practice	Calvert and Britten (1999); Chaboyer and Retsas (1996); Drennan (2008); Green et al. (2008); Pelletier et al. (1994); Perry et al. (2011); Stathopoulos and Harrison (2003); Whyte et al. (2000)
High level communication skills	Effective communication with patients, colleagues, and other health care practitioners	Barnhill et al. (2012); Calvert and Britten (1998); Constantine and Carpenter (2012); Drennan (2012); Stathopoulos and Harrison (2003); Pelletier et al. (2003); Zwanikken et al. (2014)
Becoming lifelong learner	Increased motivation for professional development and learning from practice.	Conneeley (2005); Constantine and Carpenter (2012); Drennan (2010); Pelletier et al. (2003); Petty et al. (2011b); Spencer (2006); Stathopoulos and Harrison, 2003; Whyte et al. (2000);
Enhanced sense of autonomy	Ability to function without direct support	Nicolson et al. (2005); Pelletier et al. (2003); Spencer (2006)
Enhanced career progression	Getting promoted or movement to advanced level career.	Barnhill et al. (2012); Chaboyer and Retsas (1996); Cragg and Andrusyszyn (2005); Conneeley (2005); Drennan (2008); Green et al. (2008); Le et al. (2007); Murray et al. (2001); Perry et al. (2011); Stark, (2006); Stathopoulos and Harrison (2003); Whyte et al. (2000); Zwanikken et al. (2014).

Appendix 2.8. Synthesis of M-level Programme Impact

Impact	Description	Source of Data
Management complex patient presentation	Understanding complex patient presentation, creative non-routine practice, understanding health care system, and demonstrating flexibility in role choices	Cragg and Andrusyszyn (2004); Drennan (2012); Nicolson et al. (2005); Stark (2006); Spence, (2004a)
Assuming research, leadership and management positions	Driving changes in practice and service delivery and supporting clinical-based research	Drennan (2012); Gerstel et al. (2013); Zwanikken et al. (2014)
Assuming teaching roles	Collegial teaching duties, supporting peer learning, and involvement in university education	Baron et al. (2006); Constantine and Carpenter (2012); Gerstel et al. (2013); Pelletier et al. (2003); Perry et al. (2011); Tsimtsiou et al. (2010); Whyte et al. (2000); Zahran (2013);
Reduced direct patient care	Assuming more managerial, research, and teaching duties at the expense of direct patient care	Green et al. (2008); Spencer (2006)
Increased retention rate of healthcare practitioners	Increased motivation to stay in clinical practice after M-level education.	Baron et al. (2006); Stathopoulos and Harrison (2003); Tsimtsiou et al. (2010)
Patient Care	Describing change to direct patient care routine such as earlier recovery and ability to self-manage.	Barnhill et al. (2012); Pelletier et al. (2003); Zahran (2013)

Appendix 2.9. Studies that reported key didactic features of the evaluated ML programme

Reference	Name of ML programme	Programme Philosophy and main pedagogy
Baron et al. (2006)	MSc in General Practice	Student-centred approach; Peer support and shared learning; Work in groups; Construct practice development plans; Reflection; Approaching tutors for feedback; Role-play and modelling
Bearn and Chadwick (2010)	Orthodontic problem-based postgraduate programme	Problem-based learning
Calvert and Britten (1998) Calvert and Britten (1999)	King's MSc in General Practice	Forming learning groups; Seminar discussion of preselected readings; Closing theory-practice gaps; Personalising learning experience; Ongoing assessment
Chaboyer and Retsas (1996)	Critical Care Graduate Diploma	Theoretical content; Collaborative interaction; Reflection on experience; clinical-based pedagogy
LeCount, (2004)	Geriatrics Nursing	Sharing experiences; Supervised clinical experience
Nicolson et al. (2005)	Advanced Neonatal Nurse Practitioner (ANNP)	Theoretical content
Petty et al. (2011a) Petty et al. (2011b)	Masters (MSc) Neuromusculoskeletal Physiotherapy	Theoretical content; Mentored clinical practice; Direct observation and critical feedback; Critical classroom discussion and evaluation of practice knowledge; Challenging clinical reasoning problems
Stathopoulos and Harrison, (2003)	MSc Physiotherapy & M.Sc. Manipulative Physiotherapy	Critical thinking activities; Self-direction learning
Whyte et al. (2000)	MSc in Nursing and Health Studies	Problem solving environment; Learner-centred pedagogy; Flexibility of delivery; Personalised feedback and support

Appendix 3.1: The Use of Diagnostic Thinking Inventory to Evaluate Musculoskeletal Physiotherapy Practitioners' Clinical Reasoning. Poster Presentation, The 4th European Congress of the ER-WCPT. Liverpool, United Kingdom. 11th – 12th November.



The Use of Diagnostic Thinking Inventory to Evaluate Musculoskeletal Physiotherapy Practitioners' Clinical Reasoning



UNIVERSITY OF BIRMINGHAM

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 3. The Hashemite University, Department of Physical therapy and Occupational Therapy, Faculty of Allied Health Sciences, Az-Zarga, Jordan

Introduction

Evaluation of practitioners' competencies is an integral part of service evaluation. One of these competencies is the advanced clinical reasoning skills. Within musculoskeletal physiotherapy, clinical reasoning is the context specific thinking and decision-making processes that inform clinical practice (Jones et al., 2008). High level of clinical reasoning is associated with expert physiotherapy practice (Jull & Moore, 2009).

Limited tools are available to evaluate advancement of clinical reasoning skills among musculoskeletal physiotherapists. The effectiveness and utility of these assessment tools is debated in the literature, and no single tool was found to accurately measure diagnostic reasoning (Iigen et al., 2012).

Diagnostic thinking inventory (DTI) is a self-assessment tool that have been used to capture the development of clinical reasoning skills. It was found to be valid and reliable in medical and outpatient physiotherapy practitioners (Bordage et al., 1990; Jones, 1997).

Aims

To validate the use of DTI as a tool to capture the advancement of clinical reasoning skills in musculoskeletal physiotherapy practitioners. Also, the aims were to compare between expert and novices scores; and to establish the reliability of the DTI in this population.

Methods

Participants

Two different groups of musculoskeletal physiotherapists were purposefully sampled. The level of experience and education were used to assign participants into expert and novice groups.

Instrument

DTI consists of 41 items that assess two clinical reasoning domains: flexibility in thinking (FT) and knowledge structure in memory (SM). Each item contains a sentence followed by a six point scale. The respondent is asked to decide his position on the scale between two contrasting sentences. Responses on items are then added, to give a total score ranging between 41 and 246. Sub scores will range between 20-120 for FT and 21-126 for SM. An example is shown in Figure (1).

When I am assessing a patient,

I often get one idea stuck in my mind about what might be wrong I usually find it easy to explore various possible diagnoses

Figure (1): An example of a "flexibility in thinking" item in DTI

Procedures

An online version of DTI was built and sent to participants using a survey website. The expert group were asked to assess face and content validity of the questionnaire. The total and subtotal (FT and SM) scores were then calculated for all participants and used for analysis. Construct validity was assessed by comparison between groups scores using Mann-Whitney U test. Test-retest reliability of DTI was assessed by allowing a two-week gap between first and second administrations. Test retest reliability and internal consistency were determined using Cronbach's alpha and intraclass correlation coefficient (ICC).

Results

Fourteen experts and 20 novices agreed to participate in the study. Completed data of 12 experts were included in the analysis. Characteristics of the participants are included in table 1.

Characteristic	Experts (n=12)	Novices (n=20)
Average years of experience (SD)	20 (6)	6 (3)
Place of employment	7 Hospital 3 Private practice 2 NHS outpatient 2 Education 1 research	5 NHS outpatients 12 Private practice 4 other
MACP membership	14	0
Postgraduate education	1 PhD 11 MSc 2 PgDip	1 PgDip

Table (1): Characteristics of participant groups

Validity

Face and content validity: Experts agreed that DTI measures the two domains of clinical reasoning. Minor changes were suggested to include other forms of clinical reasoning in the questionnaire.

Construct validity: Significant difference in the scores was evident in favour of the Experts' group (Figure 1). Mann-Whitney U test indicated greater and statistically significant experts scores at U= 36.5 (p<.001), 32.0 (p<.001), 43.5 (p<.003) for DTI, SM, and FT, respectively.

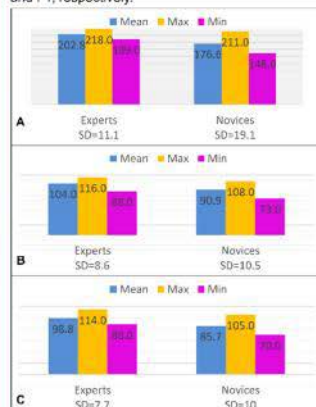


Figure 1: Scores of Experts and novices.

A: DTI scores. B: Flexibility in thinking scores. C: Structure in memory scores. SD= Standard deviation

Reliability

Scores of the first and second attempts are shown in table (2). ICC values were 0.884, 0.833, 0.814 for DTI, FT, and SM scores respectively with 95 per cent confidence interval (p<0.05). Agreement between the two measurements was noticed to be higher in DTI than the two subcategories.

Internal consistency: The Cronbach's alpha value of all participants was 0.831, 0.739 and 0.699 for DTI, FT and SM, respectively.

Score	First attempt Mean (SD)	Second attempt Mean (SD)
DTI	176.6 (19.14)	179.3 (16.37)
flexibility in thinking	90.94 (10.5355)	92.17 (10.37)
structure in memory	65.67 (9.96)	67.17 (8.66)

Table (2): Means and standard deviations of the scores in the first and second administrations

Discussion & Conclusions

There has always been a direct link between expertise and advanced clinical reasoning skills in the literature (Edwards & Jones, 2007). This study supports this link by proposing a tool that is sensitive to capture advancement in clinical reasoning with experience and continuous education. The outcomes of this study provided evidence that experts have better clinical reasoning skills than novices using a quantitative method.

DTI is valid and reliable to measure diagnostic clinical reasoning in Musculoskeletal Physiotherapists based on the results of this study. Previous studies found similar results in medicine and physiotherapy (Bordage et al., 1990; Jones, 1997).

The study validated the use of a tool that, unlike other tools, numerically measures the practitioners' clinical reasoning skills. In the context of service evaluation, DTI could be used to assess the practitioners' competency in clinical reasoning. The numerical scores provide an objective measurement of how efficient and effective the practitioners are in handling complex patient scenarios. Future research could investigate the normal values of DTI in musculoskeletal physiotherapists with different levels of expertise.

Impact and Implications: DTI can be used to assess musculoskeletal physiotherapists' clinical reasoning skills. Practitioners can use it as a self-administered tool to track changes in their clinical reasoning skills. Researchers may use it as an outcome measure to reflect the level of service delivery.

Limitations

Due to the limited time and resources; participants were recruited from only one setting, which limits generalisability of the results. An acceptable number of physiotherapists participated in this study; however a larger number could make results more significant. Content validity was assessed using open-ended questions which allowed experts to discuss both the positive and negative aspects of DTI and express any concerns they had. However, direct discussion with experts using a focus group or interviews could have added more insight to the results.

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Acknowledgements

Ethical approval was granted by the ethics committee of the School of Sport, Exercise and Rehabilitation Sciences at the University of Birmingham.

This work was not funded.

Presented at WCPT-ER Liverpool 2016

Contact details

Appendix 5.1: Information Sheet for Students

Information Sheet for Students

The Impact of PgD/ MSc Advanced Manipulative Physiotherapy Education on Clinical Reasoning Skills

Mohammad Madi

Doctoral Researcher

School of Sport, Exercise & Rehabilitation Sciences

University of Birmingham

UK, B15 2TT

[Redacted]

[Redacted]

[Redacted]

This in-depth case study that will look at how MACP approved master of Advanced Manipulative Physiotherapy (AMP) programme develops clinical reasoning skills. It will examine what impact the master programme has on students' knowledge structure and diagnostic thinking. An understanding of what educational approaches are used to reach this goal will be investigated.

As a student enrolled in a master programme aimed at advancing your clinical reasoning skills, you can provide us with valuable information on the impact the master programme on your knowledge structure and diagnostic thinking. We would also be interested in your views about the educational process and your own personal experience with developing these skills.

As part of this research, you will be asked to fill the diagnostic thinking inventory designed to measure your knowledge structure and flexibility of thinking. It will take only 15-25 minutes of your time to complete the inventory. Script Concordance Test designed to measure your clinical reasoning skills in ill-defined situation will be used as well. Reading the test background, instruction, and answering it will take around 80-90 minutes. It is important to point out that both tools were developed for this research only

and they are not part of your master programme assessment. Your scores will not be available to the course tutors for the whole duration of your study, nor will your participation impact on your educational experience on the programme. All responses will be dealt with in the strictest of confidence. No one, including my supervisors, shall review your response.

Following this, we will arrange for an interview to talk to about your clinical reasoning and educational background, and your expectations form the programme. Hopefully we will have a follow up interview to discuss the actual impact at the end of your programme.

Your participation in the study is absolutely voluntary. You will be asked to complete an informed consent form. You may withdraw at any time; before, during, and after interview with no consequences what so ever and without having to explain why. If you wish to withdraw, please contact me before data analysis planned on October 2015. If you wish, you will have access to the final report of the study.

According to the University of Birmingham ethical code of practice, any data you provide will remain confidential and anonymous. All audio recordings, files will be kept securely in password protected computer during the study. Following completion of the study, data will be stored in a locked cabinet and kept for 10 years and then destroyed. All identifying information will be coded keeping stored records anonymous. Any publication available will not contain identifying data at any stage.

Inclusion criteria: Student at manipulative physiotherapy PgD/MSc programme.

If you would like more information about this research project, timing and requirements please do not hesitate to contact me by email [REDACTED] or Phone [REDACTED]

You can also contact my supervisors using the following details:

Dr. Mark Griffiths	Dr. Nicola Heneghan
School of Sport, Exercise, and	School of Sport, Exercise, and
[REDACTED]	[REDACTED]

Appendix 5.2: Participant Consent Form

Participant Consent Form

**The Impact of PgD/ MSc Advanced Manipulative Physiotherapy Education on
Clinical Reasoning Skills**

I have had this project explained to me, and I have read the information sheet, which I keep for my records. I had the opportunity to ask any questions

I understand that my participation is voluntary, that I can choose not to participate in part or all of the study, and that I can withdraw at any stage of the project without being penalised or disadvantaged in any way.

I understand that I have the right to withdraw from this study by informing the principal investigator before ending data analysis (October 2015). I can withdraw for any reason. I will not be required to explain my reasons for withdrawing.

And I understand that any data that the investigator extracts from the interview for use in reports, communication, or published findings will not, under any circumstances, contain names or identifying characteristics.

I agree to take part in the study

Participant's name: _____

Signature: _____

Name of investigator: _____

Signature of investigator: _____

Date: _____

Appendix 5.3: Invitation Letter for module leads and tutors

Invitation Letter

The Impact of PgD/ MSc Advanced Manipulative Physiotherapy Education on Clinical Reasoning Skills

I am writing to you as Faculty Member teaching in the Advanced Manipulative Physiotherapy programme. I would like to invite you to participate in my research which is being conducted as part of a PhD in the School of Sport, Exercise and Rehabilitation Sciences at the University of Birmingham.

The purpose of study is to look for changes in physiotherapists' clinical reasoning skills after participating in advanced manipulative physiotherapy (AMP) master programme. It also seeks to investigate the impact of educational approaches used in the programme to facilitate the development of clinical reasoning skills. This is considered as the main published research priorities in the field of manipulative physiotherapy education. Having previously graduated with an MSc of Manual Therapy from the University of Western Australia, Australia, I would now like to understand more about the impact of postgraduate education on clinical reasoning, the cornerstone of advanced practice in manipulative physiotherapy.

Different studies have explored postgraduate manipulative physiotherapy education in terms of its impact on professional and career progression; and understanding differences between novices and experts. No study has so far investigated the impact of these programmes on clinical reasoning skills which is considered as an important construct of AMP programmes.

To fill this knowledge gap this study is set out to: first, provide empirical evidence about changes in clinical reasoning following engagement in master level programmes; and second, provide understanding of educational approaches used to develop clinical reasoning skills. It is believed that the outcome of this study would support current evidence of change claimed by postgraduate education. It will also help in curriculum planning which will be therefore reflected on therapist advanced practice skills.

Accordingly, I am interested in your views about the educational approaches you use in the programme that facilitate the development of clinical reasoning skills. I would like to talk to you in the way and time that suits you. Interview will involve an overview of programme philosophy, the planning and implementation of the teaching classes aimed developing professional practice and specifically clinical reasoning.

It is believed that the outcome of this study would support current evidence of change claimed by postgraduate education. It will also help in future curriculum planning which will be therefore reflected on therapist advanced practice skills.

This research is supported by Dr. Nicola Heneghan, programme leader of MSc advanced manipulative physiotherapy master programme and Dr. Alison Rushton, programme leader of MSc exercise and sports medicine at University of Birmingham. The research is conducted as part of supervised PhD programme at the University of Birmingham (PhD Student: Mohammad Madi, First Supervisor: Dr. Mark Griffiths, Second Supervisor: Dr. Nicola Heneghan). Ethical approval has been granted by the University of Birmingham Ethics Committee.

If you would like more information about this research project, timing and requirements, please refer to the attached participant information sheet and do not hesitate to contact me.

Yours sincerely,

Mohammad Madi

Doctoral Researcher

School of Sport, Exercise & Rehabilitation Sciences

University of Birmingham

UK, B15 2TT

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██

████████████████

Appendix 5.5: Script Concordance Test Instruction

Script Concordance Test

Introduction:

This page contains short background on the test along with test instruction and practice example to be familiar with the test.

Background

The primary aim of postgraduate studies is to develop your clinical reasoning skills to be ready for management of different cases especially those with unfamiliar or ambiguous patient presentation. This is done through advancing your knowledge base, thinking and reflection skills. Having this will help you in making sound clinical decisions and efficiently solve ill-defined problems.

Script Concordance Test (SCT), unlike other traditional tests, is designed to assess your knowledge structure and clinical reasoning in ill-defined scenarios. Your answers are matched with the answers of a panel of experts.

During clinical encounter, you start by gathering initial cues about the patient presentation followed by generating some hypothesis that necessitate further data collection and interpretation to evaluate this hypothesis. Like so, each SCT case item introduces a brief clinical scenario followed by 3-5 hypotheses. After that, an additional statement is introduced asking respondent on how this statement would change you judgment on a five point Likert scale.

What does script means?

The SCT is based on an established theory for cognitive psychology called script theory. Scripts refer to the structured contextualised clinical knowledge related to specific patient presentation. These scripts are developed with more experience and clinical encounter to form an integral part of your clinical reasoning skills. Organised knowledge base and the ability to recognise and retrieve relevant clinical data from memory are critical for successful clinical reasoning.

Test Instructions*: (please read the following carefully)

Structure of the SCT

- Stem –a clinical scenario
- Hypothesis
- Additional statement
- Decision based on additional statement

How to answer a SCT question?

SCT question is primarily asking you to evaluate the effect of new information on a given hypothesis. The stem is necessary to provide a clinical context to the question. This will constrain your thinking within realistic boundaries and help recall relevant script.

The simplest way of answering a SCT question is to extend in your mind the Likert response by adding the phrase “than it was before the new information become available” as shown below.

- 2: much less likely than it was before the new information became available
- 1: a little less likely than it was before the new information became available
- 0 : neither more nor less likely than it was before the new information became available
- +1: a little more likely than it was before the new information became available
- +2: much more likely than it was before the new information became available

What about other hypothesis presented in the clinical scenario or the hypothesis I have in my mind?

In this test all you need to consider is what effect that the new information (added statement) has on the likelihood of the each working hypothesis. Please do not consider any other hypothesis you have in mind and do not compare this hypothesis to the likelihood of other hypotheses in the same clinical scenario. i.e. you should approach each hypothesis independently from other ones.

Can I adopt an answering strategy to get a higher score?

If you are not sure whether new information changes things a little or a lot, you may be tempted to always go for the less extreme option. This strategy is not likely to be successful at all time since the scoring key is set by diverse expert responses on the Likert scale. Your responses to each item will be compared with those of an expert panel. Your score will reflect how closely your clinical reasoning matches those of experts in physiotherapy. Suppose that for a panel of 15 expert, 4 believed the hypothesis much more probable, 9 believed the hypothesis more probable, and 2 believed the statement has no effect on the initial hypothesis, then the credit assigned to each respondent answer is 4/9, 9/9, 2/9 respectively with zero credit for other answers.

Can I rely on the information in the scenario and the question?

SCT questions use clinical scenario in which there is uncertainty. The level of uncertainty in a question reflects uncertainty in the real world. Some of this uncertainty is due to incomplete understanding of conditions, some of it is due to systematic error (which is predictable) and some (far less) is due to random error (which is not predictable). “Systematic error” should be considered in our practice. This type of error can be found in the reliability of a history taking and the reliability

of examination findings. The level of uncertainty is contextual and is to be taken at face value. For example, a history from a demented person is going to be much less reliable than from a normal, healthy person. Knee examination findings in an adult weighing 180kg will be far less reliable than in someone weighing 60kg. These are factors that the expert physiotherapist will take in to account in formulating a diagnosis and management plan. We expect you also to factor systematic error in to your decision-making, but we don't expect you to be as good at this as an expert.

What does “I have limited knowledge” column mean?

During your master experience your basic knowledge will be enhanced through in depth discussions of different patient presentations. It is expected that some of SCT are difficult to answer, since clinical reasoning depends also on your basic and clinical knowledge. If you do not have the sufficient knowledge to answer, please mark the “**I have limited knowledge**” part. You will not receive credit for this answer but you would help us to factor the impact of your master level knowledge on clinical reasoning skills. Saying this, **it is expected that you should not consult books, friends or any other source of knowledge when approaching the test.**

Example of a SCT question

I. 35 years female long distance runner presents to you with a diffuse pain in the buttocks after recent competition							
If you were thinking of:	And then you find:	This hypothesis become:					I have limited knowledge
		much less likely	less likely	Neither more NOR less likely	more likely	much more likely	
1. Gluteus medius trigger points	Limited hip external rotation	-2	-1	0	+1	+2	
2. Stress fracture of sacrum	Non-specific low back pain	-2	-1	0	+1	+2	
3. Piriformis muscle strain	Pain Aggravated by sitting	-2	-1	0	+1	+2	

The above clinical scenario has 3 questions (hypotheses). With each question there is different additional statement to consider independently from other statement. This means that if you are thinking of “Piriformis muscle strain”, the ONLY information to consider while approaching this question is “Pain Aggravated by sitting”. i.e. the patient does NOT have Limited hip external rotation” NOR “Non-specific low back pain”

It is also important to note that the table headings and response options differ in different clinical cases, so please read them carefully.

Since this is the first time this test is used to assess the advancement of clinical reasoning in a group of musculoskeletal physiotherapist, please answer the short questionnaire following test completion.

It will take you about approximately 60 minutes to complete the test and the questionnaire.

*Test instructions are adapted from Duggan P. How to answer a SCT question (for students and experts). The University of Adelaide, Faculty of Health Sciences. <http://www.fpcmed2.umontreal.ca/www.health.adelaide.edu.au>. Accessed 14 06 2014.

Script Concordance Test clinical scenarios – Sample

I. 41 years old cyclist presents to you with a diffuse pain in the buttocks after recent competition							
If you were thinking of:	And then you find:	This hypothesis become:					I have limited knowledge
		much less likely	less likely	Neither more NOR less likely	more likely	much more likely	
4. Referred lumbar pain	No symptoms below the knee	-2	-1	0	+1	+2	
5. Inflammatory sacroiliac pain	Problems in other joints	-2	-1	0	+1	+2	
6. Piriformis impingement	Posterior thigh and calf pain	-2	-1	0	+1	+2	

II. 36 years old man presents to you with a localised pain over ischial tubersity							
If you were thinking of:	And then you find:	This hypothesis become:					I have limited knowledge
		much less likely	less likely	Neither more NOR less likely	more likely	much more likely	
7. Hamstring tendinopathy	Pain is aggravated by running	-2	-1	0	+1	+2	
8. Ischiogluteal bursitis	Pain in not constant	-2	-1	0	+1	+2	
9. Prolapsed intervertebral disc	Pain increase with back extension	-2	-1	0	+1	+2	

III. 35 years female long distance runner presents to you with a diffuse pain in the buttocks after recent competition							
If you were thinking of:	And then you find:	This hypothesis become:					I have limited knowledge
		much less likely	less likely	Neither more NOR less likely	more likely	much more likely	
10. Gluteus medius trigger points	Limited hip external rotation	-2	-1	0	+1	+2	
11. Stress fracture of sacrum	Non-specific low back pain	-2	-1	0	+1	+2	
12. Piriformis muscle strain	Pain Aggravated by sitting	-2	-1	0	+1	+2	

Appendix 5.6: Interviews schedule - Faculty Members

Interview schedule - Faculty Members

- **Thank you for participating.**
- **Statement of purpose**
"I am conducting some interviews as part of investigating what impact master of musculoskeletal physiotherapy programme has on diagnostic reasoning abilities. I am therefore interested in your views and experience as student who are enrolled in this programme."
- **Explaining ethical issue like withdrawal from the study at any time; and ensuring privacy and confidentiality**
- **Permission for recording the conversation.**

Provider

-) What is the philosophy of learning you adopt in this module? How is it influenced by the programme philosophy?
-) How the modules/lectures aims are constructed? What is it in this module that help in developing clinical reasoning? Contents? Methods? What measures are taken in ensures sustainability of impact and transfer to practice?
-) What are the criteria for selecting external lecturers? If research wise, how they could bridge the gap between know and integrate this into student reasoning.
-) How is important to provide the theory on clinical reasoning
-) How the module help the students to construct knowledge about different pathologies? packing some of the theory in patterns to help them with their storing of information
-) Do you adjust modules/lectures aims based on the background and preparation of participants? If yes, How? If No, Why?

Purpose

-) What is the level of students' clinical reasoning at the beginning? How do you view clinical reasoning? "Expert in clinical reasoning"? What do think student should get out of the module?
-) How do you think you measure that?

Formats

-) How instructions are delivered? What he think about the optimum learning environment form being interactive and supportive as compared to one way didactic lecturing or knowledge impartment.
-) How the modules/lectures promote motivation and reflection of clinical reasoning skills learning?

Contents

-) How are the contents in the modules/lectures designed to develop clinical reasoning?
-) What efforts are made to accommodate differences in learning styles of participants?
-) How does the programme facilitate the transfer of its effect to practice?
-) How does the programme consider the working environment? Current healthcare policies e.g. NHS? current extended scope of practice?
-) How does the programme help the student to manage complex unfamiliar cases?

Methods:

-) What are the educational approaches used in the programme to develop clinical Reasoning skills?
-) What kind of cooperation and communication is expected between participants themselves? *How do you ensure that collegial support?*
-) How do think these methods encourage active participation of students in clinical reasoning sessions?
-) What sort of feedback is given to the students regarding their clinical reasoning advancement?
-) What is the role of pre-reading?

Is there anything else you wish to add?

Appendix 5.7: Initial Interview schedule for students

Initial Interview schedule

- **Thank you for participating.**
- **Statement of purpose**

"I am conducting some interviews as part of investigating what impact master of musculoskeletal physiotherapy programme has on diagnostic reasoning abilities. I am therefore interested in your views and experience as student who are enrolled in this programme."

- **Explaining ethical issue like withdrawal from the study at any time; and ensuring privacy and confidentiality**
- **Permission for recording the interview.**

Characteristics of the educational system

) Can you tell me about your place of qualification, year of experience, and where have you been practicing?

) If international, can you tell me about Characteristics of the educational system from high school to university (typical entry and graduation age)

) If not answered earlier, what is the period you spent before starting postgraduate programme?

Learning and professional biography

) What do you think clinical reasoning means?

) What clinical reasoning strategies you employ in your practice?

) To be "competent in clinical reasoning" what do they believe this means? How you can achieve this

) What learning mechanism you utilise in your practice (cognitive, cooperative, communicative, reflexive) examples

) How did **previous qualification** help in cognitive (thinking) and metacognitive skills? Autonomy?

) How do think **previous experience** have shaped your current clinical reasoning skills? Reflection on previous learning, theories, and the skills gained to reach current level of clinical reasoning.

) How this **previous experience** would influence engagement in this programme clinical reasoning discussions?

) How would your **previous qualification** affect your ability to engage in the programme in general and clinical reasoning classes in particular?

Educational aims

-) Why did you join the programme?
-) What is it you are trying to achieve?
-) How do you think you can advance your clinical reasoning skills? *What learning tech you think you will use?*
-) How do you think you measure that?
-) Why do you think it can help you in your practice?

Effect of programme promotion

-) What are the features of the programme that most attracted you?
-) How these programme features would encourage active participation in it?
-) What is the level of qualification and experience you think is required for successful engagement in this programme?

Financial, Moral, Social, and Health aspects values

-) Are there any restrictions that compromise the achievement of your aims?
-) How do think these factors would influence your participation in clinical reasoning sessions?

Expected relevance, usefulness, satisfaction

-) What added benefits you think this programme would provide to your practice?
-) How is that relevant to your practice?
-) Do you think you will be satisfied with what the programme provides?
-) How you will measure that?

Is there anything else you wish to add?

Appendix 5.8: Focus Group Topic Guide

Focus Group Topic Guide - March 2015

Advancement of clinical reasoning

Do you feel the programme change your practice so far?

1. Regarding clinical reasoning?
2. Discussion about components of clinical reasoning
3. Examples?
4. How the programme have changed your model of reasoning (biomedical, psychosocial, etc.)
5. What is the social and cultural conditions necessary to sustain (create) change?

Participants 'use' of knowledge

1. What are the different knowledge that they have taken form these session?
2. What differences you feel form what the programme offered and what you expected? In terms of knowledge; Conception of learning and teaching; and the locus of control.
3. Did the nature of the course change their perceived outcome [from pre-course participation]?

Overview of their learning styles

1. How the systems support it?
2. Is there any change?
3. What did not the programme address?
4. How do they think having done this activity have helped them?
5. Learning needs, negotiation of learning outcomes

How the programme change them (WHAT HOW WHEN) - always ask for examples

) What is it about this programme that make you function at this advanced level of clinical reasoning and make it different form your previous studies and experience [consider all components: programme , modules, lecturer, other students, content, time, discussions platforms, assignments, SDP] Was it helpful ? In what terms?

) What parts of the programme have changed their clinical reasoning, how it did in what context

Hints:

1. The amount and the nature of contact with the mentors at university; and how that was helpful in terms of clinical reasoning?
2. What do you think of the activities, instructions and interactions?
3. What do you think of PANOPTO and social media platform? How do they help learning?
4. The 5 minutes seminar; Poster presentation (mini project); and viva preparation; Analysis of your past experience; sharing good practice; pre-reading; Research assignment; challenging in different modules? Let them talk about it. Does it help

pattern recognition? Reflection? Reasoning? [their knowledge about the genics, research, literature, planning etc..]

5. The APPPD assignment – the content (Expertise, CR, knowledge, cycle of confidence through life, sharing experience, reflection, identity, motivation, practice model, values, world view)

6. Did anything change due to those sessions?

Appendix 5.9: In-class observation schedule

Module: _____ **Date:** _____ **Time:** _____ **Number of students:** _____

Session Title: _____ **Total duration:** _____

Aim of the Session: (Identify priory student knowledge; Discuss pre-session preparation; Introduce new concept; Review concepts; Problem solving)

Session Activities			
Structure	Duration (In minutes)	Nature	Description of activity
1. Teacher led instructions 2. Teacher led discussion 3. Small group 4. Pairs 5. Individual	From__ To __	1. Self-directed and responsible learning 2. Use existing foundation of knowledge and experience 3. Authentic learning experience 4. Relevance to practice 5. Application to work context	
Rationale:) Educators need to facilitate self-directness and responsible learning.) Adults bring life experiences and knowledge to learning experiences.) Adults need to identify real-practice issues, and applications.) Communicating the relevance of programme activity to learners' practice and aspirations			

Identify feature of constructivist learning environment	
) Is the learner actively involved in the learning process?) Does the facilitator steer the learning experience?) Does learning environment support and challenge the learners' thinking?) Is learning interactive?) Does student present new contents to their colleagues?	Description of activity

Identify relevance to research questions:

Identify questions to be further investigated:

Identify the context in which learning occurs:

Appendix 5.10: Clinical observation schedule

<p>Rationale for observation:</p> <p>Social constructivist approach to learning (meeting student with their knowledge)</p> <p>Adults bring life experiences and knowledge to learning experiences</p>		
<p>Focus of observation:</p> <p>Recognition of prior learning and knowledge</p>		
<p>Observed Activities</p> <ul style="list-style-type: none"> • Does the mentor consider students interests and past experiences? • Does the mentor promote reflection and applying clinical reasoning processes on such experiences? • Do they examine the influence of student's existing identity in processing knowledge? 		
<p>Rationale for observation:</p> <p>Adult learning Theory – adult learners need to demonstrate autonomy, motivation and self-directed behaviour</p>		
<p>Focus of observation:</p> <p>Nature of interaction or contact</p>	<p>Focus of observation:</p> <p>Nature of feedback (Providing constructive and specific feedback)</p>	<p>Focus of observation:</p> <p>Students activities</p>
<p>Observed Activities</p> <ul style="list-style-type: none"> • Student led contact • Mentor led contact • Collaboration with others • They are moving toward less structured supervision • The mentor approachable • The mentor encouraging inquiry rather than imposing knowledge 	<p>Observed Activities</p> <ul style="list-style-type: none"> • Identifying knowledge gaps • Demonstrating skills • Facilitating understanding (putting theory into practice) • Reviewing goals • Student are asking for feedback 	<p>Observed Activities</p> <ul style="list-style-type: none"> • Are they doing activities that reflects their interest • Does student present new contents to their colleagues and mentor
<p>Rationale for observation:</p> <p>Adult learning Theory – adult learners are practical</p>		
<p>Focus of observation:</p> <p>Discussion of patient history</p> <p>Discussion of assessment options</p> <p>Discussion of management options</p> <p>Challenging beliefs, values, actions</p> <p>Sharing EBP</p>		

Observed Activities

- Is the student actively involved in the learning process?
- Does the mentor steer the learning experience?
- Does learning environment support and challenge the students' thinking
- Is learning interactive

Rationale for observation:

Review of clinical reasoning literature

Focus of observation:

Clinical Reasoning processes: Questioning, Analysis, Synthesis, Interpretation, Prioritisation, Application, Creativity

Observed Activities

- Are they going through the clinical reasoning processes?
- Are they integrating clinical reasoning tools? e.g. SINS
- Are they considering biopsychosocial models of practice?

Describe activity:**Identify relevance to research questions:**

Appendix 7.2: A Module guide extract demonstrating embedding self-directed studies in the programme structure

Module: [REDACTED] Timetable. [REDACTED] terms.

Self Directed Practice timetabled 9.00-10.00 and 17.00-18.00 each day of attendance.

Date	Time	Topic	Lecturers
Monday [REDACTED]	9.00	Self Directed Practice	
	10.00	Introduction to module / SWOT analysis What is manipulative physiotherapy?	[REDACTED]
	11.00	Principles of patient assessment: an integrated approach	[REDACTED]
	13.30	Principles of patient history (applied to [REDACTED] region)	[REDACTED]
	15.00	[REDACTED] principles of handling – sensitivity and specificity workshop	[REDACTED]
	17.00	Self Directed practice	
Tuesday [REDACTED]	9.00	Self Directed Practice	
	10.00	Clinical reasoning and its application to advanced manipulative physiotherapy including symptom presentation and hypothesis generation	[REDACTED]
	14.00	[REDACTED] continued (Physical examination)	[REDACTED]
	15.00	Pain physiology	[REDACTED]
	17.00	Self Directed Practice	